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Six Sigma: A Problem Solving Methodology

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Abstract

Six sigma is a methodology for problem solving in every walk of life. It can be used in different areas like disaster management, environment valuation, improving quality of different processes in educational institutes, finding and filling process gaps in various departments of any organization. This paper intends to introduce the reader about six sigma philosophies, its approach and how it can be used to achieve process excellence.

Keywords: Six Sigma, DMAIC, Black Belt

1. INTRODUCTION

Six Sigma is a continuous quality improvement methodology. It was created from the concepts of Total Quality Management by Motorola in 1980s and later on adopted by various organizations. Foremost was Toyota. The famous Toyota Production System is based on Six Sigma Methodology itself. The term “sigma” is used to designate the distribution or spread about the mean (average) of any process or procedure. The sigma capability (z value) is a metric that indicates how well that process is performing. Higher the sigma capability, better the process. Sigma capability measures the capability of the process to perform defect-free work. A defect is anything that results in customer dissatisfaction. In statistical nomenclature, “sigma” (σ, a lower case Greek s) denotes the standard deviation of a set of data. The standard deviation is a measure of the variation or spread about the mean of the process or procedure represented by the data. The larger the sigma (standard deviation), the greater the variation in the process. As variation goes down, sigma (standard deviation) goes down and the sigma capability of the process increases.

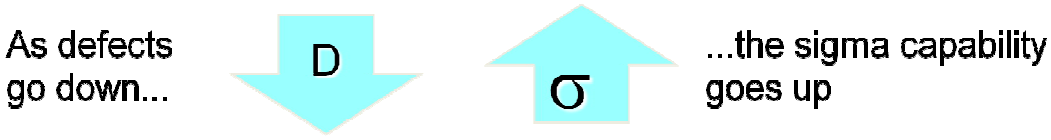

Figure 1:

A number of papers and books have been published on six sigma such as, what is six sigma (Hoerl, 1998; Harry and Shroeder, 1999), why do we need six sigma (Snee, 2000; Pande et al., 2001), what makes six sigma different from other quality initiatives (Pyzdek, 2001; Snee and Hoerl, 2003), Six sigma project selection process (Snee, 2002) and organizational infrastructure required for implementing six sigma (Adams et al., 2003).

2. CONCEPTS OF SIX SIGMA

To achieve six sigma, a process must not produce more than 3,4 defects per million opportunities. An opportunity is defined as a chance for not meeting the required specifications. It means we must be flawless in executing our processes. Six sigma revolves around a few key concepts:

- Critical to Quality: Attributes most important to the customer
- Process Capability: What your process can deliver
- Defect: Failing to deliver what the customer wants
- Variation: What the customer sees and feels
- Stable Operations: Ensuring consistent, predictable processes to improve
- Design for Six Sigma: Designing to meet customer needs and process capability

3. SIX SIGMA METHODOLOGY

Six sigma is a methodology which aims to reduce errors and eliminate variations. Its aim is to improve process so as it makes zero error. Six Sigma is a simple statistical tool which can be used to measure the quality of service. It uses quantitative, data-driven DMAIC methodology to improve existing processes e.g. Loan Approval process in Banks, Admission Process in Institutes. Six Sigma Starts and Ends with the Organization/Institution need for Process Excellence. Six sigma is a 5 step process viz Define, Measure, Analyze, Improve and Control. In short, it is DMAIC. Some of the terms associated with six sigma are as follows:

Black Belt: They are the leaders who are responsible for measuring, analyzing, improving and controlling key processes that influence customer satisfaction and productivity growth. Black belts are full time positions in any organizations.

Green Belt: Similar to Black Belt but not full time positions.

Master Black Belt: They review and monitor Black Belts. Selection criteria for Master Black Belts are quantitative skills and the ability to teach and mentor. Master Black Belts are full time positions.

Control: The state of stability, normal variation and predictability. It is process of regulating and guiding operations using quantitative data analysis.

Control Chart: It monitors variance in a process over time and alerts the organization to unexpected variance which may cause defects.

Process Mapping: It helps in visualization of an entire process and identifies ares of strength and weaknesses. It helps in reducing defects while recognizing the value of individual contributions.

Root Cause Analysis: This is study of original reasons for nonconformance with a process. When the root cause is eliminated, the nonconformance will be corrected.

Classical View of the Quality 98.930% Good (3.8 Sigma)	Six Sigma view of Quality 99.99966% Good (6 Sigma)
20,000 lost articles of mail per hour	Seven articles lost per hour
Unsafe drinking water for almost 15 minutes each day	One unsafe minute every seven months
Two short or long landings at most major airports each day	One short or long landing every five years
1,284 cheques of relief returned to department in a year (at a volume of 10,000 cheques a month)	Only 4 cheques returned in next 5 years (assuming double volumes)
No electricity for almost seven hours each month	One hour without electricity every 34 Years
5,000 incorrect surgical operations per week	1.7 incorrect operations per week

The statistical objective of six sigma can be explained with the following diagram:

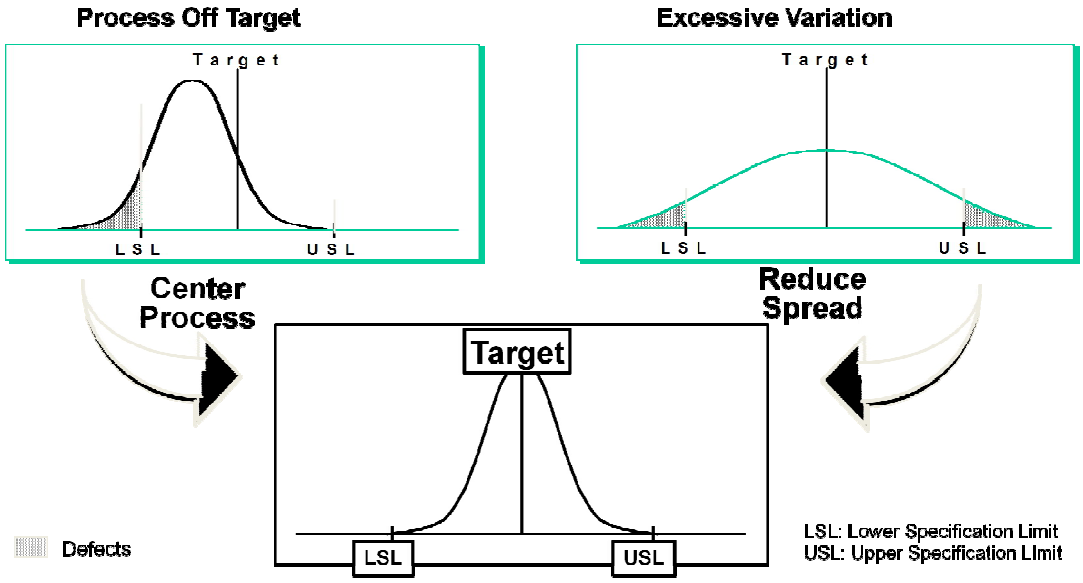

Figure 2:

The goal of six sigma is to reduce variation in the process as well as centre our process. People feel variation more than the mean. Variation hits them more rather than the mean. It can be explained with the help of an example:

Let us consider a process of sanctioning projects in a department after a proposal has been submitted. Let this process have high variation ranging from 5 days to 45 days, with a target of 20 days then candidates may receive sanction of their projects any time in this range. Suppose time of sanctioning five projects be 7, 34, 12, 27 and 39. The average would be 23.8 days. Authority may perceive that the candidates are receiving their sanctioning letters close to the target of 20 days. However the candidates feel the late sanctioning of 34 and 39 days.

But improving quality does not come easy. To increase the capability of the processes requires increasing complexity of the quality system. It needs to focus upon 3 pillars for any kind of improvement. These pillars are people, process and technology. The more you invest in technology the

less is dependence on people. People are bound to error while technology helps them to stop committing errors.

4. SIX SIGMA FOR PROCESS IMPROVEMENT

In any organizations where processes are not at six sigma level, there is lots of scope of improvement. This requires a deep down approach to understand the particular process and find out the gaps. This exercise can be done using process mapping. This usually takes 1 to 3 months. In this, the analyst's role is more important. The analyst tries to capture all the possible factors which are lowering capability of the process. Here fish bone analysis and Business Process Management System can be helpful tools. Some of common loopholes are lack of proper training to the workers, communication matrix not in place, no mistake proofing, no proper measuring of vital parameters and lack of adequate technology among others. Six sigma methodology can help us in resolving all these issues. Data needs to be collated around all such factors and then analysed with various statistical tools to identify statistically significant factors. These factors can be prioritized based on cost and time and then improvement plan is prepared. The process once improved is measured on a regular interval for possible new causes due to change in process or technology. This exercise is repeated so as to maintain good sigma level of the process. Therefore with the adoption of six sigma , different processes of any organization can be taken to the next level of performance. The diagram below explains this methodology:

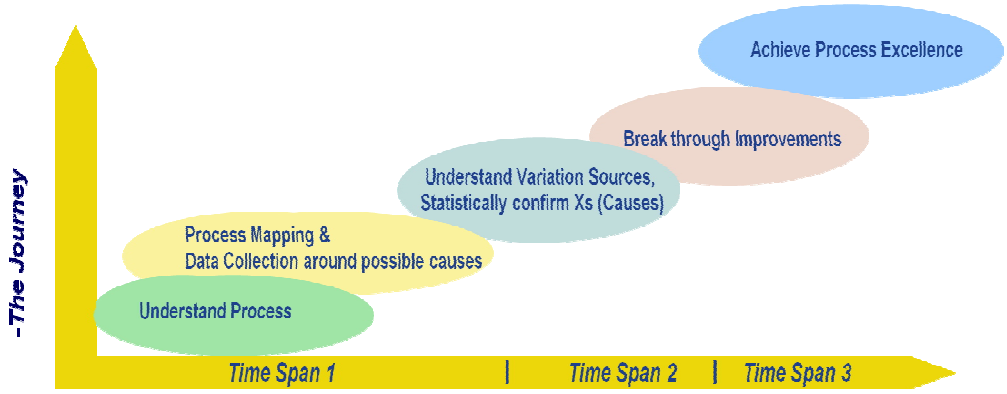

Figure 3:

5. CONCLUSION

To improve any process, we have different ways and means. One of such methodology which can help us to achieve process excellence is Six Sigma. If the possible causes are identified with desire precision and data is collated around those causes then six sigma can do wonders. It can help us in improving all three ingredients of any system viz people, process and technology.

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