Synergies of Lean Six Sigma

M Vijaya Sunder*

This paper analyzes two popular process improvement methodologies—Lean and Six Sigma—to compare and contrast the differences and commonalities which can lead to a successful continuous improvement program. The views of Lean and Six Sigma professionals across financial services, healthcare, hospitality and ITES sectors were studied and analyzed for understanding the real-time challenges of corporates in the current markets for quality deployment. The study was conducted using surveys, interviews and case studies. The scope of the study is restricted to transaction-based service organizations. Lean being an on-floor improvement technique and Six Sigma a popular statistical-based methodology are looked at from a focused perspective for developing a hybrid methodology. Lean Six Sigma model is proposed in the paper for successful deployment. The model is further tested for acceptability as a proposal of usage for process improvement professionals and proved successful with an acceptance rate of 98.8%. The paper also presents important failure modes of Lean Six Sigma deployment, its advantages and points of caution.

Introduction

The way the organizations have evolved through continuous improvement initiatives to higher customer satisfaction and lower operational costs has been evident throughout the last few decades. From the first few instances of improvements made through the invention of machines to the recent way of using statistical methods to analyze processes, the journey of evolution of organizations has been colorful. History shows examples of many companies which viewed the continuous improvement initiatives as a cultural change, more than cutting costs or improving quality. Companies believe that the cultural change in the motivation and desire of the employees continually improves business processes and policies. This fundamental change in operating and managing processes requires the stimulus of a structured method of continuous improvement.

Lean Six Sigma is a combination of two popular continuous improvement methodologies—Lean and Six Sigma. Lean and Six Sigma focus typically on improving

* Assistant Vice-President, Change Management, Barclays Shared Services, Chennai, Tamil Nadu, India. E-mail: mvijayasunder@gmail.com

the production and transactional processes of an organization. Each of these methodologies has been individually popularized by successful implementation at companies like Toyota, GE, AlliedSignal, etc.; however, they complement each other. Many companies are now recognizing the powerful synergy of these two methodologies and have successfully implemented the same. This paper models the working of successful Lean Six Sigma deployment in transaction-based environments, highlighting the synergies of the combination of Lean and Six Sigma.

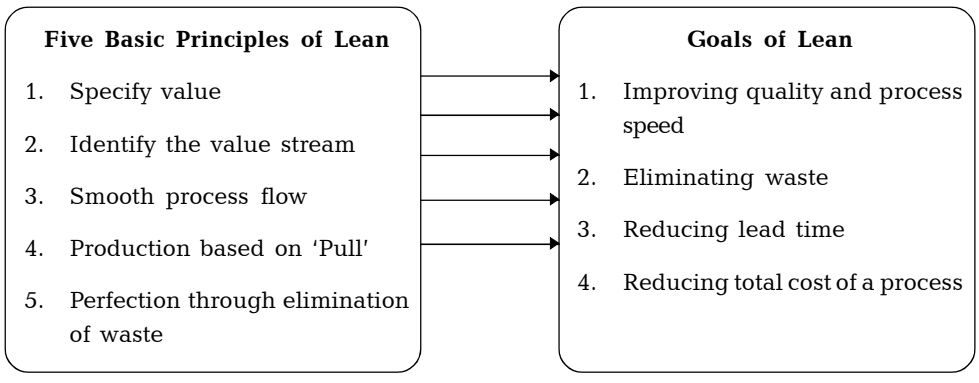
Lean

Lean production methodology was derived from the Toyota Production System (TPS) introduced by Taiichi Ohno. According to Ohno, the most important objective of the Toyota system has been to increase production efficiency by consistently and thoroughly eliminating waste. Later, lean production was introduced in the US by Womack *et al.* (1990). The expanded application of Lean methodology in the recent years across the world, commonly termed as the 'Lean Enterprise', has been popularized from manufacturing to transactional and service industries.

Lean is defined as a systematic approach to identify and eliminate waste through continuous improvement, flowing the product at the pull of the customer in pursuit of perfection (Kilpatrick, 2003).

Figure 1 presents the diagrammatic representation of lean methodology principles linked to its goals.

Figure 1: Principles and Goals of Lean



Source: Womack et al. (1996) for Lean Principles and MacInnes (2002) for Lean Goals

The Lean principles are defined as follows:

- 'Value' is defined as the right capability (as defined by and) provided to the customer at the right time and at the right price.

- Understanding the end-to-end value-adding and non-value-adding activities from customer's perspective is called 'value stream'.
- 'Flow' is created by eliminating queues and stops, and improving process flexibility and reliability.
- 'Pull' system is reacting and fulfilling the customer demand just-in-time without trying to push the products to the customer.
- Any activity which does not add value to the customer is considered as 'waste'. The different forms of waste as per Lean methodology are presented in Table 1.

Table 1: Eight Deadly Wastes as per Lean Methodology

Waste	Definition
Overprocessing	Adding value to a process/product the customer would not pay for.
Transportation	Moving raw materials, product, or information unnecessarily.
Inventory	Work-In-Process (WIP) that is not directly related to a customer requirement.
Wait Time	The time duration of WIP which is not directly related to a customer requirement.
Defects	Flaws in the WIP, final products, or services that do not meet the customer's requirements.
Overproduction	Products and services that are in excess to current customer requirements.
Motion	Unnecessary movement by people.
Unused Human Resources	Having excess workforce for the process.

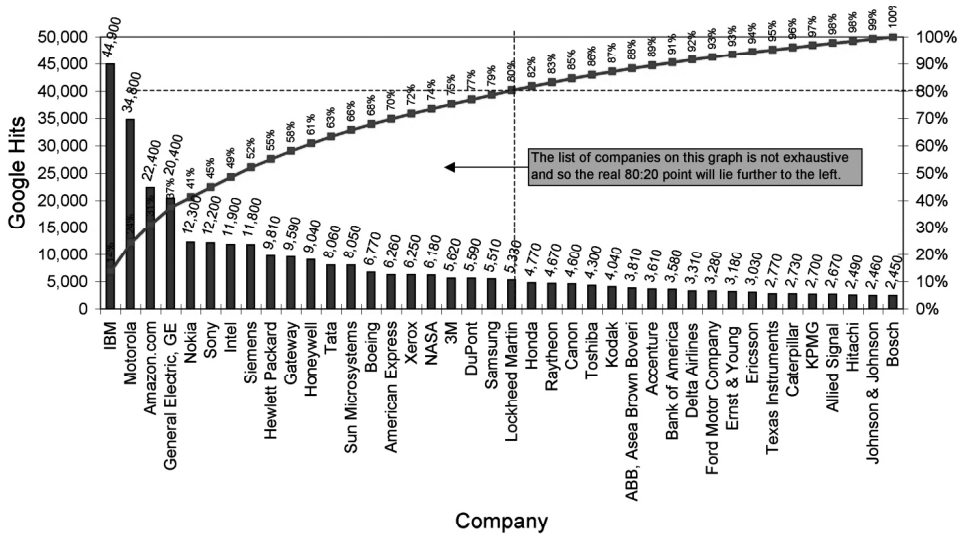
Source: Womack et al. (1996); Ohno (1988); George (2002); MacInnes (2002); and McAdam and Donegan (2003)

Six Sigma

The roots of Six Sigma as a measurement standard can be traced back to Carl Frederick Gauss who introduced the concept of the normal curve in the early 19th century. Edward Deming, the 'Godfather' of quality, had brought about immense change in the approaches and attitude towards quality in the early 1950s. In 1987, as the CEO of Motorola, Bob Galvin adopted and promoted the Six Sigma approach in the organization. In 1995,

Jack Welch, the CEO of General Electric (GE), adopted the Six Sigma approach, getting greatly inspired by the success of Six Sigma at AlliedSignal. Accenture, Alcatel, Amazon, GlaxoSmithKline, Honeywell, Boeing, Unilever, Xerox, and 161 more companies claim to have implemented Six Sigma in some form or the other (Figure 2).

Figure 2: Pareto Chart of Google Hits with Company Name and the Term 'Six Sigma'



Source: http://www.asixsigma.com/companies.php

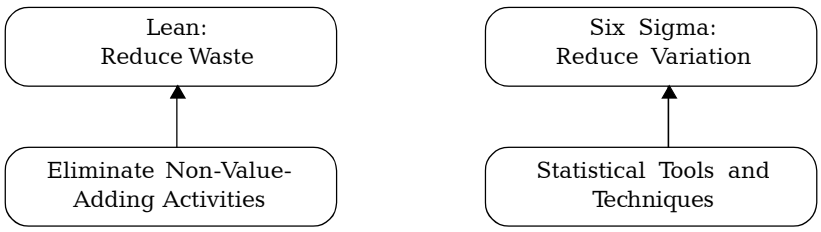
Six Sigma is a continuous improvement methodology that focuses on reduction of variation. Six Sigma as a business initiative was first espoused by the Motorola Corporation in the early 1990s (Breyfogle, 1999). Six Sigma is defined as a statistic and a methodology. As a statistic in the quality paradigm, it is 3.4 defects per 1 million opportunities and is related to the cost of quality (Harry and Schroeder, 2000). As a methodology, Six Sigma is defined as a structured problem-solving methodology using Define-Measure-Analyze-Improve-Control (DMAIC) or Define-Measure-Analyze-Design-Verify (DMADV) road maps.

While the fundamental principle of Six Sigma is to take an organization to an improved level of Sigma capability through rigorous application of statistical tools and techniques, Lean production has a role in eliminating waste and non-value-adding activities across the entire supply chain (Antony, 2003) (see Figure 3).

Analysis and Findings

A study was conducted among 85 Lean Six Sigma professionals from different transaction-based organizations in service industry to identify the corporate views on practical applicability of Lean and Six Sigma to compare and contrast their usage in real-time scenarios. Inferences derived out of the study, post analysis are highlighted:

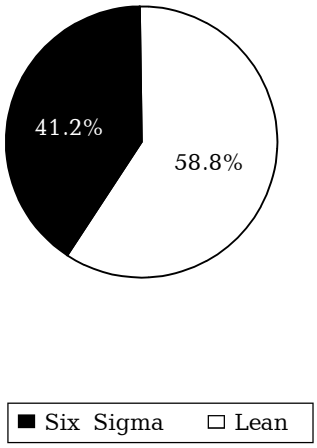
Figure 3: Fundamental Principle of Six Sigma and Lean



- 58.8% of professionals prefer Lean methodology, whereas 41.2% of professionals prefer Six Sigma for continuous improvement in their organizations (Figure 4a).
  - Six Sigma usage is dominant over Lean in financial services industry with 62.5%.
  - Lean usage is more evident over Six Sigma in IT and hospitality sectors with 71.9% and 71.4%, respectively.
  - 53.3% of healthcare professionals prefer Lean over Six Sigma (Figure 4b).
- 15 factors have been identified for the study to investigate the reasons behind preferring Lean or Six Sigma for their respective organizations. The analysis revealed the corporate view of differences and commonalities among the two methodologies from the application perspective (Table 2).

Figure 4: Lean Vs. Six Sigma Usage

a. Overall



b. Across Service Organizations

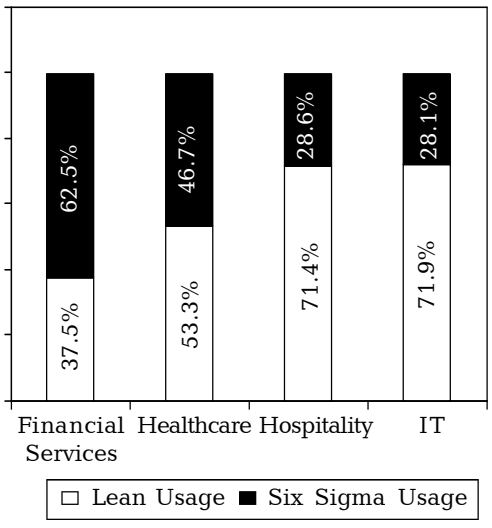


Table 2: Differences and Commonalities Between Lean and Six Sigma			
No.	**Highlight**	**Lean**	**Six Sigma**
Differences			
1	Identification of end-end value stream of the process	Y	N
2	Statistical analysis of the problem root causes	N	Y
3	Creating visual workplace	Y	N
4	Focus on eliminating waste and improving flow	Y	N
5	Focus on reducing variation for defect-free process	N	Y
6	Control over upholding/sustaining the improvements	N	Y
7	Rapid improvements	Y	N
8	Breakthrough improvement	N	Y
Commonalities			
9	Customer focus	Y	Y
10	Management commitment required	Y	Y
11	Employee engagement	Y	Y
12	Process improvements	Y	Y
13	Cross-functional deployment	Y	Y
14	Productivity/Cost saving benefit	Y	Y
15	Dedicated and structured approach	Y	Y

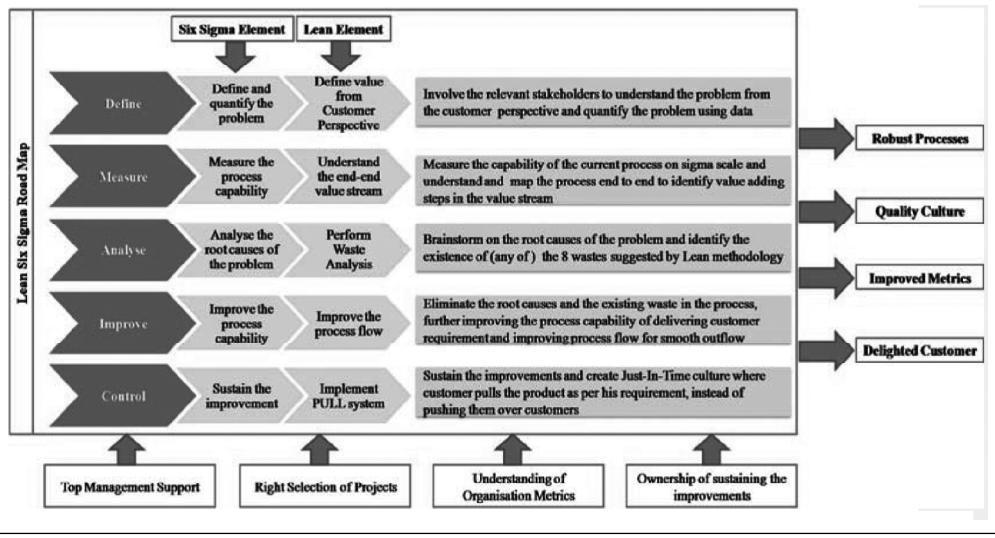
- 98.2% of the professionals agreed that Six Sigma is top-down approach which requires strong top management commitment for deployment, whereas 64% of the professionals seconded this claim for Lean, and the rest 46% claimed Lean to be a bottom-up approach.
- 58.8% of the professionals supported quick and rapid improvements with little or no data mining or statistical tools, whereas 41.2% emphasized on the importance of sampling and other statistical tool usage for robust and long-lasting improvements.
- Based on the case study, analysis and interviews with quality professionals, the model presented in Figure 5 is proposed for successful Lean Six Sigma deployment in transaction-based service organizations. The road map comprises of five stages, namely, Define-Measure-Analyze-Improve-Control, similar to Six Sigma road map. The high point of the hybrid model is that at every stage of the initiative from Define to Control, both Lean and Six Sigma

elements are blended to create synergies. A right proportion of on-floor improvement (Lean), backing with statistical analysis, makes the methodology robust and flexible. It has to be noted that the road map developed is to be used at project/focused initiative level. After every phase of the project, a tollgate review to check the successful completion of both Lean and Six Sigma components is essential. Also, it is suggested to practice the model under Lean Six Sigma expert's mentorship till the deployment attains maturity and such a culture is developed. The model focuses on delivering four important business requirements:

- Creating robust and defect-free processes;
- Developing a quality/process improvement culture;
- Improved organizational metrics; and
- Customer delight by exceeding the customer needs

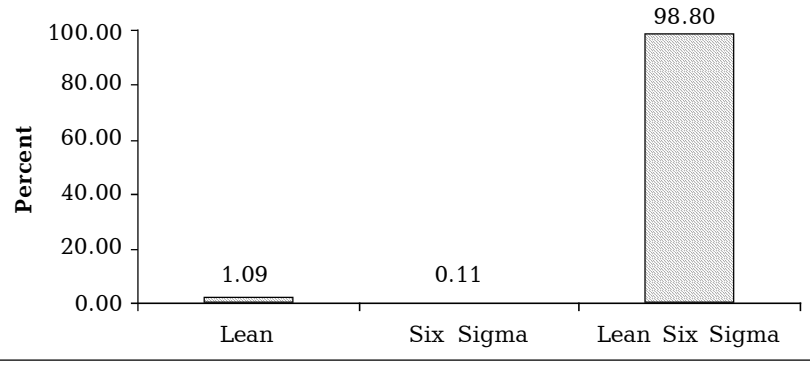
Understanding the basic statistical tools and out-of-the-box thinking are prerequisites for the deployment.

Figure 5: Lean Six Sigma Synergy Model



- Given an option to use the hybrid Lean Six Sigma (model proposed) approach, 98.8% of the survey population preferred it over Lean or Six Sigma (Figure 6). This confirms the acceptability of the proposed model across all the transaction-based service organizations in financial, healthcare, hospitality and ITES sectors. However, they claim that Lean Six Sigma deployment is not always successful; it fails with lot of investment wastage, if not implemented properly.

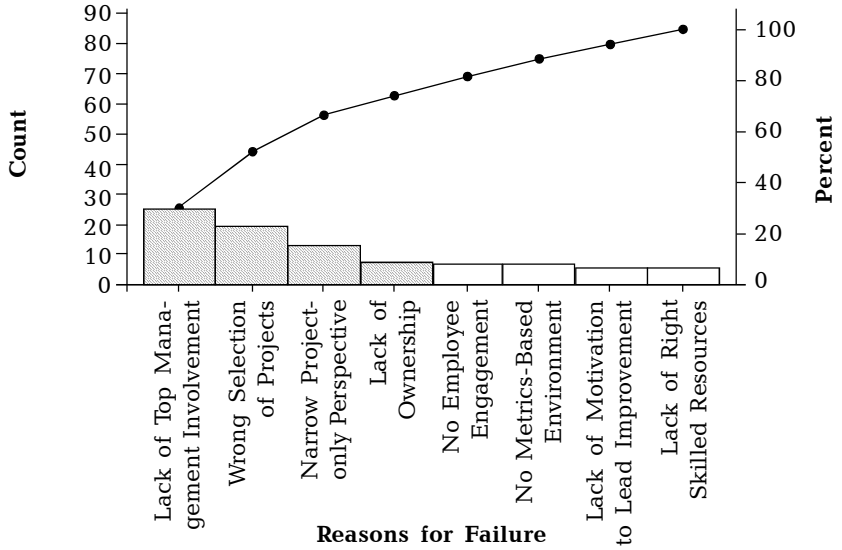
Figure 6: Success of the Lean Six Sigma Synergy Model



Vital Reasons for the Failure of Lean Six Sigma

The top four reasons contributing to 74.1% (Figure 7) of the failure of Lean Six Sigma are lack of top management involvement, wrong selection of projects, narrow project-only perspective and lack of ownership.

Figure 7: Pareto Chart of Reason for Failure in Lean Six Sigma Deployment



Count	25	19	12	7	6	6	5	5
Percent	29.4	22.4	14.1	8.2	7.1	7.1	5.9	5.9
Cum %	29.4	51.8	65.9	74.1	81.2	88.2	94.1	100.0

Lack of Top Management Involvement

Lean Six Sigma deployment is not about doing a single or group of projects. It is a way of building quality culture in the organization. Hence, it is very essential not to have

a mismatch with the existing organizational culture. The deployment not only involves resource cost (internally trained or external consultants), but also requires investment in line with the process mapping tools, metrics dashboards, statistical analysis software, etc. Hence, the top management commitment and involvement at all the stages becomes essential for Lean Six Sigma deployment.

Wrong Selection of Projects

Not every project qualifies to be a Lean Six Sigma project. Generally, projects for which solutions are known do not require a structured problem-solving approach, and can be successful with proper governance. These are called quick kills, as the time and effort to implement the known solution is minimal. Business cases which have high impact and no clue about the root cause of the problem or solution alone are best fits to take up as Lean Six Sigma projects. When the business impact is low, for an unknown solution Lean or Six Sigma could be used based on the data availability. The matrix presented in Table 3 is developed for correct project selection under Lean Six Sigma bucket. Any discrepancy from the suggested matrix might result in failure of improvement initiatives, as Lean Sigma projects alone focus on root causes of the problems for robust and long-lasting solutions, while quick kills would be a temporary solution in most of the cases.

Table 3: Lean/Six Sigma and Lean Six Sigma Project Selection Strategy Grid

		Solution	
		Known	**Unknown**
Business Impact	**High**	Quick Kill	Lean Six Sigma
	Low	Quick Kill	Lean/Six Sigma

Narrow Project-Only Perspective

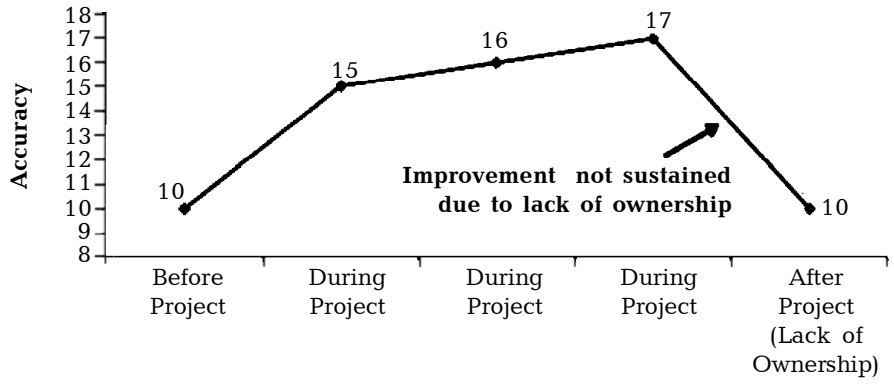
Lean Six Sigma project managers generally focus on improving their project metrics, that is, the goal of the project which describes successful completion. However, sufficient focus should be given to the side effects of the project on other metrics. For example, let us consider a project for improving the turnaround time of a transaction. The project manager should not focus on quick turnaround of the process compromising on the accuracy of the transaction. Here turnaround time and accuracy are considered to be contradictory metrics. Hence in this case, the project should focus on improving the turnaround time maintaining a minimum standard accuracy. To summarize the discussion, project managers should not think narrowly about the project metric improvement alone; rather they should have end-end vision and understanding about the process from all perspectives.

Lack of Ownership

Lack of ownership is one of the main reasons for sustainability issues with Lean Six Sigma projects. Post completion of the project, the project managers are allocated to a new project and hence do not focus any more on the completed projects (Figure 8).

Though Six Sigma 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 a successful project.

Figure 8: Lack of Ownership Impact on Project



Conclusion

Lean Six Sigma methodology is preferred over Lean or Six Sigma or any other continuous improvement methodology for process improvements across all the sectors in service industry.

- Lean Six Sigma methodology focuses on bringing customer delight. It improves processes by:
  - Adding value and eliminating waste;
  - Identifying and eliminating the root cause of the problem;
  - Reducing variation and defects in the process;
  - Placing proper controls on the improvements; and
  - Building a culture of quality in the organization
- The major success factors of Lean Six Sigma deployment include:
  - Top management involvement and support;
  - Structured evaluation and right selection of projects;
  - End-end perspective of organization metrics; and
  - Ownership of sustaining the results
- Advantages of Lean Six Sigma methodology over other process improvement methodologies are:
  - Structured approach to eliminate the root cause of the problem;
  - Stakeholder involvement at every stage of the road map;

- Statistical as well as walk-the-floor approach combination;
- Breakthrough and sustainable improvements for customer delight;
- Improves teamwork and involvement;
- Easy to document and share for best practices;
- Cuts across cross-functional barriers;
- Reduces handoffs and improves process flow;
- Reduces both process waste and process variation; and
- Systematic deployment approach. ❖

References

1. Antony Jiju (2003), "Lean Sigma", *Manufacturing Engineer*, April.
2. Breyfogle Forrest W III (1999), *Implementing Six Sigma: Smarter Solutions Using Statistical Methods*, John Wiley & Sons, New York.
3. George Michael L (2002), *Lean Six Sigma: Combining Six Sigma Quality with Lean Speed,* McGraw-Hill, New York.
4. Harry Mikel and Schroeder Richard (2000), *Six Sigma*, Random House Inc.
5. http://www.asixsigma.com/companies.php
6. Kilpatrick Jerry (2003), *Lean Principles*, Utah, Manufacturing Extension Partnership.
7. McAdam R and Donegan Stephanie (2003), "A Comparative Analysis of Trilateral and Concurrent Business Improvement Methodologies in the High Technology Sector", *International Journal of Manufacturing Technology and Management*, Vol. 5, No. 3, pp. 210-231.
8. MacInnes Richard L (2002), *The Lean Enterprise Memory Jogger: Create Value and Eliminate Waste Throughout Your Company*, Goal/QPC, Salem, NH.
9. Ohno Taiichi (1988), *Toyota Production System: Beyond Large-Scale Production*, Productivity Press, Cambridge, MA.
10. Womack James P and Jones Daniel T (1996), *Lean Thinking: Banish Waste and Create Wealth in Your Corporation*, Free Press, New York.
11. Womack James P, Jones Daniel T and Roos Daniel (1990), *The Machine That Changed the World: The Story of Lean Production,* Macmillan Publishing Company, New York.

Reference # 07J-2013-02-02-01