



GLOBAL JOURNAL OF RESEARCHES IN ENGINEERING  
GENERAL ENGINEERING  
Volume 12 Issue 1 Version 1.0 March 2012  
Type: Double Blind Peer Reviewed International Research Journal  
Publisher: Global Journals Inc. (USA)  
Online ISSN: 2249-4596 & Print ISSN: 0975-5861

## Lean Sigma- Not just a whim. It is here to Stay

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**GJRE-J Classification:** *FOR Code: 030599*



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# Lean Sigma- Not just a whim. It is here to Stay

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## I. INTRODUCTION

Improvement is needed today, perhaps more than ever before. Various methodologies have been used over the years to improve businesses. Each new approach has its building blocks on the previous approaches but also goes a step ahead from its predecessor by adding new concepts, apart from adopting the effective aspects and eliminating the limitations of the older approach. Dean (1997) showed in his work that Taylor had begun the improvement as we know about it today, with his work on scientific management. Later during the century, during the difficult financial times cash flow became essential to keep an organization running. The lean six sigma approach is the latest among the approaches of process improvement. The greatest advantage of this approach is that it improves bottom-line results that are needed to fuel innovation and growth and as well as enhancing customer satisfaction. Apart from this Lean Six Sigma has also been widely accepted as an effective leadership tool. Lean Six Sigma works better than previous approaches because it integrates the human and process aspects of process improvement.

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## II. LEAN -A HISTORICAL PERSPECTIVE

The roots of lean management originated from the Toyota production system (TPS), a manufacturing philosophy conceptualized by the Japanese engineers Taiichi Ohno and Shigeo Shingo (Inman, 1999) and the concept of mass production was established in the early 19th century by Henry Ford (1913). The development of this approach of manufacturing began soon after the Second World War when companies were faced by acute shortage of capital as well as resources. Eiji Toyoda, employed by the Toyota Motor Company, instructed his workers to eliminate all waste. Furthering on this philosophy, through a process of trial and error a new manufacturing system, also known as Toyota Production System was achieved. This lean operations management design approach, which was adapted by US as the Just in Time Approach (JIT), focused on the elimination of waste and excess from the tactical product flows at Toyota and represented an alternative to mass production. Holweg (2007) showed that Lean manufacturing extends the scope of the Toyota production philosophy by providing an enterprise-wide term that draws together the five elements of “the product development process, the supplier management process, the customer management process, and the policy focusing process for the whole enterprise”. The main target of lean, as defined by Hines and Rich (1997) is value stream (identifying value-added and non-value added activities), and to eliminate all waste, or muda, in all areas and functions within the system. Seven forms of waste have been identified as;

- 1) Over-production;
- 2) Defects;
- 3) Unnecessary inventory;
- 4) Inappropriate processing;
- 5) Excessive transportation;
- 6) Waiting; and
- 7) Unnecessary motion.

Womack and Jones(1990) identify five key principles of the lean organization

- 1) The elimination of waste (or muda);
- 2) The identification of the value stream;
- 3) The achievement of flow through the process;
- 4) Pacing by a pull (or kanban) signal; and
- 5) The continuous pursuit of perfection.

Rother and Shook (1999) showed the emergence of Value stream mapping for the role to identify value added and non-value adding processes. VSM brings together all of the lean techniques like the provision of a common language when considering manufacturing processes. In the initial period of awareness of lean during the 1990's, the main weaknesses of lean manufacturing were its automotive manufacturing-based view and limited appreciation of how to handle variability in demand. The implementation was tool-focused, and generally neglected the human aspects of the high-performance work. Later on, after the 1990's; there was a widening of focus away from the shop floor. After 1990, there was a gradual widening of focus away from the shop-floor. This evolution focused on quality during the literature of the early 1990s, through quality, cost and delivery in the late 1990s, to customer Value from 2000 onwards. Hines et.al (2004) has identified the concept of Lean to have undergone a significant evolution and expansion beyond its origins in the auto industry, and its narrow definition around shop-floor improvement.

#### a) Shortcomings of Lean

1. Implementation of Lean is costly and time consuming.
2. There is still a fair deal of misunderstanding of the contingent nature required to apply Lean thinking.
3. Lean is often criticized to be de-humanizing and exploitative because of the high pressure it puts on the shop floor workers to achieve the highest output.

### III. SIX SIGMA- A HISTORICAL PERSPECTIVE

Barney (2002) quoted Six Sigma as strategic, company-wide, approach. It focuses on variation reduction that gives projects the potential of simultaneously reducing cost and increasing customer satisfaction. The approach originated in Motorola in 1987. Six Sigma was conceptualized as a quality goal in the mid- 1980s at Motorola because technology was becoming so complex that traditional ideas about acceptable quality levels were inadequate. As the number of opportunities for defects increased, the percentage of perfection had to rise. In 1989 Motorola announced a five-year goal—a defect rate of not more than 3.4 parts per million—six sigma. This initiative challenged ideas of quality in the U.S. and changed the concept of quality levels. It was quickly no longer sufficient to measure quality as percentages (defects per hundred opportunities). Now the bar was raised, to measure defects per million or billion. In 1994 Larry Bossidy, CEO of Signal, introduced Six Sigma as a business initiative to “produce high-level results, improve work processes, expand all employees’ skills and change the culture”. Later on, the implementation of Six Sigma at General Electric began in 1995. Schroeder

et al. (2008) have identified various elements of Six Sigma programs such as management involvement, improvement specialists, performance metrics, a systematic procedure, and project selection and prioritization. Rajagopalan et. al. (2004) argued Six Sigma programs improve operational performance in order to enhance customer satisfaction with a company's products and services. Six Sigma has today evolved into a business improvement system that has taken hold at many high-performing organizations. Thomas and Fisher (2007) mentioned six sigma organizations use the five-step DMAIC (pronounced “da-MAY-ik”) as shown in fig.1. The root of Six Sigma lies in the concept of total quality management where everyone in an organization is responsible for the quality of goods and services produced by the organization. Sower et. al. (1999) concluded other components of Six Sigma that can be traced to Total Quality Management (TQM) include the focus on customer satisfaction when making management decisions, and a significant investment in education and training in statistics, root cause analysis, and other problem solving methodologies.



Fig. 1 : The DMAIC model

Revere et. al. (2002) concluded Six Sigma has evolved over the years, which now includes designing, improving, and monitoring business processes. Now it becomes multifaceted, encompassing everything from simple process improvement to broad initiatives, such as project management, change management, leadership, culture change, rewards and compensation, defect definition, teaming, and problem solving. Applications of six Sigma span over a variety of industries, from the manufacturing sectors like Motorola and GE mentioned in Pande et. al (2000) construction industry mentioned in Stewart and Spencer (2006) and accounting practices mentioned in Brewer and Bagranoff (2004) as well as in the service sector mentioned in Chakrabarty and Tan (2007).

a) *Shortcomings of Six Sigma*

1. Antony (2004) focuses the adverse effect of colour qualification belts in six sigma (green, black, master black belts etc.) used for training effects as non standardized and can be source lead to bureaucracy within an organization and thus drive the focus away from the performance issues.
2. The organizational improvement philosophy of Six Sigma is still not well understood or explored and thus faces the threat of being oversold or incorrectly used.
3. Use of Six Sigma for solutions and as well as its training can be expensive for many businesses.
4. Six Sigma alone cannot dramatically improve process speed or reduce invested capital.

IV. LEAN SIX SIGMA: WHAT AND WHY

Sheridan (2000) described the “lean Six Sigma” phrase as the integration of lean and Six Sigma philosophies. Lean Six Sigma is a business strategy and methodology that increases process performance resulting in enhanced customer satisfaction and improved bottom line results. With disparate roots but similar goals, Six Sigma and lean management are both effective on their own. However, some organizations that have adapted either Six Sigma or lean management might eventually reach a point of diminishing returns. In order to improve business processes on some periodic basis, all organizations need a methodology for problem solving and improvement. A systematic approach to improvement is needed to improve performance as measured by quality, cost, delivery and customer satisfaction. Bottom line improvements also provide the cash needed to fuel innovation and growth. Bendell (2006) has stated that the concept of lean Six Sigma as an approach to process improvement has yet to fully mature into a specific area of academic research. Smith (2003) said that in practice the majority of efforts to fully and comprehensively implement a lean Six Sigma initiative to its full potential have not been realized. Cusumano, (1994) regarded as a failure to sustain a change towards continuous improvement can be attributed for one, to the lack of commitment from management. Bendell, (2006) quoted that in the case of fusing lean and Six Sigma, the two approaches have often been implemented in isolation, creating lean and Six Sigma subcultures to emerge within the organization, which can conflict of interest and a drain on resources. The integration of lean and Six Sigma aims to target every type of opportunity for improvement within an organization. Smith (2003) stated Six Sigma is only implemented by a few specific individuals within a company, lean levels the empowerment and education of everyone in the organization to identify and eliminate non-value adding activities. The integration of the two methodologies attempts to provide empowerment even at the higher-level process analysis stages, so that employees have true ownership of the process. Figure 2

summarizes the nature of improvements that may occur in organizations that practice lean management or Six Sigma, and the corresponding improvements that an integrated program could offer. The horizontal axis represents the customer’s perspective of value, including quality and delivery performance. The vertical axis represents the producer’s cost to provide the product or service to the customer. Under either system, improvements will be made, but a improvements will begin to level off at a certain point in time. With Six Sigma alone, the levelling off of improvements may be due to the emphasis on optimizing measurable quality and delivery metrics, but ignoring changes in the basic operating systems to remove wasteful activities. Higgins (2005) argued that with lean management alone, the leveling off of improvements may be due to the emphasis on streamlining product flow, but doing so in a less than scientific manner relating to the use of data and statistical quality control methods.

A Lean Six Sigma (LSS) organization would capitalize on the strengths of both Lean management and Six Sigma. A LSS Organization would include the following three primary tenets of lean management:

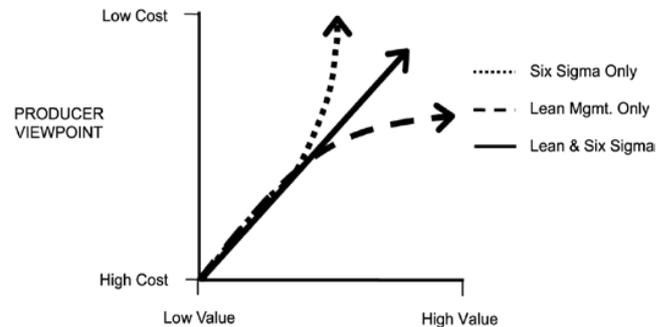


Fig. 2 : Customer View Point Source Arnheiter and Maleyeff (2005)

- 1) It would incorporate an over-riding philosophy that seeks to maximize the value-added content of all operations
- 2) It would constantly evaluate all incentive systems in place to ensure that they result in global optimization instead of local optimization.
- 3) It would incorporate a management decision-making process that bases every decision on its relative impact on the customer.

Similarly, a LSS organization would include the following three primary tenets of Six Sigma:

- 1) It would stress data-driven methodologies in all decision making, so that changes are based on scientific rather than ad hoc studies.
- 2) It would promote methodologies that strive to minimize variation of quality characteristics.
- 3) It would design and implement a company-wide and highly structured education and training regimen.

## V. LEAN SIX SIGMA - NOT JUST A WHIM

Gibson and Tesone (2001) stated that it is often argued that a method that is marketed and promoted as new is actually a reassembled version of a previous method. The early disintegrating fads leave their remnants that under new names become new fads. Abrahamson (1996) stated that these fashion-like cycles may be created by organizations continually searching for improvement in their operations. New procedures may be adopted when they are widely hailed as solutions to human and organizational problems, and then dropped after the promised results fail to materialize or are superseded by another. However, improvement approaches come and go, but improving the bottom line never goes out of style. The integration of Lean Six Sigma is not just about Lean Six Sigma, but addresses a major issue which is the improvement of business processes. The financial crisis is encouraging leaders and organizations to view Lean Six Sigma as an approach to reduce costs and keep the cash flowing. Lean Six Sigma is the method to realize improvement. The supporters of Lean Six Sigma have given numerous arguments as to why this is not just a fad. To further justify this argument, a look at what fads are is important. Fads tend to follow a seven-stage life cycle:

- 1) An academic article is written on a new discovery or theory;
- 2) The study is discussed, summarized, and repeated;
- 3) The concept is popularized in a best-selling book;
- 4) Throngs of management consultants carry the new technique to their client base;
- 5) Managers embrace the fad and champion the concept;
- 6) Time passes, enthusiasm dims, and doubts and cynicism arise; and
- 7) New discoveries occur and consultant interest turns elsewhere.

However, over the years both Six Sigma and lean management have evolved into comprehensive management systems. These philosophies have not suddenly emerged, but over the years, through trial and errors have undergone several changes to now encompass common features, such as an emphasis on customer satisfaction, high quality, comprehensive employee training and empowerment. These goals are not time or demand specific, but are the basic building blocks that are highly critical to the success of an organization. It can be argued that these goals are essential to the growth and success of an organization and any management strategy that offers solution at this grass root level is likely to survive beyond the hype that is associated with a fad. An increase in productivity is the ultimate solution that the combination of lean six sigma offers.

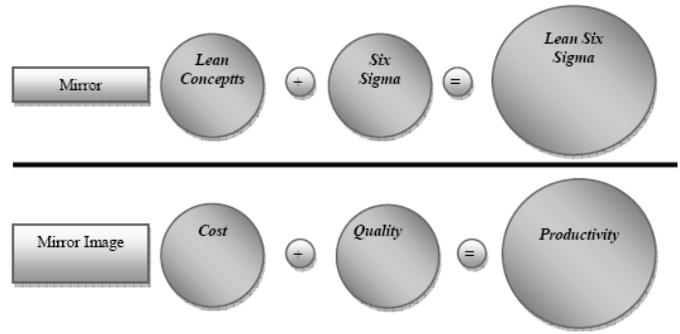


Fig.3 : Productivity a Reflection of Lean Six Sigma

As shown in figure 3 while cost can be considered as mirror image of Lean, and quality that of Six Sigma, the combination of the two, i.e., cost and quality helps in increasing productivity. Although to maximize the advantages from Lean Six Sigma method, it is important to implement the two policies harmoniously, so that it can achieve both strategic and operational improvement in productivity.

## VI. BRIDGING THE GAP BETWEEN LEAN AND SIX SIGMA

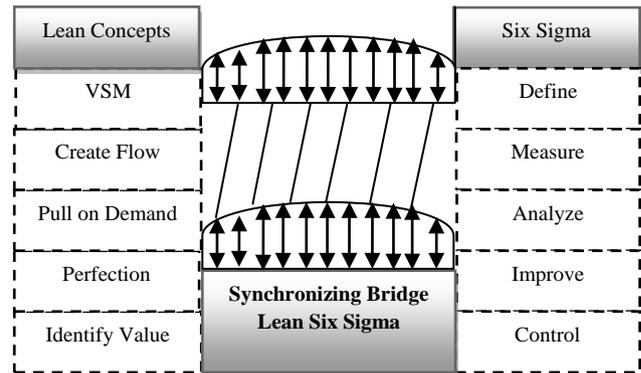


Fig.4 : Lean Six Sigma Bridge

Figure 4 reflects the five main tenets of both Lean and Six Sigma. The main features of Lean are to help in reducing cost, whereas the key principles of Six Sigma are used to reduce the variability of products. However, in any organization or industry the main aim is to ultimately improve the quality of its products or services. These issues can be addressed only by reduction in costs achieved by application of Lean and as well as process improvement by reducing variability to the six sigma levels.

## VII. METHODS AND METHODOLOGY

The author shortlisted 25 major industries in and around Delhi, India that were using Lean and/or Six Sigma as their company policy. The questionnaire that was used for the purpose of the study was tested for

reliability using Cronbach's alpha test. The questions were designed such that they all had a standardized Cronbach's alphas range from a low of 0.74 to a high of 0.84. The questionnaire formulated was then sent to the selected industries through mail. Out of the industries selected, only 10 responses were received. The main purpose of the questionnaire was to know about the experiences of these industries in using Lean and/or Six Sigma, either together or as separate entities. The first part of the questionnaire asked the individual respondent about the position they occupied in the company. It was observed that the employees belonged to different levels of the industrial hierarchy from shop floor technicians to the production managers. The next part of the questionnaire addressed questions about how the companies became aware of either lean or Six Sigma and also the duration from which they were using it. The respondent companies were then asked about their reasons and experiences of the implementation of either lean and/or six sigma in their companies and also on the reasons for further using these in the future considering the advantages it gave in the cost reduction and quality issues. The individual questions were designed such that the respondents had to give their responses to the questions or statements on a 5 point Likert scale (1-5) starting from 'Very high to Very low' as two extremes of continua, that were divided in five intervals of measurement. In addition, the approximations were used in terms of numbers and/or percentages for measurement.

## VIII. RESULTS

Based on the results of the questionnaire it was seen that considering the fact that lean six sigma is a relatively new policy, it has already been adapted by a significant number of major industries in northern India. It was also seen that most of the industries became aware of this policy through professional papers and other such publications. By the responses given, it was observed that the respondent companies were using this policy for more than a year and the most common reasons for using the policy were to improve customer satisfaction and remain competitive in the international market. The companies were seen to have a positive experience of using lean six sigma and were convinced of using it in the future because of the advantages it gave them in maintaining their quality and eliminating waste and thus helping in cost reduction. On the basis of all the results that were obtained with the help of the questionnaire the following conclusion was made.

## IX. CONCLUSION

Over the years several management approaches and solutions have been offered in order to increase the outputs of an organization and to gain maximum customer satisfaction. Several of these have been unable to retain with the due passage of time. However, as can be concluded from the results of the

present study, unlike such previous concepts, Lean Six Sigma can be considered to be fairly successful in helping organizations achieve their targets. From the responses given it can be seen that the industries had used lean six sigma before and were convinced of using it in the future as well. Companies and organizations are always in lookout for methods to improve their productivity which Lean Six Sigma can definitely provide them with. At the end of the paper, it can be concluded that a policy like lean six sigma that has its fair share of supporters who have been using it and hope to continue doing so in the future, is definitely not a fad as it has been considered by some of its critics and it holds the key for managing the cost and quality issues of industries, and specially so for those in the developing countries.

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