Industrial Engineering 361

Six Sigma – Making Corporations and Stockholders…

Kim Knuth
Grant Niebuhr
Matt Lind
Ben Mauer

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In today’s economic state, companies cannot afford to lose unnecessary time or money and every healthy company has explicit strategies for constantly improving its business processes and products. Motorola named and pioneered one of these strategies in the late 1980’s. The term “Six Sigma” came to identify a popular form of corporate improvement that is partially responsible for important growth in profits and company stocks (http://www.public.iastate.edu/~vardeman/stat531/sixsigma.pdf).

Before we began research, we questioned the importance of Six Sigma and were not sure of the value it provided to the corporate world. From a case study found on the web site http://www.sixsigmaqualtec.com/Cases/index.html, we saw testimonies of how Six Sigma changed the corporate outlook. There was one case in particular that caught our eye. “Excessive rejects at a glass manufacturer were caused due to scratches and chips created by contaminate in a critical production process. Six Sigma was applied, reducing rejects by 92%, improving line up-time by 79% and realizing $840,000 in annual cost savings.” After reading many of these types of accounts, we realized the huge impact Six Sigma could have on corporate finances and investigated the philosophies that created Six Sigma.

The term Six Sigma defines an optimum measurement of quality; 3.4 defects per million events. (A Six Sigma defect is defined as anything outside of customer specifications. A Six Sigma opportunity is then the total quantity of chances for a defect.) The Greek letter Sigma is a mathematical term that simply represents: a measure of variation, the distribution or spread around the mean or the average of any process or procedure in manufacturing, engineering, services or transactions (http://www.all-six-sigma.com/SixSigmaName.htm).

The fundamental objective of the Six Sigma methodology is the implementation of a measurement-based strategy that focuses on process improvement and variation reduction through the application of Six Sigma improvement projects. This is accomplished through the use of two Six Sigma sub-methodologies: DMAIC and DMADV. The Six Sigma DMAIC process (define, measure, analyze, improve, control) is an improvement system for existing processes falling below specification and looking for incremental improvement. The Six Sigma DMADV process (define, measure, analyze, design, verify) is an improvement system used to develop new processes or products at Six Sigma quality levels (http://www.isixsigma.com/sixsigma/six_sigma.asp).
The DMAIC methodology should be used when a product or process is in existence at your company but is not meeting customer specification or is not performing adequately (http://www.isixsigma.com/library/content/c001211a.asp). There are five steps that create the DMAIC philosophy. The different steps are Define, Measure, Analyze, Improve and Control.

The first step and most important step is **Define**. Defining the problem is crucial to the success of a Six Sigma project. In this step the company must define the project goals and customer (internal and external) deliverables. Without a clear goal, the project may be focusing on the wrong initiatives and cause the company’s Six Sigma program to not bring about the desired results.

The second step is **Measure**. Measuring involves just that: measuring the desired data in order to help you achieve your Six Sigma goals. You should be careful with this step to collect the right data with the right tools. If you cannot measure accurately you will not be able to accurately employ the proper Six Sigma strategy.

The third step in the DMAIC methodology is to **Analyze**. This step goes hand in hand with measuring, only this one involves the analysis of the data you have gathered. The use of statistics is prevalent here using tools such as confidence/prediction intervals and other such descriptive statistics to help interpret your data. Proper analysis will produce data summaries and formal inferences adequate to make clear initial process performance (http://www.public.iastate.edu/~vardeman/stat531/sixsigma.pdf).

The fourth step is **Improve**. This step is where results are most easily seen. If the steps up to now have been followed correctly and carefully, you will end up with several areas that could be seen as ‘problem spots’ and the goal of this step is to work to eliminate those defects. This can be done by experimenting with different methods and seeing firsthand which works the best.

The fifth step is **Control**. This step involves the careful monitoring of the process by observing and statistics to measure the new process and ensure everything is working the way it should be. The obvious goal in this step is to ensure future process performance. Tools such as Shewhart Control charts are very handy in this step.
The five steps that compose DMIAC are very comparable to those that create DMADV. DMADV is compiled by Define, Measure, Analyze, Design and Verify and should be used when a product or a process is not in existence at the company and one needs to be developed. Also, DMADV should be used when the existing product or process exists and has been optimized but still does not meet customer specifications or the Six Sigma level (http://www.isixsigma.com/library/content/c001211a.asp).

The initial two steps of DMADV are exactly the same as for DMIAC and are used in a similar manner. The variation between the two processes comes during the Analyze stage. For DMADV the analyze stage occurs earlier than in the DMIAC methodology but is still used to analyze the process options to meet customer needs. The final two stages of DMADV are completely different and do not exist in the DMIAC methodology.

The fourth stage in the DMADV methodology is **Design**. The design stage is used to create the process that will meet the customer’s needs and also fall within Six Sigma expectations. One important factor in the design stage is to make sure a detailed mapping of the process is created so there are no questions regarding the process and there is no room for interpretation. The design needs to be clear enough so that everyone involved has a clear understanding of the expected process.

The final stage in the DMADV methodology is **Verify**. The verification stage is used to confirm the design performance and the processes ability to meet the customer’s needs. This step is important to ensure that the proper path was followed to maximize product quality and customer satisfaction. Without verification the company has no facts to validate that the new process and design is actually an improvement over the existing process or that the proposed process is indeed the most efficient and cost effective method for production (http://www.isixsigma.com/library/content/c001211a.asp).

When choosing to use DMAIC or DMADV precautions must be taken to ensure the correct methodology is used. There are many instances when the wrong path is chosen; however, employing either of these methods will give you or the company a better grasp on the problem at hand. The following are some examples of how the two methodologies are alike (http://www.isixsigma.com/library/content/c001211a.asp).

- Implemented by Green Belts, Black Belts and Master Black Belts.
• Ways to help meet the business/financial bottom-line numbers.

• Implemented with the support of a champion and process owner.

• Data intensive solutions approaches. Intuition has no place in Six Sigma – only facts.

Many corporations, across the globe, have utilized both DMIAC and DMADV methodologies. Most have found the process to be efficient and beneficial to financial success. However, just because there are many success stories about Six Sigma does not indicate that everyone is a believer in the process methodology or that the approach is suitable for all situations.

Some experts believe Six Sigma methodologies to be a combination of old concepts. D. H. Stamatis argues that Six Sigma presents nothing new and is a marketing ploy that has mesmerized many quality professionals. He states, “It offers easy money, because both the training and qualification are controlled as though the concepts are unique and innovative and can only be understood, taught and implemented in one way. In reality, many consultants who promote the Six Sigma methodology lack consistency in their training materials and course content, and they themselves lack a knowledge base to build on” (www.bettermanagement.com). He also claims, “The program sounds impressive because some major corporations claim exceptional returns on their Six Sigma investments,” in his article “Who Needs Six Sigma, Anyway?” Although it is true that some companies--and they constitute a small percentage of the whole--have had exceptional returns on investment, they only experienced such a tremendous turnaround because they attacked the simplest, easiest-to-solve problems first, and their quality levels were so low that anything they tried would have been a success?” (www.bettermanagement.com).

Stamatis illustrates in his article, “Who Needs Six Sigma, Anyway?” the alternate means of achieving Six Sigma goals. He points out there are many other methods of reaching optimal performance without using Six Sigma. Through his analysis of the Six Sigma process he reached a conclusion that the methodology presented nothing new, it only combined attributes from other similar methods such as The Theory of Constraints (www.bettermanagement.com).

Although everyone does not agree on the merits of the Six Sigma methodology, implementing and adopting the process involves a great deal of time, resources, and most importantly, effort from all levels of the corporation. A Six Sigma program must penetrate all levels of a corporation or organization. It must start with a commitment from the highest levels of management and filter through the remaining levels. In order for the corporation to experience all benefits of Six
Sigma programs, an understanding and commitment throughout all ranks of the company must be obtained. After time the approach will change the way that the entire company goes about doing business (http://www.isixsigma.com/sixsigma/six_sigma.asp).
References:

i Six Sigma:
http://www.isixsigma.com/sixsigma/six_sigma.asp

Statistics and Six Sigma Programs:
http://www.public.iastate.edu/~vardeman/stat531/sixsigma.pdf

All Six Sigma: Your Six Sigma Resource:
http://www.all-six-sigma.com/SixSigmaName.htm

Six Sigma Qualtec:
http://www.sixsigmaqualtec.com/
http://www.sixsigmaqualtec.com/Cases/index.html

Better Management:
http://www.bettermanagement.com