

Business improvement tools – lean and six sigma methodologies

[Business](#)



Abstract

Lean and Six Sigma methodologies are stand-alone tools and have been implemented in isolation by many businesses in the past. But there have been recent shift in the paradigm, as more and more businesses are implementing the integrated approach. The aim of this study is to understand the concept of lean and Six Sigma as a combined approach and also to investigate the advantages and the probable challenges in implementing lean Six Sigma in both manufacturing and service industry.

Introduction

Businesses are always looking out for the ways to improve their bottom line. Business improvement methodology has been constantly developing from the last century (Snee, 2004). While businesses have always ventured for improvement, but improvement as we think about it today, began with the seminal work of Taylor (1911) on scientific management. Among various process improvement methodologies, Six Sigma and lean are considered as the best methodologies widely used by various industries and are currently referred to as state of the art. But, there is a drawback in applying only one of the two methodologies alone, as the continuous improvement may have the deficiency of being slow. In the next section we would discuss the concepts of Six Sigma and lean.

Concepts of Lean and Six Sigma

The six sigma methodology is founded by Motorola and is a well disciplined and structured approach to enhance process performance and to obtain high levels of quality and low levels of variability. A six sigma process is expected

to be statistically 99.99966% free of defects i. e, it aims for reduced defect rate of 3.4 per million opportunity (Brady and Allen, 2006). The Six Sigma approach starts with the identification of the need for an improvement initiative.

The lean methodology founded by Toyota help organizations to achieve on time delivery of the right quality and quantity to satisfy customers (Salah et al. 2010). Lean helps in eliminating waste, variation and work imbalance. Waste not only includes unnecessarily long cycle times, or waiting times between value-added activities but also include rework or scrap, which are often the result of excess variability, so there is an apparent connection between Six Sigma and lean.

Lean Six Sigma

The phrase lean Six Sigma (LSS) is used to describe the integration of lean and Six Sigma philosophies (Sheridan, 2000). Figure 1 shows how lean and Six Sigma can be integrated for process efficiency and effectiveness.

According to Bendell (2006), the concept of LSS as an approach to process improvement is yet to fully mature as an area of academic research. Smith (2003) has argued that the majority of the efforts to implement LSS comprehensively in organizations have not been realized to its full potential. Specifically, in case of fusing lean and Six Sigma, the two approaches are often been implemented in isolation (Smith, 2003). This has produced subcultures of lean and Six Sigma in an organization, which can cause a conflict of interest and drainage of resources (Bendell, 2006).

Figure 1: Integrating the two improvement approaches (Source: Juran Institute)

Arnheiter and Maleyeff (2005) have demonstrated through Figure 2, how each approach can gain when seen as a single framework and a certain balance can be reached when integrated effectively. The figure explains that equilibrium is needed to achieve between the two, moving from the blinkered approach in any one direction. Figure 2 indicates that an organization can run into risk by becoming too lean and therefore rigid in responses to the market and subsequently impacting on value creation. On the other hand, concentrating too much in reducing variation beyond the requirements of the customer would waste unnecessary resources in the pursuit of zero variation. To bring equilibrium, sufficient value should be created from customers' viewpoint, so that market share is maintained, while at the same time variation should be reduced to an acceptable levels so that cost can be lowered by removing any over-engineering of the process.

Figure 2: Competitive advantage of lean, Six Sigma and lean Six Sigma (Source: Arnheiter and Maleyeff, 2005)

Six Sigma complements lean philosophies by providing tools and knowledge to deal with specific problems that are identified along the lean journey: “Lean eliminates ‘noise’ and establishes a standard” (Wheat et al., 2003). Arnheiter and Maleyeff (2005) have taken this discussion further in their work on the integration of lean and Six Sigma, and have outlined the benefits

of such a consolidated approach. For example, Processes can be kept on target, effectively reducing waste incurred through faulty processing by incorporating lean with other scientific approaches like control charts for attaining quality. LSS is also widely recognized as leadership developmental tool. According to Welch and Welch (2005) the benefit of this principle lies on the capacity of developing a cadre of great leaders.

Kiemele (2005) has suggested critical success factor for the deployment and implementation of LSS in the organization such as leadership alignment, proper selection of people and projects, training, motivation, accountability, information technology, marketing and supply chain management. Snee (2010) has supported the requirement of leadership aspect for implementing LSS by mentioning, “ without the full support and involvement of top management the improvement effort is likely to wither on the vine”. Also George (2002) has signified that in order to influence the LSS learning in an organization, there is a need of strong curriculum, communication channel, technology exploitation and documentation of best practices.

In the following section we would explore the advantages and the probable challenges of implementing LSS through case studies.

Case 1: Application of Lean Six Sigma in Manufacturing

[Source: Lean and Six Sigma – A One-Two Punch, Smith, 2003]

The case study is about a manufacturing factory named Heatcraft that makes commercial refrigeration equipment. Though the factory had been following lean principles for a year but still, too many units were coming off the line

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leaking, creating costly rework loops, warranty claims and customer dissatisfaction.

A lean Six Sigma Team led by Doug Bonner, a TMB senior consultant and Six Sigma BB was assigned with the objective of determining and fixing the major causes of leaks. “ Once we knew what to work on, we began to map out the process” said Bonner. The team started its first kaizen event by breaking down the transformation steps successively noting down each time the product changed.

Analysis revealed that more than half of the leaks were in the return bend of the coil. The team even found multiple variations in the way the units were made, from how far the coils were from each other and to how much the tubes stuck out before brazing connected them to the return bend. They determined which variations contributed to the leakage after analyzing the process, more specifically the differences between the two lines. Also the team fixed the quality issues of each brazer brazed by the employees, resulting in better quality at the source.

The efforts from that first Six Sigma kaizen week yielded a 75% reduction in quality issues and a 40% overall reduction in leak rates by just focusing on one defect.

Discussion

As in the literature, we have seen that Six Sigma complements Lean principles; here in this case study also, we have found that the organization was rolling out too many faulty units irrespective of the fact that they used

lean philosophies. The combination of both the approaches has helped the organization to get rid of the leaks.

Using the tools of LSS, the lean Six Sigma team mapped the process, which helped them to reveal that the plant made two types of units with same bend. For investigating the process further the team created cause and effect diagram for the process, listing the five M's and E. As Bonner said “ All you need is one defect to cause a lot of grief”, so the cause and effect diagram proved helpful in measuring each step carefully and more importantly, the effect on the final product could be examined carefully. Such a detailed scrutiny of the process actually revealed the prime cause of the problem and helped the team to fix it up.

By Applying LSS principles, the team standardized brazer quality. This actually ensured the better quality of the source materials used to manufacture the end product. Such a standard has brought a change incultureof the organization as the workers started getting feedback from their co-workers regarding their work after it has been tested in the test tank.

Among the ancillary benefits, lean Six Sigma team's efforts and observations also corrected problems with the header. After carefully watching the mapping process, the team discovered the piece was not being seated properly in the joint. The piece was reduced by ? inch and a standard specification was institutionalized. This improvement reduced the defects to a significant extent and helped in achieving better flow and throughput.

LSS principles help in yielding significant amount of process improvement by eliminating minute problems which remain undetected in normal production cycle. For example, we can understand that just focusing on the soldering aspect of the units, the organization has benefited to a substantial extent. Such a process improvement in an organization can be translated into various ways, be it financial benefit or customer satisfaction. The lean component helps in reducing waste from the process, whereas the Six Sigma component reduces the possibility of error. The integrated approach of the two principles helps the organization in attaining increased productivity or in broader way, financial gain as less rework need to be done on an end product. Simultaneously from the customer perspective, the improved quality of product creates a satisfaction among them. Also a decrease in operational cost due to process efficiency and increase in customer satisfaction would provide an opportunity for the organization to serve more number of customers, hence resulting in revenue gain for the organization.

Case 2: Application of Lean Six Sigma in a Service Industry

[Source: Lean six sigma in a call centre: a case study, Laureani et al. 2009]

This case study is focused on a large corporation in the service sector operating in the vehicle leasing and renting industry. Its European call centre was receiving an average of 1, 200, 000 calls annually from customers who had an issue with either the level of service received or the billing/invoicing process. Most of the time they failed to solve the problem at the first attempt, hence leading to customer dissatisfaction and unnecessary

repetition of work in the Centre. The objective of the project was to increase the first-call resolution ratio.

A cross functional project team was created led by black belt consultant with the intention of implementing DMAIC Six Sigma methodology integrated with lean principles in order to increase first-call resolution ratio. The project scope was laid down by the team, identifying which specific areas of the call centre and services they were going to focus on and also a high-level process map was created. The lean principles were used to identify and remove the four different types of wastes such as motion, waiting, over processing and defects that were hindering their first-call resolution ratio.

The operational definition of first-time call resolution was developed and it was agreed by the major stakeholders involved in the whole process. The team sliced the measurement data into different dimensions and after analyzing they observed that two types of queries were accounted for 70% of unresolved first-time calls.

The team provided tested improvement actions which resulted in reducing the percentage of unresolved calls from 11.82 percent to 8.45 percent. As this result seemed satisfactorily, the improvement actions were rolled out to the whole call centre.

There was 3 per cent decrease of unresolved queries after first contact which resulted in 36,000 fewer calls to the call centre on an annual basis.

Discussion

The LSS methodology has not only helped the organization to reduce the waste by reducing the unnecessary movement of call centre operators who needed to move to perform some routine task such as sending/receiving fax but also helped to define first-time call resolution. This has actually helped to achieve the desired performance as the parameter to measure the success of first-time call resolution was apparent to all employees. Also the lean component of LSS has helped in reducing the waiting time for an operator to access necessary information from other department for catering the need of customers query. Hand in hand, as a part of the process, a consistent measurement system was followed that has assisted in measuring the performance of the process. In precise, the DMAIC process has helped in developing advanced statistical techniques and to become “ technical” in the approach to problem solving, implementing Six Sigma. On the contrary, the lean approach developed a culture towards continuous improvement and elimination of non value added activities before Six Sigma implementation.

Drawing on the principles of LSS, tools and philosophies of both methodologies has enabled them to produce breakthrough innovations such as the quick wins in the improve phase that resulted in profound business improvements. The improvement ideas were pre tested through the pilot group and data were collected from the pilot group to quantify the improvement actions followed by calculation of the sigma value. This strict procedure of deploying improvement actions has ensured the overall quality of the services and helped them to reduce unresolved queries to a significant extent.

One of the critical success factors for continuous improvement efforts at an organization is the availability of a common set of problem solving tools (Chapman and Hyland, 1997). This has been effectively achieved through the toolkit that Six Sigma and lean has provided when integrated. A known type of query was solved by the customer service at the first place without any defects. Hence the customer didn't need to call back, thus the unnecessary works were reduced and customer satisfaction was increased.

Challenges of lean Six Sigma

Reviewing the above two case studies we have found some problems common to both the case studies.

In the first case study of Heatcraft, we have seen some standards were institutionalized, but for fostering a climate for continuous improvement, an organization must train their employees about LSS principles. This training of employees can be time consuming as it would require balance between routine work and the work involved in LSS training and projects.

In the second case study of Call Centre, the Black Belt consultant left the organization by handing over the completed control plan to the process owner and there was no commitment of revisit from their end. So, the assurance that improvement actions are still in place and the process has not reverted to the pre-project status was not there.

It is not known from both the case studies that, how much each organization spent for training employees about LSS principles and also the cost of implementing LSS solutions in their business as it has been indicated by

Senapati (2004) that such training cost and cost of implementing LSS solutions can be expensive.

Also, LSS sustainability in the process requires high skill and sufficient resources are required to ensure its sustainability.

Conclusion

Lean and Six Sigma paradigms can be considered as influential catalysts for change as stand-alone methods but more provokingly, when fused together represents an exceptionally powerful tool. When the cultural aspects of lean are aligned with data driven investigations of Six Sigma, the integrated approach can bring a genuine and sustainable approach to organizational change and process improvement.

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