Ten Commandments of Lean Six Sigma: a practitioners' perspective

Abstract

Purpose - The purpose of this paper is to provide Lean and Six Sigma professionals and researchers of tomorrow with Ten Commandments of Lean Six Sigma.

Design/methodology/approach – The Ten Commandments of Lean Six Sigma are based on several years' experience of four authors who act as researchers, Lean Six Sigma Master Black Belts, consultants, practitioners and trainers on various topics of Lean, Six Sigma and general quality management and continuous improvement.

Findings – The Ten Commandments in our opinion include: alignment of LSS initiative with organisational strategy, Lean Six Sigma project selection and prioritisation, selection of top talent for the project execution, Leadership for Lean Six Sigma, effective training and design of appropriate curriculum for different LSS roles, development of reward and recognition system, Lean Six Sigma sustainability, Linking Lean Six Sigma with Organisational Learning and Innovation, Linking Lean Six Sigma with Environmental Management System Standards and finally LSS and Big Data.

Research limitations/implications – The key features outlined in this paper are based on the practitioners of LSS. The authors of this article are planning to pursue a global study to critically evaluate these commandments by various practitioners of LSS.

Originality/value – The senior managers and executives of various businesses can use these commandments of Lean Six Sigma as a guide to achieve and sustain competitive advantage.

1. Introduction

While a number of continuous improvement methodologies exist in the literature, the most renowned as successful are Lean and Six Sigma methodologies, which could meet the evolving organisational needs through continuous process improvements. The synergies of Lean and Six Sigma have been highlighted by multiple researchers in the past 15 years or so. As an integrated methodology, Lean Six Sigma (LSS) includes the speediness of Lean through smooth flow of processes and robustness of Six Sigma through a disciplined and systematic approach to problem solving. Over the past 15 years LSS is implemented worldwide in a variety of processes starting from manufacturing, engineering to service organisations like healthcare, financial services to public sector such as Police Force, Higher Education, etc. While the success stories speak for themselves, at the same time there were critics who have highlighted the failure of LSS due to various reasons (Albliwi et al., 2014; McLean et al., 2017). As more and more organisations are joining the journey of LSS, the failure of this initiative is also surfacing from various organisations. Though there are significant research evidence available on critical success and failure factors of LSS implementation in organisations, these aspects have been merely restricted to the tactical side of LSS. There is lack of literature in linking the strategic perspectives of management principles to LSS implementations. Though organizations initially realized LSS as an effective toolkit with a collection of problem solving tools for process improvements, later the evolution of understanding clarified LSS as an organization strategy and a leadership gizmo for imbibing the quality culture in organizations. In this article, the authors present Ten Commandments of LSS which need to be essentially considered for a successful LSS implementation and deployment in organisations.

2. Ten Commandments of Lean Six Sigma

2.1 Alignment of Lean Six Sigma with organisational strategy

An organizational strategy is the sum of the actions a company intends to take to achieve long-term goals. Together, these actions make up a company's strategic plan and objectives. Strategic objectives take at least a year to get implemented, requiring involvement from all levels across the organisation (Johnson et al., 2008). . The organisational vision and strategies are deployed down the level in the organisation based on the defined objectives for the respective functions and processes that in turn translates into individual Key Result Areas (KRAs). The success of an organisation and its individuals are evaluated based on how well they are able to meet the set objectives and targets.

In the context of LSS deployment, the strategic alignment becomes essential. The project selection, identification of right personnel to undergo LSS training, execution of projects, participative leadership, business impact and ROI generation, certification process and celebration of the LSS deployment needs to be in sync with the organisational strategies for success. According to Snee (2010), the LSS aspiring organisation must also be mindful of the appropriate time of launching LSS, as a decision of this kind needs a lot of strategic alignment. In this context, Kotter (2008), emphasizes to begin with a sense of urgency.

In this process, Hoshin Kanri (or Policy Deployment) model for strategic planning and deployment, is proposed as a useful tool. Hoshin Kanri also helps to think long term, beyond the traditional policy management and helps to differentiate the projects which deliver both short-term and long-term objectives (Antony, 2014). According to Jackson (2006), right usage of Hoshin Kanri in Lean enterprises develops competitive capabilities towards managing profits. Witcher and Butterworth (1999), highlights the effective usage

of Hoshin Kanri for the identification and implementation of continuous improvement projects at Xerox Inc. Further, Banuelas (2006) through their research confirms it as an aid in the identification of Six Sigma projects.

This method has the following broad steps.

a. Establishing Organisational Vision
b. Developing Objectives
c. Deriving and Deploying Annual Objectives
d. Periodic Review of Objectives

If LSS is included while establishing the organisational vision, the LSS projects can be selected based on the deployed objectives. This ensures that the teams are working on right projects which are strategically important for the organisation and the achieved improvements could be aligned with the delivery of the business objectives. This process also enables systematic periodic reviews to identify and remove the obstacles in the execution of the LSS projects for time bound delivery.

2.2 Lean Six Sigma project selection and prioritization

Not every project qualifies to be a Lean Six Sigma project (Vijaya Sunder, 2013a). Business cases which have high impact and no clue about the root cause of the problem or solution unknown from the start of problem definition are best fits to take up as LSS projects. Hence project selection and prioritisation become an important activity during LSS deployment in organisations. If right types of projects are not selected, it can lead to failure of projects and eventually failure of LSS implementation in the organisation leading to heavy loss in investments and deviations from delivery of process improvements. Moreover, this would result in scepticism among senior managers and

lack of buy-in for future projects and the continuing journey of LSS. In quite a few occasions, it was observed in many organisations that the selected projects are not the real LSS projects. Organisations are suggested to follow a systematic procedure to prioritise the LSS projects through robust selection criteria. There are a number of criteria for identifying the right projects but above all, one should pursue projects that produce the highest value in relation to the business goals in order to generate bottom-line impact (Snee, 2010).

A set criterion which is not aligned with voice of the customer (VOC) or voice of the business could lead to challenges in execution and time-bound delivery of projects. Tools like focus group interviews, survey questionnaires, formal or informal meetings with customers, market research are few of the tools used to capture VOC for selection of LSS projects. Kano model analysis, organisational metrics dashboards and balance scorecards are few of the tools which could help to prioritise the business problems to be taken ahead as LSS projects.

2.3 Selecting the top talent for the execution of projects

The quality of the outcome of projects depends on the competency and capability of people working on it and hence selection of right talent becomes essential. LSS deployment involves a variety of roles where the selection of right talent needs to be taken care. LSS adapts the belting system from its predecessor Six Sigma. As per the 1999 ASA Quality and Productivity Research Conference, the roles are defined as below (Vijaya Sunder, 2013b):

- Master Black Belts (MBBs) are the quality leaders responsible for strategy, training, mentoring, and deployment of LSS.

- Black Belts (BBs) are LSS experts who work on projects across the business functions.
- Green Belts (GBs) are part-time quality professionals who work on projects relevant in their job area.

Another significant role is for the LSS Champion. The champions are part of the management and they have a final say in selection of projects alongside organisational MBBs. The champions should ensure that business critical or customer critical problems are selected as LSS projects and should monitor the progress till its successful completion. In case of problems which creep into the smooth running of projects, the champion should actively intervene and help the teams to complete the projects. Depending upon the size of the organisation, there are two types of LSS champions; LSS project champion and LSS deployment champion. LSS project champions are responsible for the running of projects in each business function in an organisation where as a deployment champion is primarily responsible for the entire organisation.

The MBB can be an internal resource or a temporary resource hired for a specific period (like an external consultant), providing leadership support and owning the overall delivery of the LSS program. According to Laureani and Antony (2016), leadership is considered as a critical success factor for success of LSS program. MBBs are expected to lead change in organisations, helping the champions by providing strategic support in decision making and the team for selecting right projects. Moreover they are responsible in many organisations for conducting LSS training and provide handholding of projects, as and when required.

Black Belts are expected to lead the project teams for on time successful completion of projects by providing mentoring/coaching support. Black Belts are also expected to facilitate the review meetings and to make appropriate communications with the champions with regard to the selected projects and the subsequent progress at every milestone. BBs play a key role of establishing the stakeholder connects for change management which is considered as another critical success factor of LSS deployment (Vijaya Sunder, 2016a).

The GBs are selected from the sub-processes and they should be in a position to contribute to the project in terms of data collection, analysis, and implementation of solutions including sustainability of results. These BB and GBs normally constitutes a LSS project team. Others who are directly or indirectly supporting the LSS projects can be identified as Yellow Belt (YB) professionals (Assarlind et al., 2013). The Yellow Belts are working full time in organisations and can be viewed as process owners in many cases. They are responsible for conducting some continuous improvement projects using basic tools of Lean and Six Sigma but follow the DMAIC problem solving methodology when and where possible. The management should take at most care to ensure that the best people from the operational processes are selected as to lead the LSS projects at all the above mentioned roles who can act as agents for success of LSS projects in short-run and to bring cultural transformation in the long-run into the organizations.

2.4 Leadership for LSS

A few researchers considered LSS as a top-down initiative, where the decision to implement LSS has to start from the top management, where they (1) communicate to the

people in the organisation about the urgency for implementation of LSS, (2) identify projects that can have a good impact on the organisation or on customers, (3) selecting the right people for working on the projects so that the projects are completed successfully, and (4) monitoring the progress of projects and providing necessary support in implementation.

According to Pfeffer (1977), Leadership is not merely based on organisational position, but could be exhibited across all levels in the organisations. Leadership is an essential component for LSS deployment as it requires workforce to exhibit leadership across all levels irrespective of their position in the organisational ladder. While the top management understands the need of the organization and business better than anyone, it's the bottom-line workers who know the process better than the top management as they work day-in and day-out on the operational transactions.

While top management provides a strategic and transformational leadership, LSS also needs leadership at execution and project management level from the mid-management. Leadership at all levels needs to be consistent, in order to face and resolve the deployment issues. According to Laureani and Antony (2017), no matter how successful a Lean Six Sigma programme appears to be, inevitably there will be operational issues, budget constraints, and ah-hoc challenges that will divert the organisation's attention from the programme. At these stages, it is critical for leadership to show firm dedication (Jones, Parast, & Adams, 2010), with a determined tenacity towards the successful implementation. While leadership is important for LSS, educating the leadership is even more important. Deming suggested that quality excellence could not be achieved in organisations without educating leadership on importance of quality – obligations, principles and methods (Krishnaiah and Rao, 1988; Vijaya Sunder, 2016b).

2.5 Effective training and design of curriculum for different LSS roles

Any business organisation is a conglomerate of staff from different backgrounds and in many cases many of them may not be aware of the LSS methodology. This becomes more apparent in the organisations embarking the LSS journey for the first time or in its nascent stages of maturity. Hence, it is necessary to impart training to all the concerned people (Champions, MBBs, BBs, GBs, other operational support staff including YBs), who are involved in LSS implementation in the organisation as each of these stakeholders have specific roles to play in the LSS journey . Hence the training duration and curriculum for each of them has to be planned very specifically. For example, the champions have to select good projects, select right people for LSS and monitor the progress of LSS implementation status. Hence it is necessary to plan for the training for champions to understand what type of projects can be selected as LSS projects, whom to be selected as BB, GB etc., and how to monitor the progress of projects. This training can be designed for duration of one to two days based on the LSS maturity of the organisation.

Predominantly this training covers leadership aspects, change management and strategic elements of LSS rather than technical tool-kit. Handling resistance to change, change acceleration process, importance of metrics in business, selection and prioritising right projects for improvements, data-orientation, analytical thinking and decision making, creative and structured problem solving etc., could be a few topics relevant to this champion's training.

Champions and MBB training should overlap but typically are not identical. MBBs need strong technical orientation, strong people orientation, and little business orientation, unlike Champions who need strong business orientation and little people orientation with no need for any technical orientation (George, 2003). MBBs are experienced Black Belts,

that have exceeded at project execution, and have practiced for a few years, may move forward to the role of Master Black Belt: a full time practitioner and facilitator in LSS and a mentor to successful Green and Black Belts (Ingle and Roe, 2001). According to American Society for Quality (ASQ, 2017), MBBs have outstanding leadership ability, are innovative, and demonstrate a strong commitment to the practice and advancement of quality and improvement in organisations.

The BBs are considered as the leaders of the LSS projects and hence they have the overall responsibility of LSS project management. BBs are expected to be the change agents with teaching, mentoring and cross-functional stakeholder management skills and possess high degree of technical mastery over the LSS tools. Hence the BB training should include various technical aspects of LSS and advanced statistical tools.

Many organisations certify BBs not merely by attending the training programs but to demonstrate the learnings though application in business contexts (Ingle and Roe, 2001). For example, Black Belts in General Electric are certified after completing 2-5 financially successful projects. A few other firms like Motorola, DuPont and Microsoft test the capabilities of BBs through a written test alongside demonstration of successful project management (Marx, 2008)

Green Belts are expected to have intermediary LSS technical knowledge for successful implementation of medium size functional projects. GBs are generally considered as part-time quality professionals unlike BBs who are expected to work on cross-functional projects as full-time quality professionals. Hence, the GB training can include intermediary level LSS toolkit and various techniques for data collection and analysis.

The Yellow Belt is expected to apply the basic tools of Lean Six Sigma in a business process improvement project and follow the DMAIC problem solving methodology. The project focus of Yellow Belts can be quite narrow and the savings to the bottom-line can be generous. It is considered as low-cost, basic overview training for the common employee to understand what exactly the company is trying to achieve using LSS (Setter, 2010).

2.6 Development of reward and recognition system

According to Kotter (2008a), Rewards and recognition should be inherent part of any Change Management initiative to align and boost the motivation of staff and morale of teams in organisations. LSS programs require staff across different organisational levels to exhibit high energy and efforts towards the successful deployments; hence a platform to recognise staff for their efforts in the continuous improvement journey becomes essential. Most importantly, LSS is not merely a one-time effort of executing projects for a continuous improvement journey and hence keeping the motivation levels of staff on consistent basis is an important factor for success.

According to McNulty and Canty (1995), celebration of success is an essential component suggested by both Edwards Deming and Joseph Juran. Further, Snee (1999) emphasised the importance of ownership, resources recognition has a positive correlation on and reinforcement of desired improvement alternatives and behaviours of people towards consistency towards improvement initiatives. Even today, rewards and recognition are highlighted as critical success factors for LSS by many researchers (Manville et al., 2012; Albliwi et al., 2014).

In the context of LSS program management, different approaches of reward and recognition could be followed. According to a survey based research among global LSS

professionals, it was found that staff involvement in LSS project by itself is a motivation factor to the employees, and LSS is claimed to be a management strategy to drive higher employee satisfaction in organisations alongside customer satisfaction (Vijaya Sunder, 2013b). A few of the other approaches are suggested below.

- Sharing a part of the savings achieved in the project with the team. This will give a direct financial benefit to the team members, and will be encouraged to work with more projects in future.
- Active participation in LSS implementation and success of the project is directly linked to the performance appraisal system in the organisation. This can ensure involvement and on time successful completion of LSS projects for carrier growth in the organisation.
- Visual display of the photographs or names of the LSS project support teams on the operations floor
- Recognition during leadership gatherings
- Building healthy competition through yearly Lean Six Sigma awards etc.
- Branding the LSS program as a learning opportunity and marketability of the profiles through LSS certification credentials.

2.7 Lean Six Sigma sustainability

In most organizations, LSS implementation kick starts with a lot of fanfare. After two to three cycles of LSS projects, the program will apparently start losing its momentum. Sustaining improvements for a longer duration is a common challenge in many organisations today. There are several reasons why sustenance of LSS projects improvements becomes challenging. Firstly, holding people's interest on LSS initiatives for longer durations becomes challenging. This leads to the decline in the seriousness of

the LSS program, leading to sustenance issues. This is where measuring the maturity of the LSS implementation becomes helpful. This provides directions for enhancing the program periodically so that the newness of the LSS initiatives remains in the organisational ecosystem with periodic revisions in branding, involvement of right people, executions and recognition approaches. Snee (2009), calls LSS as a "cash cow" as organisational leaders can never lose interest in LSS till it reduce costs and keep the cash flowing.

Secondly, sustaining change in LSS projects becomes challenging due to the lack of ownership (Vijaya Sunder, 2013a). Generally, after completing a project, the project manager (BBs) will be allocated to a new LSS project and hence do not focus any more on the completed projects. Though LSS encourages 'Control' phase in its road map to sustain results, lack of ownership makes it unsuccessful many times. In such a scenario, the process tends to revert to its old habits. Hence, ownership is important to sustain the results reaped out of successful projects.

Thirdly, organisations generally focus on sustaining the gains after implementing the LSS improvements. Snee (2006) calls this as 'backward thinking' and claims that for effective sustenance, one should begin to focus on sustaining the improvement gains in the course of its implementation itself –otherwise, improvements are unlikely to last. In order to achieve this sustenance as an ongoing effort right from the improvement phase of the projects, management systems are to be put in place.

Finally, "institutionalization" of LSS is essential for sustainability. According to Hilton and Sohal (2012), once the LSS program becomes part of the organizational DNA, financial impact could be sustained leading to the pervasive Lean Six Sigma culture for

transformation– even beyond the LSS practitioners and beyond the organization boundaries.

2.8 Linking LSS with Organizational Learning and Innovation

Organisations that are subjected to accelerating change puts focus on their learning ability (Isaksson et al., 2015). To have organisational learning, there must also be individual learning, which puts focus on lifelong learning. LSS is an enabler of individual learning as it promotes activity based learning though project management and structured problem solving. A few other aspects of organizational learning such as social aspects, cultural aspects of human action, cognitive aspects, technical aspects of the work, change aspects, etc., are also linked with the LSS deployment. According to Antony (2011), LSS being a hybrid version of Lean and Six Sigma is more powerful as it integrates the human and process aspects of process improvements. Similar claims were made even on its predecessor Six Sigma by Gowen and Tallen (2005), that the dynamic capability view of Six Sigma provides a framework for understanding both the technical (project selection, review, and sharing best practice) and the human aspects of Six Sigma factors.

Further, Anand et al., (2009) provides empirical evidence of the dynamic capability perspective and its underlying theory of organizational learning for continuous improvement such as LSS. Linderman, Schroeder, and Sanders (2010) suggest that according to social-technical system theory, the interaction between social support and technical support enables process improvement to create knowledge and solve problems. The LSS problem-solving approach (DMAIC) facilitates rational decision making and improves organizational routines and processes. As people carry out more and more projects and master the LSS tools and techniques, they gain experience in structured

problem solving. It is therefore argued that LSS enhances individual and organizational learning.

LSS enables learning and through transmission of knowledge through specific practices. For example, LSS project teams during the execution of projects exhibit knowledge gathering behaviour in gathering individual knowledge and then synthesizing this into team-level knowledge to solve problems. LSS tools like brainstorming, Failure Modes Effect Analysis, Cause and Effect diagrams etc., which are generally performed as group activities enables such behaviour.

The goal of organizational learning is to successfully adapt to changing environments, to adjust under uncertain conditions, and to increase efficiency (Dodgson, 1993). According to Argote (1999), true organisational learning occurs when the individual workers become more proficient, improve the organization's technology, and determine the organization's strengths. While LSS not only improves proficiency of human resources through learning and development, also improves the organisational technology and systems and hence certainly is as an enabler for organisational learning.

Antony et al. (2014) explores the relationship between Six Sigma and product/service/process innovation in 10 UK based companies, ranging from manufacturing to service to professional services such as consulting firms. The study was carried out in both small and large sized enterprises in the UK. The authors found that LSS is commonly viewed as fostering incremental innovation (process/product/service). For the long-term success of organisations, a balanced approach to business improvement is needed – focusing on approaches to continuous improvement and problem solving, such as LSS, and also on approaches to identifying opportunities for Radical Innovation using Design for Lean Six Sigma.

2.9 Linking LSS with Environmental Management System standards

Mitch Kidwell, a senior staff from United States Environmental Protection Agency (EPA), advocated linkage between lean and environmental management system with few real case lets in his article titled *Lean Manufacturing, the Environment and the Bottom Line*. According to him - "Harnessing the productivity of lean manufacturing -- which emphasizes using the lowest-cost, highest-efficiency practices -- can also dramatically reduce waste and pollution." (Kidwell, 2007).

To meet the environmental obligations of its operations, mostly firms opt standard environmental management system (EMS) certifications such as ISO 14001. There are norms and standards under ISO 14001, which, if implemented, reduce negative externality with water, energy, material, and biodiversity conservation. However, there are studies which raised doubt about the influence of ISO 14000 certification on firms' performance (Habidin and Yusof, 2012; Gupta and Racherla, 2016).

Many firms have been planning and designing their green initiatives to demonstrate their corporate citizenship against climate change. Though the literature is almost silent on linkage between LSS and environmental management system, the basic philosophies of Lean (less waste) and Six Sigma (less defects) have theoretical overlap with environmental management and control measures. The commonly used tools and measures to address the issue of environmental impact in a firm evolved from the 3R approach of circular economy which focuses on reduce, recycle and reuse to get cost reductions as well the potential to reduce taxes and liability insurances (Bocken, Bakker, & Pauw, 2016; Preston, 2012). It emphasizes the need for a fundamentally new model of industrial organization to link rising demand for quality products and services with

prosperity and eco-friendly products and services with resource depletion – one that goes beyond incremental efficiency gains to deliver transformative continuous improvement.

Porter and van der linde (1995) highlighted the need for "product and process changes to better utilize resources and avoid pollution early, rather than mandating end-of-pipe or secondary treatment, which is almost always more costly." The concept of in-process control proposed by Porter and van der linde (1995) recommended the continuous improvement approach of 'proactive' organizational behaviour for environmental competitiveness (Ambec, Cohen, Elgie, & Lanoie, 2013) rather than 'reactive', which is also supported by LSS framework. To implement changes or improvements in product or process, firms may opt for DFSS and DMAIC approaches which are widely accepted and validated across various industries. This way a firm can reap the competitive advantage of synergy between quality and environmental management drive (Jabbour, De Sousa Jabbour, Govindan, Teixeira, & De Souza Freitas, 2013; Molina-Azorín, Tarí, Pereira-Moliner, López-Gamero, & Pertusa-Ortega, 2015; Yang, Hong, & Modi, 2011) and foster fundamental rather than piecemeal solutions.

2.10 LSS and Big Data

Six Sigma is known for its data driven approach for process improvement. Specifically, the success of measurement phase of DMAIC cycle depends on the availability of data over various operations, time periods, operators etc. (Snee, 2010). Similarly, Six Sigma tools like design of experiment (DoE) and design and development of simulation based production models for optimization would be no use unless a firm has not managed rich databases. Han & Lee demonstrated and supported the above argument with the following quote – "plant information systems allow us to store and analyse a tremendous amount of data, the future plant operation system should provide the users with all the

supporting functions to collect and analyse data, develop models, design experiments, and control the process at the optimum condition" (Han & Lee, 2002).

There are only very few studies which directly highlight the relevance of linkage between LSS and big data through either comprehensive theoretical or empirical research. Stojanovic et al. (2016) proposed "a novel approach for data-driven Quality Management in industry processes that enables a multidimensional analysis of the anomalies that can appear and their real-time detection in the running system". Similarly, a recent study highlights the usage of big data-driven clustering for an efficient discovering of real-time defects in the process and their route-cause analysis (Stojanovic et al., 2015).

In each phase of DMIAC cycle, decision making is a crucial activity that need to be performed using extensive data collected from various functional units. Though the applications of big data in manufacturing process improvement is quite nascent at present (Fosso et al., 2015), the field has great potential to make production workflows more customer-centric than ever before. For instance, Columbus (2014) reported that "Using sensors on all machinery in a production centre provides operations managers with immediate visibility into how each is operating. With increasing demand for automation in manufacturing, advanced analytics and cyber-physical system-based approaches, such as 'internet of Things' (IoT) have supported the big data environment, have to be implemented to improve efficiency and productivity (Lee et al., 2013).

3. Conclusion

Although a plethora of articles on Lean Six Sigma have been published in a wide variety of sources, the authors have observed that there are no general guidelines provided yet to organisations to take into consideration for implementing and sustaining this powerful continuous improvement strategy. This paper presents Ten Commandments of Lean Six

Sigma from the perspective of practitioners, researchers and academics who have been involved in the training, teaching, research and consultancy on various topics of quality and continuous improvement such as Lean, Six Sigma and LSS. These commandments can serve as a practical guide for senior managers and executives for achieving operational and service excellence in various manufacturing, service and public sector organisations despite of their size. One of the major limitations of the article is that the views expressed are based on four practitioners and this limitation can be addressed by pursuing a global study to critically evaluate these commandments using various leading academics and practitioners of Lean and Six Sigma topics.

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