SIX SIGMA: FANTASY, FAD OR FACT?

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Delivered by:

Gregory H. Watson, CIQA, FASQ, FAOQ
President, Business Systems Solutions, Inc.
Chairman, Business Systems Asia Pacific, Pty. Ltd.
President, eCommerce Standard Board, Pty. Ltd.
Adjunct Professor, Industrial Engineering, Oklahoma State University
Past-president, American Society for Quality
Rätiköntie 18
Kukkila 15270 Finland
gregbss@aol.com

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ABSTRACT

The Six Sigma movement is international and is applicable across industry. It is a committed management approach to quantifiably solve problems and optimize critical processes. Six Sigma represents a new philosophy of management, defines a statistical measure of business success, describes a problem analysis methodology and also identifies a business culture. Applying Six Sigma leads to dramatically improved business performance and bottom-line profits.

This lecture explores the fundamentals of Six Sigma, outlines tools and techniques used in its implementation within both large and small companies, and evaluates both the fantasy and fad in its application. The training and preparation of Black Belts, the engagement of key business leaders, and the selection of projects are all critical ingredients in success of a Six Sigma business improvement initiative, which are also explored. Finally, this lecture pays tribute to the pioneering work of the late Professor Stuart Pugh for his contributions to creation of Design for Six Sigma.

INTRODUCTION

It is a true pleasure to come to Scotland and deliver this 25th annual lecture in the memory of John Loxham, a former President of the Institute of Quality Assurance and a pioneer in the field of precision engineering. I am greatly honored by this invitation to address the members of the Institute for Quality Assurance.

I am particularly pleased to be chosen to deliver this address for three reasons.

First, on a personal note, I am pleased to be here today because my family originally came from nearby Drymen and subsequently migrated to Edinburgh before they immigrated to the United States in the late 1800s. It is good to return home again!

Second, this speech recognizes the personal influence of Professor John Loxham to the Six Sigma philosophy. Professor Loxham held an unwavering belief in the total repeatability of machines under automated control. An outcome of such consistent performance is the of a predictable factory that operates in a robust manner – with a minimum influence of variation from process changes or procedural drift due to the loss of production discipline by tired workers.

Finally, I am pleased to recognize that Strathclyde University is known globally due to the reputation of the late Professor Stuart Pugh, former Babcock Professor of Engineering Design and one of the key contributors to the body of knowledge of Design for Six Sigma. It is truly fitting that today we will discuss the belated impact of his work.

Altogether, it feels appropriate for me to present this lecture in Glasgow on the topic "Six Sigma: Fantasy, Fad or Fact?"

WHAT IS SIX SIGMA AND WHY IS IT IMPORTANT?

Six Sigma represents a new philosophy of management, defines a statistical measure of business success, describes a problem analysis methodology and also identifies a business culture. As a managerial philosophy, Six Sigma is a business improvement initiative that aligns the organization around a common set of goals that are evaluated using measures of productivity, cost-effectiveness, and quality. The philosophy that drives Six Sigma is the 'relentless pursuit of excellence' where perfection is defined using the Six Sigma metric coupled with strong emphasis on the flawless execution of the customer experience with an organization's products and services as delivered by its work processes. Six Sigma also depends on a system of measurement that holds the business leaders accountable for performance within the areas where they are able to self-regulate the performance of the organization's work.

The statistical performance measure for Six Sigma is the standard deviation (sigma) of a performance measure. Six standard deviations represent 'virtual perfection' in a process that is the result of 'flawless execution' of well-designed work procedures. Six standard deviations represent the distance between the process or product mean and the customer requirement for that performance. The measurement used for improvement is chosen to achieve consistently exceptional performance in a characteristic that is a critical to product or service quality as defined by its customers. Six Sigma performance thus makes an important competitive difference to customers of the product or service and can be a true differentiator among alternative choices of a consumer.

Six Sigma performance is achieved through use of one of two methods for gaining this exceptional performance: a problem-solving process and an innovation process that are designed to work together to achieve sustainable performance gains in the face of a competitive market.

Finally, Six Sigma represents a business culture that emphasizes motivation of teams to work on common problems to achieve higher levels of performance effectiveness and productivity at lower cost. In mature organizations (which is normally achieved after three years of operating the Six Sigma way), management by fact, root cause analysis and definition of problems according to their source of variation become part of the business language and form a common bond among all levels of employees. In a mature organization Six Sigma is the preferred way of working.

Why is Six Sigma so important? One reason that Six Sigma is important is that it has

been embraced by Wall Street analysts as a yardstick to measure the seriousness of a company in making business improvements. This came about due, in large part, to the use of Six Sigma at General Electric as a way to improve business performance. Once GE's Jack Welch embraced Six Sigma in 1996, it came under public scrutiny as a management methodology worthy of attention. In the two years following the GE adaptation of Six Sigma a bandwagon effect occurred as over thirty companies moved to embrace Six Sigma. Today, most of the Fortune 500 companies in the United States have a Six Sigma effort and it is only the rare large American company that has not implemented this method – while many have extended it to their customers and suppliers. The GE claim, backed by industry analysts, of savings in the billions of dollars makes the promise of increased shareholder value a substantial reason to take a hard look at doing Six Sigma!

THE FANTASY OF SIX SIGMA

Is Six Sigma a fantasy? Yes, in some meanings of the word, Six Sigma is a fantasy! The goal of Six Sigma (statistically defined as 3.4 defects per million opportunities as measured against a customer's requirement) may be unattainable. Certainly in a world where customer requirements continuously increase, an objective to achieve perfection is exceptionally difficult, if not a fantasy – it is at the very least a moving target because the standard of measurement continuously changes with the opinions of customers as to the level of desired excellence to be achieved!

THE FAD OF SIX SIGMA

Is Six Sigma a fad? Yes, in some meanings of the word, Six Sigma is a fad! Once an industry leading company begins a Six Sigma improvement initiative, the trend is for all of the companies in that industry to 'jump on board the bandwagon.' The clear example is the implementation of Six Sigma at General Electric where all of its major global competitors had implemented Six Sigma programs within five years of the GE start. In the American chemical industry all the major companies began a Six Sigma program within the same year! Like many management methods, once it is evident that a respected business leader has accepted the methodology then a rush to the method occurs among many other 'want-to-be-great' business leaders. Whenever such a stampede to implement a new management method occurs, it is subject to criticism that it has become a fad. There is enough evidence to convict Six Sigma of this atrocity as well!

THE FACT OF SIX SIGMA

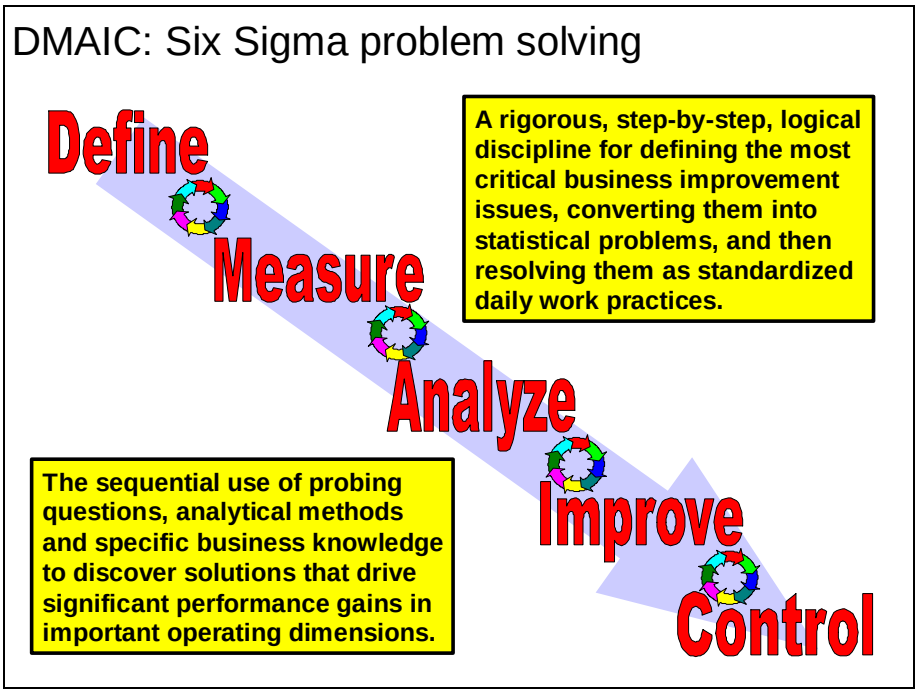
But, if in some ways Six Sigma is a fantasy and also a fad, does that mean it should be dismissed as inappropriate for your business? No, first organizations must assess the merits of observable Six Sigma facts in those companies where it has been proven a success. It is true that the Six Sigma movement is truly international and has come to many companies in almost all industries. It is reasonable for executives to ask: is Six Sigma right for us? According to claims by many of the world's leading businesses, the successful implementation of Six Sigma saves lots of money – it can't be that they are all engaged in a conspiracy of lying about this! So, what are the Six

Sigma facts that business leaders should know before they begin doing Six Sigma? Let's answer this question by considering the following questions:

- How does Six Sigma work?
- What is most important about implementing Six Sigma?
- Is Six Sigma a program that works only with large businesses?
- Will Six Sigma work in your business environment?

How does Six Sigma work?

Six Sigma operates on current business processes as well as the products and services that they deliver. When management recognizes that there is a problem in the way that a current process delivers results, they assign a Black Belt to work with the local team members to Define-Measure-Analyze-Improve-Control the problem – this is the Six Sigma problem-solving process (in typical Six Sigma shorthand this process is most often just called DMAIC). When the current process does not have enough capability for improvement (e.g., due to limits of technology or equipment) then the problem becomes a Design for Six Sigma (DFSS) problem.



In DFSS the Black Belt works with a design team to apply statistical tools for rigorous, systematic innovation to obtain the goal of flawless execution, relative to the customer's most important requirements (or a Six Sigma defect level) using a Define-Measure-Analyze-Design-Verify process (the acronym for the DFSS approach is DMADV).

Following either of these methods, the Black Belt serves as the analytical catalyst for a business team to solve its own problem or to create a new approach to conducting

business or serving customers. Throughout these processes statistical and graphical analysis tools are used by the Black Belt to identify those sources of variation in the process that keep it from consistently delivering the desired customer outcomes. The Black Belt seeks to discover factors that shift the mean of the performance to the desired target level and that manage the variation so that performance is consistently less than the tolerance for variation of its customers.

The result of both the Six Sigma approaches for problem solving and innovation is to develop the most sound work processes that reliably deliver an organization's promise to the market place at the lowest possible operating cost. Following the Six Sigma way there are two major steps toward delivering the right quality to customers: first, designing quality into the products or process to assure that customer needs are met and competitive performance is achieved and, second, following a disciplined work process that delivers consistent outcomes to customers that continuously meet their needs or modifying the process whenever changes in customer needs are detected.

What is most important about implementing Six Sigma?

Clearly training and preparation of Black Belts, the engagement of the key business leaders, and the selection of projects are all critical ingredients in the success of a Six Sigma business improvement initiative. In the most successful Six Sigma companies, the job of Black Belt is a full-time position. These people are normally selected from among your best employees and trained for four weeks over a four-month period. In this time they also demonstrate the skills they are learning by conducting a real-world project that typically generates enough savings to cover the total cost of a Black Belt's training and salary. An average Black Belt can complete 3-5 such projects in a year, if they work full-time in this analysis role. Smaller companies have an advantage over the giants in this area because their projects are better defined, have fewer people involved and can be completed much quicker as a result. Six Sigma projects usually come from the senior management. The role of the key business leader is essential in a strong Six Sigma initiative – they assign and define the project scope, review project work to assure that business objectives are attained, and they provide the resources for implementing project experiments and the recommendations for change. The active involvement of business leaders is a critical success factor for assuring alignment of a Six Sigma effort with the business strategy as well as assuring the long-term viability of the project work. The training and engagement of business leaders in a Six Sigma initiative is as important as the training of a Black Belt because Six Sigma provides a blending of business analysis and process analysis into a methodology that is capable of making lasting changes in the way organizations work to benefit of their targeted customers.

Is Six Sigma a program that works only with large businesses?

The history of Six Sigma reaches back to the 1980s with the work of the Six Sigma Institute, a consortium of high-technology companies led by both Motorola and Texas Instruments, developing the core methodology. From there it extended to other large organizations from around the world such as ABB, AlliedSignal, General Electric, Nokia, Bombardier, Ford, DuPont, Toshiba, Sony, and American Express. However,

smaller organizations have also taken on a Six Sigma improvement program and found that it can be effective in improving their business practices as well. Six Sigma has reached into all sectors of the economy – it has been implemented in hotels, retail stores, and automobile service stations as well as in the largest organizations in the world. In summary, Six Sigma has been proven to be scalable so that it also effectively works with small businesses and divisions of large companies.

Will Six Sigma work in your business environment?

Consider taking a self-assessment of your need for Six Sigma. What is involved in such a self-assessment? The following graphic is a change readiness evaluation form. Scores over 40 tend to indicate that your organization has the maturity to take on a full-scale implementation of Six Sigma. If your organization's score is below this level, then work on the opportunities for improvement to increase your organization's adaptability for innovation and ability to assimilate new ideas and make significant changes in structure and systems. If your organization does not have this degree of flexibility it may be vulnerable to more agile competitors who have learned that change is an essential management ingredient in business – no matter what its size!

Change readiness assessment:

Criteria	Low 1	2	Neutral 3	4	High 5	Score
Propensity to adapt and experiment						
Degree of success with last major change						
Access to information and resources						
Management tolerance for delay and failure						
Level of interpersonal trust						
Comfort level with change						
Willingness to cooperate						
Management will for achieving new state						
Leadership capability of local process teams						
Culture of continuous improvement						
Degree of delegation of decision authority						
Acceptability of work standardization						
					TOTAL	

How ready is your organization to take a serious look at Six Sigma? It is a primary responsibility of management to design changes that are needed to improve corporate performance.

THE CONTRIBUTION OF STUART PUGH TO DESIGN FOR SIX SIGMA

DMAIC is only one of two approaches to improvement that are used by Six Sigma companies. The second approach is generically called Design for Six Sigma and it

includes three major components: product line management, design and new product development project management, and the Six Sigma tools that are applied in the process of design. Much of the thinking that is incorporated into DFSS owes a debt of intellectual gratitude to the work of the late Professor Stuart Pugh of the University of Strathclyde. In his work Pugh differentiated between production engineering-led design and design engineering-led design. The emphasis on corrective action that is inherent in the DMAIC process is strongly related to the production engineering-led design process that results in the developments of variants on the core conceptual design. Here, the emphasis is on the incremental change that is required to make small improvements that increase quality or enhance production capability, reduce cost or improve performance at the margin of the core product. The emphasis on clean sheet product development is found in the design engineering-led design process of DMADV that incorporates many of the tools and methods that Pugh emphasized: Kano model for feature analysis, enhanced QFD (Quality Function Deployment), Theory of Inventive Problem Solving (TRIZ), Pugh concept selection matrix, Taguchi experimental design, as well as statistical tolerance analysis. Even the controversy about how to engage the computer aided design tools that was a core of Pugh's design concept is embedded into the DMADV where the use of CAD/CAM tools is focused in the last two steps of the process, following the conceptual design and elimination of design vulnerability to error at the level of the initial product design specification. I can say with confidence that the work of the late Professor Stuart Pugh lives on in the spectrum of companies that are today applying the concepts of Design for Six Sigma.

CONCLUSION

I would like to draw the following three conclusions as I close this lecture:

First – yes, Six Sigma is a fantasy. However, it can become a realizable dream if it is managed appropriately.

Second – yes, Six Sigma has become a fad. However, it can become a fad that is able to differentiate a business from its competitors if it is managed appropriately.

Third – yes, Six Sigma is a fact and this fact provides the greatest challenge of all to today's business leaders. How can we incorporate the Six Sigma DMAIC process to gain competitive advantage from a more cost-effective operation and how can we use the Six Sigma DMADV process to gain competitive advantage from design of new products and processes?

Picking up the gauntlet of this challenge is a top management task for all businesses – both large and small. This is a decision that must be made for every company. As the late Dr. W. Edwards Deming once remarked: "You don't have to do this – survival is not compulsory."