

Double LEAN Six Sigma – A Structure for Applying Lean Six Sigma

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'Lean Six Sigma' is gaining popularity among industries as a faster quality improvement initiative in lieu of the traditional approaches. The combination of lean tools with the six sigma technique is considered better because of six sigma improvement results attainable without demanding more resources. However the steps involved or the procedure is still not standardized or commonly agreed upon by the practitioners. This paper provides a systematic approach to 'lean six sigma' clearly differentiating it from the conventional 'six sigma'. The paper illustrates the concepts of 'lean six sigma' and also improves the scope with the 'double lean' approach illustrating the applications.

INTRODUCTION

There are a variety of ways to introduce Six Sigma into a company, involving different levels of structure, time frames, costs and management commitments. But all agree on the basic steps of the improvement process, the five stages of the DMAIC process. DMAIC is synonymous with Six Sigma when talking about the process to follow, the steps.

In recent years, however, new developments in Six Sigma have led to the amalgamation of the “lean” tools to bring about certain changes in the methodology and expedite the results. In this context “Lean Six Sigma” (LSS) has now become the industry flavor and many applications are being cited to show its popularity.

To date, however, the proponents of Lean Six Sigma have failed to develop a process to prescribe how to apply Lean Six Sigma. Most articles and textbooks on LSS read like Six Sigma texts with the word “lean” added many times, especially in the title, and with some of the lean tools added to the tool kit. But the process followed is DMAIC with no changes. If that is all Lean Six Sigma is, then it is still just Six Sigma.

In this paper the authors explain the advantages of adopting the “lean” approach and suggest “Double LEAN” as a new methodology for better results. The paper briefly discusses the perceived benefits in comparison with the traditional approach and gives a new expansion to the lean approach to convert it into “Double LEAN”.

What is Meant by “Lean”?

It is assumed that the reader is familiar with Six Sigma and the DMAIC process. Before looking at Lean Six Sigma, however, it is better to understand the meaning of “Lean”. Lean is a separate approach to

process improvement, tracing its ancestry back through Just-in-Time all the way to the Toyota production system. Lean is the set of "tools" that assist in the identification and steady elimination of waste (muda). As waste is eliminated, quality improves while production time and cost are reduced.

According to Alukal and Manos (2007), lean focuses on value-added expenditure of resources from the customers' viewpoint. As used by National Institute of Standards and Technology, lean indicates a systematic approach in identifying and eliminating waste by providing the product at the pull of the customer in pursuit of perfection. This leads to improved quality, better cash flow, increased sales, greater productivity and throughput, and improved morale.

Before going on to describe Lean Six Sigma, there is one other interpretation of Lean that must be developed, as it is an important selling point for Lean Six Sigma. Lean, in the sense of no waste, has been interpreted as having less levels of management. In the Lean organization, the organization chart is flatter, bringing everyone closer to the work processes being managed.

What is Lean Six Sigma?

Lean Six Sigma (LSS) is understood as integrating Six Sigma and the lean tools to reap the benefits of both. LSS is fast becoming a buzzword among in industry. It seems to be replacing Six Sigma as the next generation approach to many.

While the term "Lean Six Sigma" is quite commonly used, the definition varies across different sources and doesn't mean the same thing. Some common perceptions about Lean Six Sigma (LSS) are:

- ◆ It is a condensed and less costly version of Six Sigma
- ◆ It is Six Sigma on a fast track (less completion time)
- ◆ It is Six Sigma combined with lean tools for better results

Because of these differences in their practice and adaptation, Lean Six Sigma is not having a universally common meaning or implementation procedure. But one thing that is quickly recognized is that Lean Six Sigma takes much less time and other resources so that the results are visible in a shorter span of time. It is this perceived image that has made it popular and attractive to industries. In fact, that is the reason for the order of the perceptions just provided. Most companies are adopting it for the first two reasons, not necessarily the inclusion of the Lean tools.

George, Rowlands, and Kastle (2004) define "lean six sigma" as a combination of two improvement trends, namely, making work better using Six Sigma, and making work faster using Lean principles. But a closer look at their book reads like a Six Sigma book. The Lean tools are included, but they are just describing DMAIC. It leaves the reader wondering "Just what is Lean Six Sigma that is really any different from Six Sigma?"

Arthur (2007) describes "Lean Six Sigma" as elimination of delays, defects, and variation, associated with the processes, using two important tools namely "value stream mapping" and "Balanced Score Card". This book makes a better attempt at describing Lean Six Sigma, but the large majority of that book as well is basically Six Sigma.

If the leading texts fail to define Lean Six Sigma as a unique methodology, perhaps it is because no clear methodology has yet to be developed for implementing it. After making the case for LSS in the next section, this paper provides that methodology.

Why Lean Six Sigma?

In practice, it can be seen that the reasons for adopting Lean Six Sigma stem from four fundamental barriers to adopting Six Sigma. These barriers to adopting Six Sigma lead to adopting Lean Six Sigma in an attempt to get the same results.

The first barrier is just the size and number of roles in the Six Sigma structure. To make it work, management must be heavily involved. There are champions, and sponsors, and master black belts, who have to be touch with the improvement projects conducted at any level of the organization. Setting up this framework will be a big job in itself. The second barrier is the amount of training involved. Every potential team member is trained at the green belt level, and a core of black belts must be trained to lead

the teams. This is very costly and takes time to set up before any results can be achieved. The third barrier is the time it will take to yield results. No results will be achieved until the project begins, and that will not happen until the infrastructure is in place and the training is completed. The fourth barrier is the cultural change required to make it work. There is always resistance to change.

A logical justification for blending Six Sigma with Lean is given by Devane (2004). He states that a pure six sigma approach lacks three desirable lean characteristics:

1. No direct focus on improving the speed of a process
2. No direct attention to reduction in the amount of inventory investment
3. No quick financial gains due to the time required to learn and apply its methods and tools for data collection and analysis.

He further states that on the other hand, a pure lean improvement effort has the following shortcomings:

1. Processes are not brought under statistical control
2. There is no focus on evaluating variations in measurement systems used for decisions
3. No process improvement practices link quality and advanced mathematical tools to diagnose process problems that remain once the obvious waste has been removed.

Smith (2003) comments that when six sigma and lean production methodology run separately they will collide with each other and in contrast, a combination of lean and six sigma will have a positive impact on employee morale, inspiring change in the workplace culture because teams see the results of their efforts put to work almost immediately.

Based on the two references above, and on our own experiences, most companies adopting this Lean version of Six Sigma are doing it for cost reasons. They know that Six Sigma is popular and effective, but are not willing to invest in setting up the program and all of the training that is required. The Lean version is sold as having little or no infrastructure. All you have to do is to set up a few improvement teams, task them with a process to look at, and get them going. So, Lean here actually means “cheap” as opposed to the meaning we have been developing.

This leads to the another reason beyond lower cost, faster results. In the Lean version, we go straight for the projects and the results, and within a month or two can show savings or improvement to a process. In the traditional Six Sigma approach, it takes months to get things set up, and then a typical project team can take months more to get results. So here the word Lean is used to mean “quick” again different than the true meaning.

Proposed Approach for Adopting LSS

In the previous paragraphs, the LSS approach and its merits and demerits have been described. Based on these observations, we see that the LSS method will give faster results and that it will be less expensive to implement. Since no one argues these conclusions, our recommendation is always to begin any improvement effort with LSS, not Six Sigma.

On the other hand, the claim that LSS provides better solutions is questionable. It should be obvious, however, that a larger tool set can provide better results. Where one question comes in though is that LSS fails to look below the surface at underlying causes of problems in quite the way that Six Sigma does. A second issue is the long lasting effects, where Six Sigma seems to be a more sustainable approach relying on a structure to support it in the organization, not just a few projects here and there. And the third issue is the strategic one, where Six Sigma again provides a better global view of the improvement efforts and links them with the goals of the organization.

Our recommendation is to begin to build a Six Sigma structure for sustaining the improvement efforts in the long run as soon as the initial LSS projects provide valuable results. LSS builds the momentum, and Six Sigma can then sustain it. Once success comes from the initial LSS projects, a few individuals should be selected to be provided with more training and groomed for leadership roles, much like is done in Six Sigma.

Finally, we provide one suggestion that carries the LSS idea to its extreme in terms of fast and inexpensive. It is possible to start a LSS program with no prior training. Training can be provided on an

as-needed basis (just-in-time, or true Lean) with groups from a company that have improvement projects to work on. The “trainer” then guides the improvement teams, providing training in the tools they will need at each stage of the project. This yields immediate results without the costly investment in training up front.

The approach we describe is the best way to implement LSS. Perhaps more important it minimizes all resistance to establishing an improvement system. This approach to implementing LSS allows larger funding decisions to be made after valuable results are achieved.

How to Conduct the Improvement Project - The Double LEAN Method

A Six Sigma project follows the DMAIC process steps. But there are problems with this approach. The five phases take too long to complete, delaying results. More importantly, it misses key steps and is unclear in where to finish one phase and begin the next.

For an example of a missing step, the Define phase fails to look at the organization and define its processes. It also fails to help choose the process to study for improvement.

For an example of how the delineation of the phases is not clear, look at the line between Define and Measure. Define should state the goal for the project, but too often this cannot be done until results are in from the Measure phase. So Define is not complete until much of Measure is complete. The lines are blurred.

Another example is between the Analyze and Improve phases. It is not specified anywhere if identifying the improvement is in one or the other. Most would say it is in Improve, but the results of the Analyze phase identify the improvements. And then it is not clear whether the actual improvements are put in place in Improve or Control’

In response to this, a new approach is proposed. The authors have coined the “LL-EE-AA-NN” acronym for the **Double LEAN Approach**. Each of the letters represents a particular action to be taken up by the group or the team responsible for quality improvement. Further every two letters of the acronym constitute a phase and thus four phases are involved in the proposed methodology.

By having four phases instead of five, the time to completion is already reduced. By having clear lines between the phases, or phase gates, the conduct of the projects is made more clear and easier. The tools we use are the same common tools used in Lean and Six Sigma. In our discussion of the phases that follow we mention some of the key tools used in each phase as is done in many presentations of DMAIC.

Phase1 – Look and Locate

In the first phase, the LL stands for Look and Locate. Here we “Look” at the organization and its customers and processes and “Locate” the process in need of improvement. The organization is described in terms of its Critical-to-Quality customer-based measures of success, and the set of processes in place to achieve those measures. The organization is modeled in a way that leads to customer satisfaction.

The Look and Locate (LL) phase seeks to identify the process to be studied. The main outputs of this phase are the justification for the selection of the project chosen and the charter for that improvement project. While these outputs are similar to the Define phase of DMAIC, the justification is has much more in it and the lines between this and the next phase are more clear.

Begin by Looking. Look at the business organization. Describe that organization in terms of its business processes. This is the Six Sigma view, or the Process View (the LOOK) of the organization.

A convenient approach used is to list the high level processes first, and then list the processes under each of those. Continue this until the 3rd or 4th level of processes to get the necessary level of detail in the LOOK.

The suggestion is to use Voice of the Customer in conjunction with a high level SIPOC. Start with the Customer, the “C”, and see what the main needs of the customer are. Then, go backward to see what processes, the P’s, are in place to provide those needs.

Once all of those processes are identified, it is time to LOCATE the issues and select the process to be studied. Process mapping can identify where most problems or delays are occurring in a process. A Pareto chart can identify and rank the urgency of looking at any particular process. Financial analysis can

help determine which process improvements can save the most money for the time invested. Multi-voting can be used for the selection where multiple factors weigh in on the decision.

Ultimately, the process is selected and a Charter is written. It should be approved by management (first phase gate) prior to beginning the actual process improvement work.

Phase 2 – Explore and Establish

In the second phase, “EE” represents “Explore” and “Establish”.

The basis for improving a process is to understand the process, how it works as well as how well it is working. EXPLORE the process to understand it. Use detailed process mapping or value stream mapping here. The more detailed version of the SIPOC done earlier can also be used. Tools like swim lane flowcharts and spaghetti diagrams are also useful.

Then, collect data on the process to ESTABLISH a baseline, or the before improvement position, on how well the process is performing. These measures are mostly on process outputs.

The main output of this phase is the knowledge and the measures of the degree of problems in the process. At this point, the problems can be seen more clearly, hopefully bringing the solution to those problems into sight.

The fact that this phase ends with the establishment of a baseline is valuable in three ways. From a prescriptive viewpoint of what to do, it provides a clear phase gate in the project. A review can take place to refine what needs to be improved, what needs to be further investigated, and the goals for improvement can be established.

The second item of value at this point is the understanding of the current process that is gained from this step. Most times when running a process, especially if done by many people, there is no clear understanding of it. Everyone is doing it differently. This Establish phase yields improvements just by getting everyone doing the same thing.

The third item of value is the baseline itself, the main goal of this phase. The baseline provides a point to look back at and compare to prove later that improvement was achieved. This baseline will be needed in later phases to reach that conclusion of success and to identify the degree of success.

Phase 3 – Analyze and Apply

The third phase is denoted by “AA” which stands for “Analyze” and “Apply”. In this phase the effects that potential changes in process inputs will have on the process outputs related to customer satisfaction are analyzed. This leads to a list of process improvement actions. These actions are then applied to the process to check the validity of the changes, and to assess the feasibility of implementing them. Again, a clear line is established to end this phase.

To ANALYZE the problems, or the processes, it is necessary to identify the possible process parameters or steps that lead to those out measures established in the previous phase. The linkage between inputs and outputs from the process, the causes and effects, is the most critical step in this entire methodology. By linking the causes of problems to the problems, we can then APPLY that knowledge to identify the improvement steps to take and try out those improvement actions. The goal is to improve the outputs by modifying the process inputs.

The output of this phase is the identification of the improvement actions to take, and their use on a trial basis to test them out. The tools of hypothesis testing and ANOVA can be used to verify that improvement is achieved.

Another key phase gate is introduced here. In the DMAIC, the improvements are really identified in Analyze, but not mentioned until the next phase. But since these cannot really be separated, Double LEAN combines them. At the end of the phase, another phase review can take place. The improvements are reviewed and any required investment decisions can be made.

Phase 4 – New and Navigate

The fourth phase consists of “NN” indicating “New” and “Navigate”. In this phase a “New” process is developed based on the evaluation and implementation of the improvements. Schedule and budgets are

prepared to implement the desired changes. Besides the improvement tools, project management and change management tools are introduced to facilitate the move to the improved process. Plans are introduced here to “Navigate” the use of the new process, to ensure that the improvements achieved are monitored and maintained.

The improvements have been selected, and the process improvements are ready to implement. The NEW process should be described with a new process map. The major tools needed now are the tools of project management to implement the new system.

The improved process is now ready to use with the new system. Finally, a plan to NAVIGATE the new system needs to be prepared. The poka yoke can be used to prevent problems from occurring. New operating procedures (SOP’s) are developed. Control processes like user logs or control charts are used. The intent is to make sure that the system continues to show the improvements and that they are not just temporary.

At the end of this phase the improvements should be visible and the cycle can be repeated with other processes.

APPLICATIONS

This Double Lean approach has been successfully implemented by many organizations. While there are examples from SAS and ADB, the best examples have been in health care. At one hospital, as part of the Main Line Health System, five projects were undertaken and four showed outstanding results. In a similar way of thinking, Anderson Packaging, the world’s largest pharmaceutical packaging supplier, has moved to a four-phased approach to replace DMAIC.

CONCLUSION

This paper has clearly established that there is good reason to adopt a LSS approach, either in place of Six Sigma or as an introductory step toward adopting Six Sigma. It also shows that no methodology exists for conducting a LSS project. An approach to implementing a LSS program is developed, providing suggestions for how to plan and manage that evolution in the company. The main result of this paper is the method for conducting a LSS project. This is the Double LEAN method. The four phases are each described.

The Double LEAN method is more prescriptive and easier to use than the DMAIC. In addition, the establishment of phase gates is a major improvement over the DMAIC. It is also shown that it can be implemented with no prior training.

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