

Lean Six Sigma: A Literature Review

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Abstract

This paper reviews the published literature related to lean six sigma from start to date. The methodology involves is the review study of 116 papers related to Lean six sigma from well known database searches including Science Direct, EBSCO host, Emerald and Google Scholars. The paper includes the results from different perspectives such as implementation of Lean six sigma, Focus Area, Focus Industry, Focus Country, Year Wise Publications and Year Wise Focus Area and Focus Industry. The review of literature found that Lean Six Sigma is mostly implemented in the Health industry. Research on LSS is on elementary stage. Lean Six sigma framework in SME organizations is needed.

Key Words: Lean Six Sigma

1-Introduction

Lean Six sigma is a combination of well known waste elimination and process improvement techniques Lean Manufacturing and Six Sigma. Spector R. (2006) concludes that LSS is most effective in process improvement it is widely implemented in the top performing organizations. It came from manufacturing environment and found its way to services. Ronald D. Snee (2010) describes Lean six sigma as a well structured theory based methodology to improve performances, develop effective leadership, customer satisfaction and bottom line results. Together lean manufacturing and six sigma become more powerful and eliminates the cons of each approach. It applies the tools and techniques of both Lean manufacturing and six sigma. DMAIC and DMADV are applied with lean environment to achieve bottom line results. It is implemented project by project (3-6 month) as Juran (1989) signifies that improvement is achieved only through projects. LSS is implemented through Champions, Master Black Belts, Black Belts, and Green Belts same like six sigma.

2- Methodology

A structured approach was adopted to search the published literature regarding lean six sigma. It involved searches from the well known research databases like EBSCO host, Emerald, Google scholar, Science direct. The literature search is limited to the English language only. I found total 116 articles highly related to lean six sigma. The criteria of selection of the papers includes that the publication must have LSS or Lean and six sigma combined applied either as a case study or described as theory. The search years included are from 2000 to December 2011 because there were no research article related to Lean Six sigma found before 2003 using the searching databases. The search results were sorted out as case study or theories, Industry focused, area focused, year wise publications, year wise focus area and industry, country wise research on lean six sigma. The data collected, analyzed and the results are presented in graphical.

3- Results

Out of total 116 Lean Six Sigma relevant found research publications there are 66(53%) papers are case study based while 50 (47) % papers are theory based. Figure 1 shows the focus area of implementation of LSS mainly has been Process improvement. The organization adopted LSS either to improve their processes or modify them to increase efficiency and productivity. Miscellaneous category includes different areas in publication frequency of one like E transition Emotional Intelligence, HRM, BPO, Marketing, Services, Web Technology, Security Assistance, Suppliers, Product Life Cycle, TRIZ Methodology, Cross Doc, Investigation, Methodology and TURA. Tools and techniques are focused considerably. It helped out

to evolve the literature regarding implementation of LSS. But there is still need to explore the tools and techniques of LSS making it complete fit in service or manufacturing organizations. Publication frequency on the integration of Lean and six sigma is still needed to be explored in a scientific and systematic way. There must be research on building up a complete picture of integration of these two methodologies. It is considered that LSS is hurdle in the way of innovation Roger W. Hoerl, Martha M. Gardner (2010). Some papers have directly focused on the quality of the product using the LSS methodologies. There is less focus on implementation of LSS as compared to process improvement, tools and techniques. The need is to build up some implementation models individually for service, manufacturing, large and small scale organizations. Research and development has been focused of LSS implementation especially in pharmaceutical sciences. Literature shows that LSS has not always benefited the organizations but there are some failure cases. Causes of failure has been identified but in limited perspectives. Culture wise investigations of failure causes are still needed.ERP, Data Mining, Simulations, risk management and project management has been explored in both in theories and case studies.

Figure 2 shows that LSS research is indifference to developed and developing countries. USA is leader in LSS related research following is the UK. Miscellaneous category in the fig. includes different other countries with comparatively less research on Lean Six Sigma.

Figure 3 shows that the research and implementation on Lean Six Sigma in publication started at 2003. Afterward research is continuously increasing as organization know better about the successful stories of world top performing organization using Lean six sigma. Much research has been done in 2011 nearly 33 publications.

Figure 4 shows that the lean six sigma is mainly implemented in the Health sector where the defects are less tolerable. Health sector basically includes pharmaceutical, clinical and drug discovery research practices.LSS has been implemented in military which includes Deployed Warrior Medical management, Armored Equipment Maintenance, Nuclear facility, Navy security Assistance etc.SME includes manufacturing concern. LSS has been proved quite effective in SME organization. But there is need to explore more this sector for theory evolution regarding the implementation of LSS in SME organization. Government organization besides military used LSS for process improvement. They focused more on tools in employed in different nature of governmental organizations. Financial Services includes mainly banks. In the information technology and related industries like telecommunication and computer manufacturing, Lean six sigma was used frequently.

Figure 1:

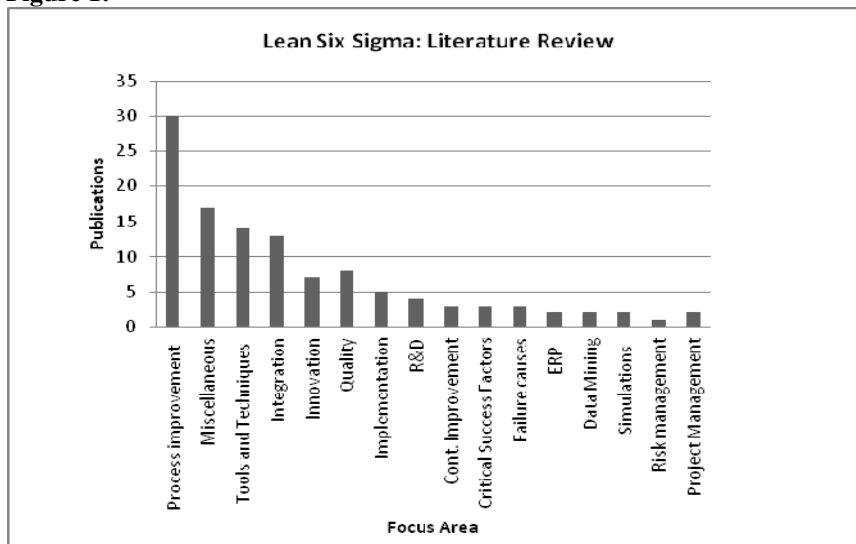


Figure 2:

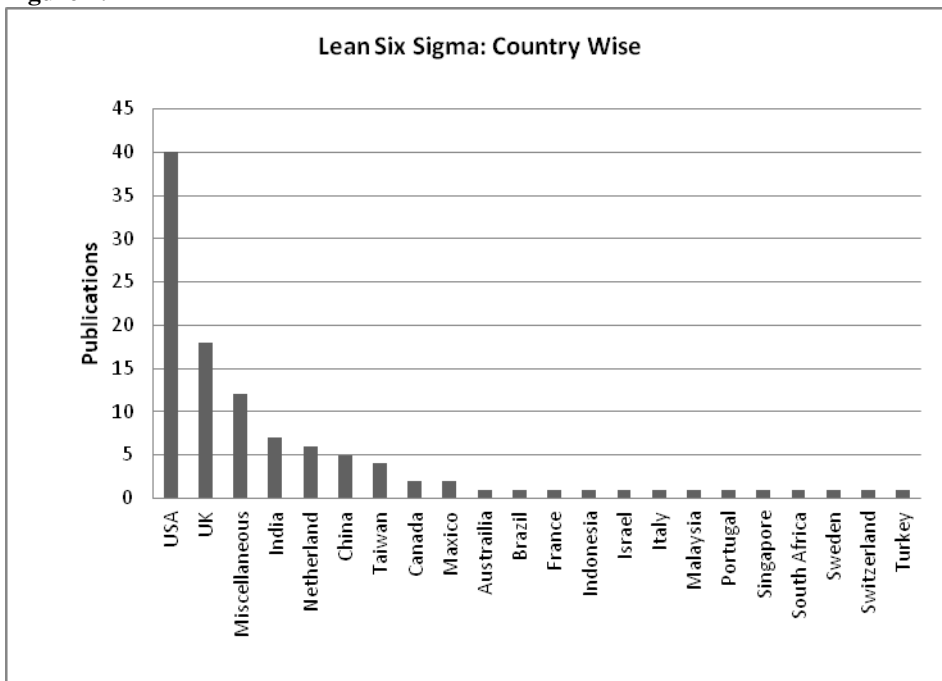


Figure 3:

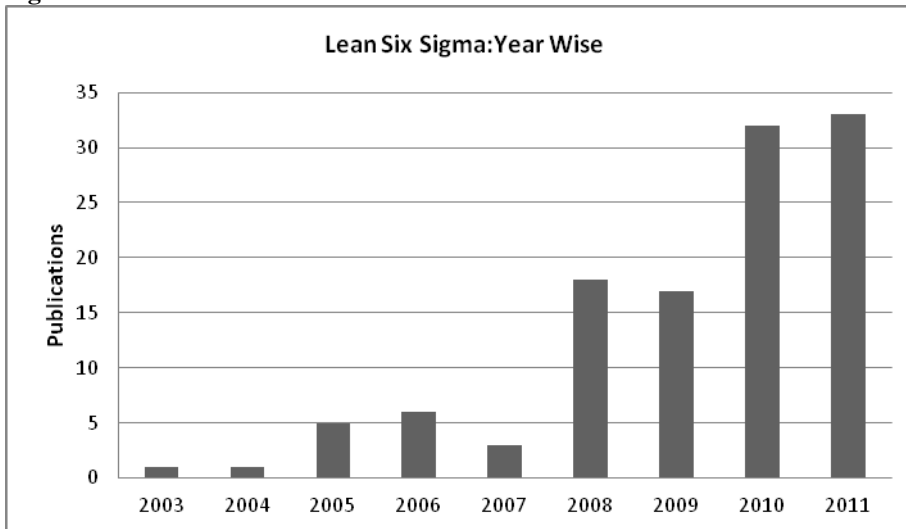


Figure 4:

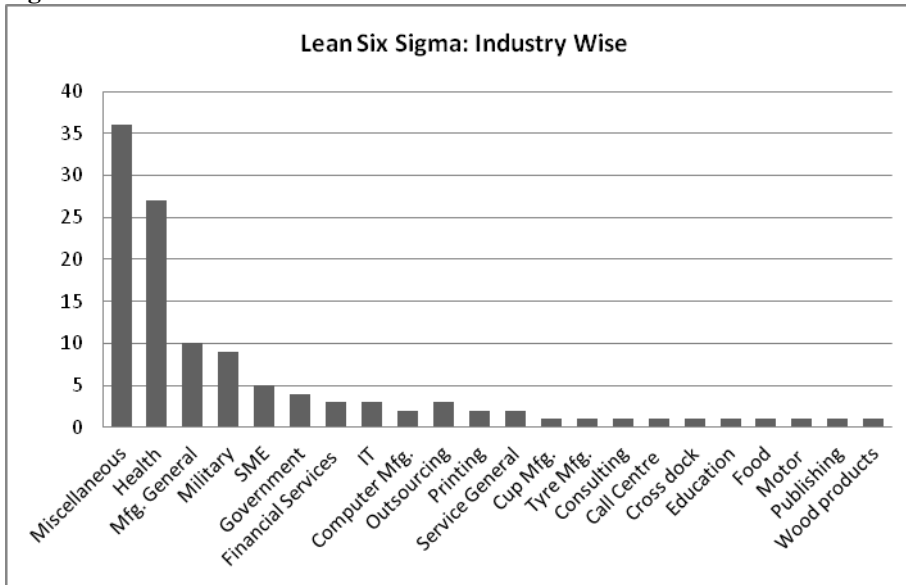


Table 1 Industry Wise Focus Area

Industry	Focus Area
Health	Process Improvement, Process Innovation, Continuous Improvement, Innovation, Quality, Tools, R&D, Methodology, Integration, Implementation, Simulation
Manufacturing General	Process Improvement, Tools, Implementation, Integration, ERP, Suppliers, Continuous Improvement, Data Mining, Innovation
Military	Process Improvement, Failure Causes, Security Assistant, Tools, Investigation
Government	Tools
Financial Services	Processes Improvement, Implementation, TRIZ methodology
IT and computer Manufacturing	E transition, Web Technology, Process Improvement, Product Life Cycle
Outsourcing	Process Improvement, BPO
Printing and Publishing	Project Management, Process Improvement
Service General	HRM, Process Improvement
Cup Mfg.	Tools
Tire Mfg.	Tools
Call Centre	Process Improvement
Cross dock	Cross Doc

Education	Process Improvement
Food	Process Improvement
Motor	Data Mining
Wood products	Quality
Consulting	Process Improvement

Table 2 Country wise Focus Industry and Focus Area

Country	Focus Industry	Focus Area
USA	E transition, tools, integration, simulation, Quality, Services, Critical Success Factors, Process Improvement, Web Technology, Innovation, Product Life cycle, Emotional Intelligence	Computer Manufacturing, Manufacturing, Service, Information Technology, Health, Financial Services
UK	Process Improvement, Risk Management, Integration, Innovation, R&D, Continuous Improvement	Health, Manufacturing
India	ERP, BPO, Quality	Manufacturing, Outsourcing, Health
Netherland	Quality	Health
China	Integration	-
Taiwan	Data Mining, Project Management, TRIZ Methodology, Process Improvement	Financial Services, Food, Printing, Motor
Canada	Integration	
Mexico	Tools, Process Improvement	Health
Australia	Marketing	Outsourcing
Brazil	Implementation	
Indonesia	Process Improvement	Telecommunication
Israel	Failure Causes	-
Italy	Critical Success Factors	
Malaysia	Critical Success Factors	Electronic Industry

Singapore	Integration	
South Africa	Process Improvement	Education
Turkey	Data Mining	Manufacturing
Japan	Quality	-

France, Portugal, Sweden, Switzerland has worked on theory perspectives of Lean Six sigma without focusing on any particular industry.

4- Conclusions

The research on lean six sigma is on initial stage. Lean Six Sigma has been equally beneficial both for manufacturing or service concerns and Large or small scale organizations. It is quite beneficial for different industries with little modifications as per industry requirement. It is suggested to research on SME sector for implementation of Lean Six Sigma where the financial capability is a hurdle.

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