

# A State of Art of Review of DMAIC Approach

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**Abstract:** DMAIC approach is a business strategy used to improve business profitability and efficiency of all operation to meet customer needs and expectations. The DMAIC technique is an overall strategy to accelerate improvements in its processes, products and services. It is a powerful improvement business strategy that enables companies to use simple and statistical methods for achieving and sustaining operational excellence. In the present research work, an attempt has been made to review the DMAIC approach, its utilization in different sectors.

**Keywords:** DMAIC, Review, Quality Techniques.

## 1. Introduction

DMAIC approach differs from other quality programs in its top down drive in its rigorous methodology that demands detailed analysis fact based decisions. It is a rigorous data driven method for dealing with defects, waste and quality problems, in manufacturing, services and other business activities. This approach is an upcoming quality improvement process and is proving to be a powerful tool for solving complex problems. It would not work well without full commitment from upper management.

The DMAIC methodology has a core process: Define-Measure-Analyze-Improve-Control (DMAIC) methodology. The five steps to DMAIC approach are shown in Figure 1.

**Define:** The definition of the problem is the first and the most important step of any DMAIC project because a good understanding of the problem makes the job much easier. An average definition may mislead people into trying to achieve goal which are not required or making the problem more complex.

**Measure:** The measure phase identifies the defects in the product, gathers valid baseline information about the process and establishes improvement goals. DMAIC approach is based on measured data. There will be unfavorable consequences from analysis using quality tools if there is problem with measuring system.

**Analyze:** The analyze phase examines the data collected in order to generate a prioritized list of source of variation as in Figure 2. It is the key component of any defect reducing program. This is the stage at which new goals are set and route maps created for closing the gap between current and target performance level. The conventional quality technique like brainstorming, root cause analysis, Cause and effect diagram etc. may be used for carrying out the analysis.

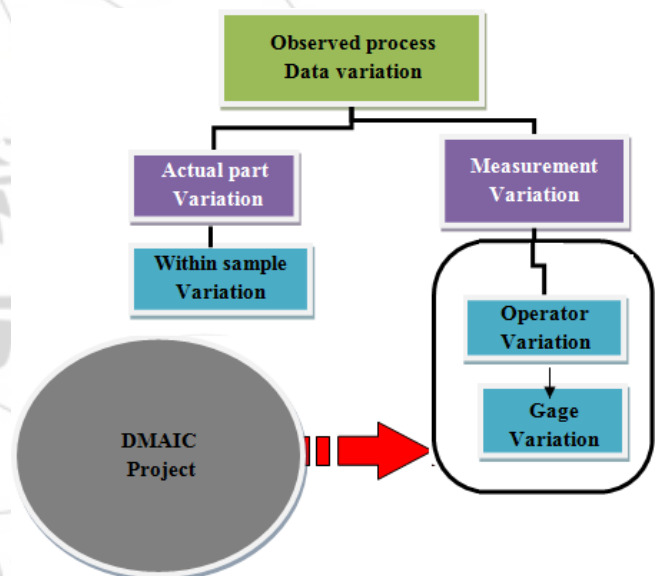


Figure 2: Measurement Variation of System

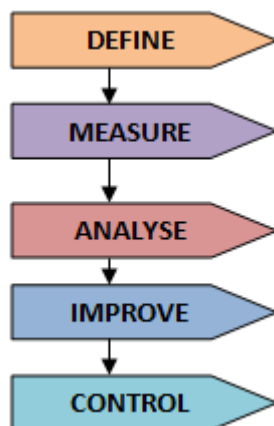


Figure 1: Five Steps to DMAIC approach

**Improve:** Improve the process to remove cause of defects. Specific problem identified during analysis

1. Use of brain storming and action workouts
2. Extracting the vital few factors through screening
3. Understanding the correlation of the vital few factor
4. Process optimization and confirmation experiment.

The purpose of this step is to identify, test and implement a solution to the problem; in part or in whole. Identify creative solutions to eliminate the key root causes in order to fix and prevent process problems.

**Control:** Control the process to make sure that defects do not recur i.e. remove the root cause of the problem. The control phase is preventive in nature. All the specific identified problems from the analysis phase were tackled in the control phase. It defines control plans specifying process monitoring and corrective action. This phase provides

systematic re-allocation of resources to ensure the process continues in a new path of optimization. It also ensures that new process conditions are documented and monitored. The purpose of this step is to sustain the gains. Monitor the improvements to ensure continued and sustainable success. Create a control plan. Update documents, business process and training records as required.

## 2. Literature Review

Various researchers worked on DMAIC approach and is described in below paragraphs:

**Snee (2000)** defined that the basic concept behind the DMAIC approach is to reduce product and process variation and conducted a case study at carriage and wagon works. Rejection statistics of axle were collected and critical causes were identified for corrective actions. Then, suggestions were implemented and rejections thereafter collected and compared with the previous rejections and found there were considerable improvements. The results achieved were demonstrated using Pareto diagrams and it was found that 5.9% of rejections were reduced.

**Horel (2001)** described that the (DMAIC) quality technique was first applied in manufacturing operations and rapidly expanded to different functional areas such as marketing, engineering, purchasing and servicing. The company Whirlpool has increased its quality by 10% by adopting DMAIC technique.

**Anthony and Banuelas (2002)** conducted a case study on bulb manufacturing company to reduce the shell cracking during the manufacturing of bulbs and achieved dramatic improvements in defects by using DMAIC quality technique

**Tony (2002)** explained that DMAIC approach has become a global trend setter in developing quality management strategy. The success is primarily due to its data based approach, which eliminates personal bias.

**Zbaracki (2002)** described that DMAIC approach is a well structured, data driven methodology for eliminating defects, wastes or quality control problems of all kinds in manufacturing, service delivery, management and other business activities. DMAIC approach properly implemented will improve customer satisfaction, significantly improve quality and create a continuous improvement.

**Hack man and Wageman (2003)** explained that DMAIC approach provides a way for improving processes so that the company can more efficiently produce world-class products and services. DMAIC have five phases to take specific problems.

**Breyfogle (2004)** affirmed that the DMAIC approach has proved itself highly effective in terms of delivering cost saving and increased customer satisfaction. DMAIC technique has been proven to be extremely valuable by reducing cycle time.

**Joseph (2004)** has defined DMAIC as a data-driven method for achieving near-perfect quality by using a traditional set of quality tools that have been evolving for years. In the

1980s, everyone had a different problem-solving method for improving quality. One of the most universally used was Juran's five-step method that provided a standardized way of achieving DMAIC results. Today, thanks to many practitioners, the five-step approach to DMAIC has become a standardized process. It is different from other quality efforts because it targets higher standards of quality and lower defects, which the customer defines. It catches mistakes before they happen.

**Bendall and Marra (2005)** affirmed that in order to reduce quality problems in the industry and to eliminate customer complaints, the DMAIC approach can be applied effectively. DMAIC brings improvement in organization through systematically reducing variation in processes

**Kumar et al. (2006)** have explained a case study dealt with the reduction of casting defects in an automotive engine and demonstrated how the effective introduction and implementation of a DMAIC approach in organization can lead to a breakthrough in profitability. The dramatic improvement achieved was the result of listening the problem of customer with the objective of evaluating and understanding their concerns. The defect rate per unit has been reduced from 19.4% to 2.9%.

**Sanders and Hilolo (2007)** stated that DMAIC is a quality improvement process which solves customer problems. It is a way to focus employees on quality and establishing a common language across the company. It also creates clearly defined performance goals. After the detailed study it was analysed that the quantum of rejections in the castings can be reduced after applying the DMAIC technique.

**Kim Yong et al. (2010)** have conducted a case study into a corporate research library of a telecom company in Korea to identify and remove ineffective components and unnecessary steps in library works and services. They used DMAIC to identify 12 key factors, which have a great effect on information acquisition time and information utilization, and proposed the improvement plans for those factors.

**Al-Refaei et al. (2013)** used the well-known six sigma approach define-measure-analyze-improve-control (DMAIC) to improve the performance of direct compression process with two quality responses; tablet's weight and hardness. At current factor settings, the  $\bar{x}$  and  $s$  charts are judged in-control for both responses. However, the process was found capable for hardness but incapable for weight. Three process factors are investigated, including machine speed (S), compression force (F), and filling depth (D). The Taguchi's  $L_{27}$  array is adopted to investigate the effects of the three process factors concurrently. Then, the grey relational analysis based ranking is implemented to determine the combination of optimal factor levels. Initially, the process capability values for hardness and weight are 1.5 and are 0.587, respectively. The multivariate capability index,  $MCpk$ , is calculated and found 0.938. After process improvement, the process capability values are found equals to 3.31 and 0.848. The  $MCpk$  is enhanced to 1.68. DMAIC approach is found to be effective for improving the performance of direct compression process with tablet's weight and hardness.

*Roy et al. (2013)* applied Six-Sigma philosophy in Bangladesh, especially in Manufacturing Industry. To show the technical pathway of implementing this technique in our industries for improving the productivity and quality was the main concern of this research. Present Sigma Level is calculated as a part of the framework and total factors, which are directly related with the process, are taken under calculation. At the same time all the process related to production are clearly observe. As a whole, the total improvements of production system by implementing the Six-Sigma tools were our research goal. A Fan Manufacturing Company was our research area where it has possible to analyzed and implemented. In the thorough procedure, DMAIC is used as technical tools for developing the process. Finally, by changing the traditional layout to balanced layout model as per DMAIC approach, remarkable improvements have been achieved.

### 3. Conclusions

After comprehensive study of DMAIC approach it has been concluded that a number of industries adapting this approach to solve any quality or production related problems. This approach has been utilized by industrial engineers in library, manufacturing industries and service industries effectively to eliminate any customer related problem. DMAIC approach can be applied in any small or medium scale industry to remove problems associated with the products.

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