

# Six Sigma - Overview of DMAIC and DMADV

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*Abstract: Six Sigma has been adopted by maximum of all the software development companies to identify the problems in software developments and its processes, to find optimal solutions for the problems identified, and improve the development processes so as to achieve company's business goals. An effective Six Sigma initiative can help a company to identify processes that truly add value and will move everyone and every activity closer to the customer and the customer's needs. In this paper a project is selected in order to prove that implementation of the six sigma improves the software quality by changes the existing process of the software development.*

## I. INTRODUCTION

In any software development, quality of the software is very important to meet the customer satisfaction. Testing is a phase where the software defects are identified which leads to the better software quality. There are many international standards available for improving the software quality, six sigma is one of them.

### Six sigma

The word is a statistical term that measures how far a given process deviates from perfection. The central idea behind Six Sigma is that if you can measure how many "defects" you have in a process, you can systematically figure out how to eliminate them and get as close to "zero defects" as possible. Six Sigma is a highly disciplined process that helps focus on developing and delivering near-perfect products and services.

“Six sigma is not an improvement program. It is instead a business philosophy that employs a step by step approach to reducing variation, increasing quality, customer satisfaction, and in time, market share ”

- Mikel Harry , CEO, Six Sigma Academy

“Six Sigma is a comprehensive & flexible system for achieving, sustaining and maximizing business success. Six Sigma is uniquely driven by close understanding of customer needs, disciplined use of facts, data, and statistical analysis, and diligent attention to managing, improving, and reinventing business processes.”

### Six sigma – Why?

- Reduces dependency on “Age old Knowledge”
- Decisions based on facts and data rather than opinion
- Attacks the high-hanging fruit (the hard stuff)
- Eliminates chronic problems (common cause variation)
- Improves customer satisfaction
- Provides a disciplined approach to problem solving
- Changes the company culture
- Creates a competitive advantage

### Advantages of Six Sigma

- Six Sigma quality refers to having 3.4 defects per million opportunities or product samples.
- Six Sigma is driven by the customer and thus aims to achieve maximum customer satisfaction and minimizing the defects. It targets the customer delight and new innovative ways to exceed the customer expectations.
- Implementation of Six Sigma methodology leads to rise of profitability and reduction in costs. Thus improvements achieved are directly related to financial results.
- Six Sigma is successfully implemented in virtually every business category including return on sales, return on investment, employment growth and stock value growth.
- Six Sigma targets Variation in the processes and focuses on the process improvement rather than final outcome.
- Six Sigma is prospective methodology as compared to other quality programs as it focuses on prevention on defects rather than fixing it.
- It is attentive to the entire business processes and training is integral to the management system where the top down approach ensures that every good thing is capitalized and every bad thing is quickly removed.
- Adopting Six Sigma process improvement puts in place a continual process improvement methodology at all levels of an organization. Once Six Sigma is embedded in a corporate culture, the business processes will continue to improve. Furthermore, new problems will be quickly identified and corrected due to the close monitoring Six Sigma entails.

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- By focusing on defect prevention over fixing defects, companies can realize major and continuing savings over prior rework, scrap and return costs.
- Six Sigma is data driven. No changes are made until the current process is thoroughly understood, documented and measured. The revised process is similarly measured and verified. If the Six Sigma project does not deliver what was intended, the Six Sigma team is still there to correct new found problems or study what went wrong.

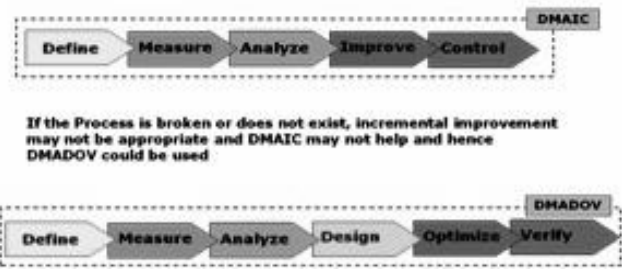
## Disadvantages of Six Sigma

- Six Sigma projects may not yield any cost savings at all. Improving product quality can generate capital costs and long term overhead costs in terms of more quality personnel.
- As product quality improves, tighter quality standards may be adopted or the process is left as it

is but closely supervised. Yet data collection and analysis takes up time and resources; this is called the cost of quality, and the cost of achieving high quality must be balanced against other business objectives.

- Six Sigma does not work well with intangible results. Six Sigma projects are best for physical products that are out of specification, either too large or too small. Six Sigma projects can be applied to business processes that generate measurable outputs such as calls handled per hour or customer wait time. Six Sigma projects do not work well with goals like improving customer satisfaction or lifting employee morale.
- When Six Sigma process methodology is applied to business processes such as performance reviews or processing purchase orders, the recommended solution is often called "bureaucracy busting". This can result in push-back from management afraid of losing their jobs.
- Six Sigma implementation constantly require skilled man force. Thus control and employee dedication are hard to accomplish if its not implemented regularly.
- While converting the theoretical concepts into practical applications there are lot to real time barriers which needs to be resolved.
- Six Sigma gives emphasis on the rigidity of the process which basically contradicts the innovation and kills the creativity.

## Six Sigma Methodology



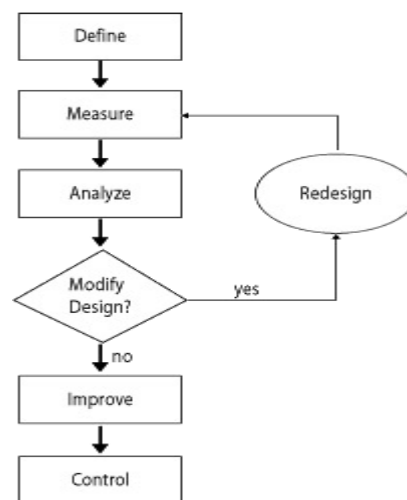
## DMAIC Process

DMAIC model is a systematic method for analyzing & improving business processes.

DMAIC is a data-driven quality strategy used to improve processes. It is an integral part of a Six Sigma initiative, but in general can be implemented as a standalone quality improvement procedure or as part of other process improvement initiatives.

It consists of five phases

- **Define** the problem, improvement activity, opportunity for improvement, the project goals, and customer (internal and external) requirements.
- **Measure** process performance.
- **Analyze** the process to determine root causes of variation, poor performance (defects).
- **Improve** process performance by addressing and eliminating the root causes.
- **Control** the improved process and future process performance



### 1. Define Phase

In the define phase three major activities are involved. They are

- 1) Develop Team Charter: The following details are identified Business case, Problem and goal statement, Project scope, Milestones and Roles.
- 2) Customer Focus: The customer needs are translated into specific requirements and the methods of collecting customer information are identified.
- 3) Process Mapping: First define the Process and connects the customer to the process. Business process mapping is done for the existing process to identify the benefits and applications of process mapping.

## II. MEASURE PHASE

Following are the tasks carried out in this phase

- 1) Performance standards are defined i.e. set specification limits which are meeting the customer needs.
- 2) Develop data collection plan and collect the data.
- 3) Validating the measurement system.

## III. ANALYSE PHASE

The collected data has to be reviewed and identify the root causes of the defects.

Steps involved in this phase

- 1) Examine the value of each step of the process
- 2) Inspects the collected data and transforms it into charts and graphs
- 3) Brainstorm the problem causes by using Cause Effect diagram
- 4) Additional analysis on the cause of the problem

## IV. IMPROVE PHASE

Based on the cause of the problem, devise potential solutions and identify the easiest solution to implement. The identified best solution is communicated to the stake holders. Process maps and high level plan is developed for the pilot solution. By implementing the final solution improvement benefits/impacts are determined.

## V. CONTROL PHASE

The objective of the last stage of the methodology is to develop metrics that will help leaders monitor and document continued success.

- Six Sigma strategies are adaptive and on-going.
- Adjustments can be made and new changes may be implemented as a result of the completion of this first cycle of the process.

At the end of the cycle additional processes are addressed or the initial project is then complete.

### DMADV Process

An improvement system used to develop new processes or products.

### When to Use DMADV

The DMADV methodology, instead of the DMAIC methodology, should be used when:

- A product or process is not in existence at your company and one needs to be developed
- The existing product or process exists and has been optimized (using either DMAIC or not) and still does not meet the level of customer specification or Six Sigma level

The application of **DMADV** is used when a client or customer requires product improvement, adjustment, or the creation of an entirely new product or service. The application of these methods is aimed at creating a high-quality product keeping in mind customer requirements at every stage of the game.

It consists of five phases

### 1. Define Phase

Project leaders identify wants and needs believed to be considered most important to customers. Wants and needs are identified through historical information, customer feedback and other information sources.

- Teams are assembled to drive the process.
- Metrics and other tests are developed in alignment with customer information.

### 2. MEASURE PHASE

The second part of the process is to use the defined metrics to collect data and record specifications in a way that can be utilized to help drive the rest of the process.

- All the processes needed to successfully manufacture the product or service are assigned metrics for later evaluation.
- Technology teams test the metrics and then apply them.

### 3. Analyze Phase

The result of the manufacturing process (i.e. finished product or service) is tested by internal teams to create a baseline for improvement.

- Leaders use data to identify areas of adjustment within the processes that will deliver improvement to either the quality or manufacturing process of a finished product or service.
- Teams set final processes in place and make adjustments as needed.

**4. Design Phase**

The results of internal tests are compared with customer wants and needs. Any additional adjustments needed are made.

- The improved manufacturing process is tested and test groups of customers provide feedback before the final product or service is widely released.

**5. Verify Phase**

The last stage in the methodology is ongoing. While the product or service is being released and customer reviews are coming in, the processes may be adjusted.

- Metrics are further developed to keep track of ongoing customer feedback on the product or service.
- New data may lead to other changes that need to be addressed so the initial process may lead to new applications of DMADV in subsequent areas.

The applications of these methodologies are generally rolled out over the course of many months, or even years. The end result is a product or service that is completely aligned with customer expectations, wants and needs.

**DMAIC vs DMADV**

DMAIC	DMADV
Define-Determine Project Objectives, Scope, Resources, Constraints, Etc.	Define-Similar
Measure-Determine CTQ's, Gage R&R, Obtain Data To Quantify Process Performance	Similar Measure-Determine CTQ's, Gage R&R
Analyze-Analyze Data To Identify Root Causes Of Defects	Analyze-Develop Design Concepts, And High-Level Design
Improve-Intervene In The Process To Improve Performance	Design-Develop Detailed Design, And Control Plan
Control-Implement A Control System To Maintain Performance Over Time	Verify-Test Design With Pilot, Full Scale Implementation

**VI. CONCLUSION**

Six Sigma is a customer-centric which reduces process variation and optimizes development. Six sigma project is a continuous process improvement with the intention of satisfying customer needs. It increases the software quality by 3.4 defects per million opportunities. This study offered the differences between the DMAIC and DMADV process of the six sigma methodologies and when to use which process.

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