



REFLECTIVE PRACTICE

Six Sigma vs Lean

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Lean

Some perspectives from leading academics and practitioners

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Abstract

Purpose – The purpose of this paper is to present the fundamental and critical differences between two of the most powerful methodologies in a process excellence initiative in any organisation.

Design/methodology/approach – The approach taken was to collate opinions from a number of leading academics and practitioners from five different countries. It was also important to ensure that all participants have a good knowledge and expertise in the field of both Lean and Six Sigma methodologies.

Findings – Although both methodologies are focused on process and quality improvement, Lean is formalisation and codification of experience and judgement which is not a feature of Six Sigma. Lean emphasises speed and waste, however Six Sigma emphasises variation, defects and process evaluation.

Research limitations/implications – The viewpoints expressed in the article are those of a few academics and practitioners. It is important to capture the viewpoints of more academics and practitioners to arrive at sound and valid conclusions.

Originality/value – The paper provides an excellent resource for many researchers and for practitioners who are engaged in research and applications of the most two powerful methodologies for achieving and sustaining operational excellence. It is also critical to understand the fundamental differences between these two methodologies.

Keywords Quality, Lean production, Six sigma, Operations management

Paper type Viewpoint

Introduction

The concept of Lean Thinking (LT) developed from Toyota Production System (TPS) involves determining the value of any process by distinguishing valued-added activities or steps from non-value added activities or steps and eliminating waste so that every step adds value to the process. Lean focuses on efficiency, aiming to produce products and services at the lowest cost and as fast as possible. The commitment to LT must start at the top management level and should be cascaded down to various levels across the organisation to improve flow and efficiency of processes. Lean strategy brings a set of proven tools and techniques to reduce lead times, inventories, set up times, equipment downtime, scrap, rework and other wastes of the hidden factory.

Six Sigma was developed at Motorola by an engineer Bill Smith in the mid 1980s. Six Sigma is a business improvement approach that seeks to find and eliminate causes of defects or mistakes in business processes by focusing on process outputs which are critical in the eyes of customers. Six Sigma principles can be used to shift the process average, help create robust products and processes and reduce excessive variation in



processes which lead to poor quality. The statistically based problem solving methodology of Six Sigma delivers data to drive solutions, delivering dramatic bottom-line results. Moreover, Lean is primarily focused on material and information between the process steps whereas Six Sigma can be extremely useful in addressing poorly performing value adding transformations within the process steps. Many Lean principles are fundamentally based on qualitative models developed from years of experience. Six Sigma on the other hand can play a critical role in understanding what is really happening inside the process steps.

Each methodology proposes a set of attributes that are prerequisites for effective implementation of the respective program: top management commitment, cultural change in organisations, good communication down the hierarchy, new approaches to production and to servicing customers and a higher degree of training and education of employees. The integration of two systems can achieve better results than what either system could not achieve alone. The integrated approach works better than previous approaches because it integrates the human (such as leadership, customer focus, cultural change etc.) and process aspects (process capability, process management, statistical thinking) of process improvement. Many companies often fail to integrate the above elements within their process and quality improvement initiatives and hence such companies never achieve the breakthrough results they would like to have.

Although there are many commonalities between Lean and Six Sigma, there are some real and fundamental differences. A panel of academic experts and practitioners were chosen to discuss the topic "How would you compare Lean with Six Sigma?". The people who have participated in this panel discussion include the leading practitioners and academics in the field.

Professor T.N. Goh, National University of Singapore, Singapore

Both Lean and Six Sigma will lead to quality improvement and business competitiveness. The application of both Lean principles and Six Sigma thinking in real world require learning of various tools and techniques and their applications, not by will power or simple attitude changes. Professor Goh firmly believes that there are certainly more sophisticated ideas and tools/techniques. Lean is formalisation and codification of experience and judgement which is not a feature of Six Sigma.

Professor Sung Park, National Seoul University, South Korea

Lean and Six Sigma both emphasise process flow. Lean focuses on process flow with minimum waste and the idea is to improve speed and increase productivity. Six Sigma focuses on process flow with minimum variation. Lean focuses on reduction of cost by eliminating all sorts of non-valued added activities and waste. Six Sigma however focuses on reduction of cost by systematically tackling cost of poor quality items in various processes. Lean likes to use value stream mapping, JIT, visual management, work flow standardisation etc. Six Sigma on the other hand uses statistical and non-statistical tools for reducing process variation such as design of experiments, Analysis of Variance (ANOVA), Statistical Process Control (SPC), cause and effect analysis, histograms, Multi-vari charts, etc.

Alessandro Laureani, Master Black Belt, Hertz Corporation, Ireland

In my experience, it is better to start with Lean: a 5S exercise is a very good starting point, as it helps organizing the workplace where the process takes place. Levelling and

scheduling tools help to streamline the flow of the process and ripe those “low hanging fruits”, i.e. quick wins that energize the staff, and make them rally after the initiative.

It is important to note that two critical components for any continuous improvements initiative to succeed are:

- top leadership support; and
- staff engagement.

As Lean tools are usually more simple and straightforward than Six Sigma ones, starting with Lean help in getting early engagement from staff members and show quick results to the leaders of the company.

After this initial phase, that depending on the complexities of the processes and size of company involved, it is then possible to move to the second stage, bringing in more complex statistical Six Sigma tools to tackle more complex problems with no immediate root cause resolution.

Dr Andrew Thomas, Associate Dean (Research and Enterprise, University of Wales Newport, Wales, UK

In my experience as a Lean/Six Sigma practitioner I have certainly found a greater appetite from companies to deliver Lean rather than Six Sigma as the key business process methodology for business improvement. However, it is the Six Sigma approach which delivers better bottom line improvements than the application of Lean. It can be argued that Lean fails in delivering effective bottom line results due to the application of lean being poorly implemented by consultants who themselves are badly trained in the principles of Lean.

It can be argued that this may be because Six Sigma provides a clear and well established five stage DMAIC process which allows practitioners to implement the approach in a clear manner whereas it is somewhat more difficult to understand which tools to use at what times when applying Lean. In my experience of applying lean, I have been called in to resurrect Lean programmes when they have failed to deliver bottom line results. Normally companies start with a value stream mapping (VSM) programme and spend endless time in developing rigorous VSMS without progressing to Future Stream maps as energy and momentum is lost. During this stage, companies also miss the important issue of defining value from the customer perspective and therefore the voice of the customer is often neglected where it should be a pre-cursor to the VSM development stage.

Six Sigma on the other hand benefits from a clearer and better structured approach which maintains momentum and has a clearer set of application tools which allows companies to resolve issues quickly. The perennial problem still surrounds Six Sigma (which does not hinder Lean in the same way) in that it is seen as a highly analytical methodology which requires many years of statistical training and development before it can be effectively applied.

Mr Greg Watson, Business Excellence Solutions, Limited, Finland

What is the relationship between the Lean and Six Sigma methodologies? Some say lean methods do not require statistics. This is an error! Statistical methods have always been part of Lean – however, many of the methods used by workers to manage Lean (5S, standard work, visual factory, cycle time reduction, single minute exchange of

dies, mistake-proofing, *kanban*, etc.) do not require statistics, thus these methods can be employed by workers who are operating at the Six Sigma Yellow Belt or Green Belt level of proficiency. Statistical methods are useful for establishing cycle time performance targets and for managing the flow of lean production. Production line balancing can be achieved using one-way ANOVA while control charts can be used to monitor cycle times in the distribution and Pareto charts help to keep track of systemic causes of problems throughout the process. While it is true that lean methods can be implemented at the work-floor level without implementing Six Sigma as a company-wide improvement program, companies must examine the symbiotic relationship between these methods and recognize that the most advanced applications of lean systems in Japan rely on the use of “production engineers”, whose training is an equivalent of the Six Sigma Black Belt, to assist front line operators when advanced knowledge or capability is required. Thus, I resolve this issue as the need for merging Lean and Six Sigma methods into a holistic systems approach to business process improvement with the methodologies blended using different levels of worker competence which are required to manage and improve work processes on a daily basis.

Professor Rae Cho, Clemson University, USA

Six Sigma focuses on variation reduction, reducing cost through variance reduction, etc. Six Sigma uses more statistical tools and is used for tackling more complex problems with unknown solutions. Lean focuses on waste reduction, cycle time reduction, reducing cost through waste reduction, etc. Lean is primarily used to tackle problems which are readily visible to the organisation and hence used for initial round of improvements (that is quick wins).

Professor Ronald Does, University of Amsterdam, The Netherlands

Lean expresses the systematic pursuit of waste reduction in organisations. Lean focuses on efficiency, aiming to provide products and services at the lowest cost and as fast as possible. The key to a successful integration of Lean and Six Sigma is to regard Six Sigma’s project management and its DMAIC roadmap as a general framework for problem solving and process improvement.

Dr Shirley Coleman, University of Newcastle, Newcastle, UK

Lean has a main feature related to the 14 principles of the Toyota way whereas Six Sigma is characterised by statistical analysis.

Lean involves statistics but they follow on from the revelations that come from the Lean analysis, for example a flow chart may show important junctions and so data are collected to evaluate the problem and search for root causes. The Six Sigma approach would place a higher visibility and priority on statistics so that the flow chart would be part of the define stage and would be followed by more extensive data analysis. Six Sigma allows and encourages more imaginative use of statistics so that a Six Sigma practitioner might actively look for opportunities to apply correlation, regression, DoE etc. and so they are likely to find some interesting patterns and relationships. Lean practitioners would be content to look for more organisational explanations for problems.

Mr V. Arumugam, Certified Six Sigma Black Belt, Vestas Wind Systems, Denmark

Lean and Six Sigma are both process improvement strategies. Lean can be considered typically as an approach for inter-process improvement promoting flow and Six Sigma typically for intra-process improvement reducing variation and enhancing quality. When deployed simultaneously, both can complement each other to make the process perfect which will satisfy customer's desire for value with zero waste. Both Lean and Six Sigma help to identify opportunities for improvement in the organization. Both enhance problem solving capability of people and make them more valuable to themselves and to the organization they belong, both current and future. There is a growing apprehension that Six Sigma does not involve all people in improvement activities whereas Lean engages people at the grass root level through creative and continuous improvement activities (*kaizen*). It is true that people require a fair amount of specific skills and training in using special tools and techniques to participate in Six Sigma projects. To address all key issues and problems faced by an organization, it needs a well-rounded approach that includes both Lean and Six Sigma projects. Lean and Six Sigma when deployed simultaneously, help to engage all types of people in improvement activities so that organizations become truly capable and attain competitive advantage.

Dr Phil Rowe, Burton Consulting Group, Rugby, United Kingdom

Both Lean and Six Sigma are quality/cost improvement approaches which are fundamentally focused on processes. The fundamental differences between these two approaches lie in the degree of training and the level of statistical knowledge. The time scale for the implementation of both methodologies vary significantly as Lean is primarily focused on tackling low hanging fruits with quick solutions whereas Six Sigma is focused on dealing with more complex problems where variability has been the major concern. Lean is much easier to be understood by senior managers compared to Six Sigma. Six Sigma requires more real involvement from senior management to keep it going due to timescales and complexities of projects.

Professor Jiju Antony, University of Strathclyde, United Kingdom

As a researcher and a practitioner of Lean and Six Sigma methodologies, I would firmly believe that an integrated approach would produce long lasting results. The following are some of the similarities between the Lean and Six Sigma approaches to process management and improvement:

- Both are process focused or process-centric.
- Both need management support for success, especially in terms of creating the infrastructure and allocation of required budget and time for changing the culture of the business.
- Both can be used in non-manufacturing environments.
- Both methodologies are focused on business needs as defined by the customer.
- Both concepts use multi-disciplinary teams to address business problems.
- Both offer complementary tool sets which, together with each other and with other best management practices, offer a comprehensive means of transforming a business from operational chaos at one extreme to operational excellence at the other.

The following are some of the fundamental differences between the Lean and Six Sigma approaches to process management and improvement:

- Application of Six Sigma methodology requires more intense training compared to Lean methodology.
- Six Sigma implementation requires more investment as opposed to Lean implementation.
- Lean is fundamentally used to tackle process inefficiency issues whereas Six Sigma is primarily used to tackle process effectiveness issues.
- Six Sigma will eliminate defects in processes, but it will not address the question of how to optimise process flow. In contrast, lean principles are not very helpful in achieving high capability and high stability processes.

Most companies using the integrated approach apply basic Lean tools and techniques at the starting phase of their program such as current state map, basic house keeping using 5S practice, standardised work, etc. After implementing the above tools and techniques, some wastes are eliminated from the system. Now, the tools and techniques of Six Sigma are used to offer powerful solutions to chronic problems. The integration of two methodologies can achieve better results than either method could achieve alone. While Lean strategies play an important role in eliminating waste and non-value added activities across the organisation, Six Sigma, through the use of statistical tools and techniques, takes an organization to an improved level of process performance and capability.

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