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Six Sigma

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Introduction

Six Sigma, developed by Motorola in the 1980's, is a methodology of drastically improving quality within an organization. Six Sigma involves the implementation and training of the entire spectrum of individuals within an organization, ranging from upper management to customer representatives or operators. The underlying principle behind Six Sigma is a vast reduction of defective products, to the point where 99.9997% of the products/service are error free. Two of the largest benefits behind Six Sigma include an optimized process flow and improved customer satisfaction, both of which directly affect the organizations bottom line.

History

Six Sigma originated when total quality management began fading out due to its lack of customer focus. Bill Smith, an engineer at Motorola coined the term Six Sigma, which was first implemented at the Motorola facility in Schaumburg, Illinois. This idea emerged when the traditional quality levels of total quality management were not meeting their satisfaction. Instead of measuring defects in their product per thousand products made, they wanted to measure the defects per million product made. This ideology seeks to produce greater returns on the initial investment.

Following the development of Six Sigma at Motorola, General Electric, under the leadership of Chief Executive Officer John F. Welch, started their Six Sigma initiative in 1996. General Electric has had so much success with Six Sigma that, according to a July 2002 issue of *Business Week*, they now utilize "4,000 full-time Six Sigma experts, plus 100,000 employees who've undergone basic training." Now GE has trained teams who visit Dell Computer and Wal-Mart locations to improve their quality inefficiencies.

At first Six Sigma was focused in the manufacturing industry. Due to the overwhelming success of this application, many customer-oriented companies are now beginning to implement the ideals of Six Sigma.

Six Sigma Basics

The main driving force behind Six Sigma focuses on both internal and external customer satisfaction. A number of statistical tools are utilized in order to improve quality in an organization. There are four major themes within the Six Sigma process, which are as follows:

measuring, analyzing, improving, and controlling. These four themes lead to the goal of Six Sigma, which is to minimize part and process variation. For example, in manufacturing the goal is to reduce cycle time and the number of defects produced.

The Greek letter for Sigma, σ , represents one standard deviation from the normal or average. The higher the Sigma level, the better the quality level, which can be seen below in Table 1.

Table 1: Levels of Sigma Performance (Pande and Holpp, 10)

Sigma Level	Defects per Million
6	3.4
5	233
4	6,210
3	66,807
2	308,537
1	690,000

A defect can be any type of product or service that does not conform to a standard inspection unit or satisfy the customer. In addition a defect can be an error in a product or service. For example a bag of potato chips not meeting the specified weight or a patient having to wait thirty minutes to be attended to in an emergency room can both be considered as a defect.

Implementation

Implementation of Six Sigma begins with education and training within an organization. In order for Six Sigma to be successful, top level management and everyone below them must fundamentally believe in the strength of it. Managers need to support all individuals and teams involved in improving the quality of the part/service or process. If employees need to leave their daily duties to be trained in Six Sigma, all others need to exercise support.

The amount of training an individual receives is proportional to their involvement in the Six Sigma application. Management obtains one to two days of Executive Training where they are taught the basics of Six Sigma, with emphasis of the establishment and management of Six Sigma in their organization. Six Sigma Champion training lasts for five days. Champions are taught how to manage Six Sigma projects and act as advisors for the different project teams that are in place. Green belts generally receive two weeks of training, which include project-

oriented tasks. Green belts can go through a four-week training period if they are going to have a substantial role in Six Sigma projects in addition to their daily routine. With this increased involvement in projects, they will be on teams with Black Belts. Black Belts can be divided into two areas of expertise. A Black Belt that works exclusively on Six Sigma projects completes four weeks of training and that involves learning the four Six Sigma themes. A Master Black Belt is the one who conducts Six Sigma training and also has on the job training and experience.

The Black Belt educational and training process expands over a four-month period where one week per month involves a classroom setting while the other three weeks are hands on projects in their specific task area. The projects to be completed should have goals that are challenging, yet attainable. They should be large enough to show success for the organization and span from four to six months. During the project process, documentation should be kept to follow the steps and progression. These documents ought to be made readily available for other interested employees within the organization.

A successful Six Sigma project has a five-step methodology. The first phase is to define the opportunity. This includes collecting any background information about the process and defining the most important aspects for the customer. The next phase is measuring the process performance or collecting relevant data according to the parameters defined in step one. Once this data is collected it can be analyzed using statistical tools. Some these include: Gage Repeatability and Reproducibility, flow diagrams, multiple regression analysis, process capability, and statistical visualizations. The fourth step involves implementation of the solutions that were found after analyzing the data. The last step acts as a final check for the improvements that have been implemented.

Six Sigma Benefits and Success Stories

There are countless benefits of having employees trained in the practices of Six Sigma. Some of the benefits include the following: cost savings, increased productivity, lower frequency of defects, shorter cycle time, and improved customer satisfaction. Below are just two success stories that had their own particular benefits after implementing Six Sigma. There are many more companies that have also had positive results with Six Sigma.

One of the earliest success stories begins with Motorola, the founders of Six Sigma. At the Schaumburg, Illinois facility, ten years after implanting Six Sigma, great successes were seen.

They increased productivity by more than 12 % each year, reduced poor quality costs by 80%, eradicated more than 90% in process defects, and saved more than \$11 billion in manufacturing costs. Motorola is not the only organization to see such success.

At Froedtert Hospital in Milwaukee, Wisconsin, the 655-bed hospital only had one occurrence of a wrongly medicated patient after implementing Six Sigma. Also, the intensive care unit reduced the amount of time it takes to get lab results back from 52 minutes to 23 minutes.

Downfalls

Although many companies have had success with Six Sigma, some companies have not been so fortunate. It usually takes four to five years to see any benefits of Six Sigma once an initial commitment has been made. For example, it took General Electric more than five years to implement Six Sigma and see any significant results. Besides taking a long time to see any benefits, it is expensive to begin such a process, which is why those who generally utilize Six Sigma ideals are large companies. Between 1996 and 1998, General Electric has spent \$1 billion on Six Sigma procedures. Because of these great up-front costs many small companies do not have the monetary resources needed to use Six Sigma. Often it is very difficult for small companies to take employees away from their regular duties in order to be trained in Six Sigma. If employees are not available to give their services, the company loses money due to a reduction in productivity.

Another downfall of Six Sigma is the idea behind what constitutes a defect. If a defect or mistake is not well defined, it is hard to determine if one has occurred or not. For example, in customer service, how does one know when an error has occurred? Often errors may be based upon one's opinion. There should be a set standard as to what an error is.

Conclusion

After reviewing the benefits and limitations behind Six Sigma, a company should determine whether or not Six Sigma is for them. A clear trend is that Six Sigma is diversifying into large service oriented organizations. In the future, it is likely that more changes will emerge, making Six Sigma an even more beneficial application for organizations of all types and sizes.

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