



Research Paper

A STUDY ON LEAN SIX SIGMA JOURNEY AT SME BUSINESS IN INDIAN SME PERSPECTIVE.

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ABSTRACT

The protection of planet and upliftment of the society have earned equal importance as that of economic progress in this 21st century. In the years to come these subjects are going to remain at the top most agenda for all the countries, governments, public and private business enterprises. According to **George, M. L. (2002/2003)** On one hand companies will have to innovate new processes and methods to conserve the planet and its non-renewable resources for the future generations and on the other hand, optimize efficient use of resources. Companies will slowly exhaust all low hanging efforts to achieve the improvements in the sustainability goals and the time will come when companies will have to adopt to structured and disciplined methodologies to achieve the stringent sustainable development targets and demonstrate consistent results to all the stake holders. Importance of Sustainability reporting has been underlined by governments, several non-profit and for-profit organizations. There are several research papers already published on Sustainability Reporting trends. A limited research is available on the quality of the reports. Overall the trend of disclosure is encouraging however, a lot has to be done in terms of the quality of the information disclosed in these reports. A critical analysis of BSE Top 100 companies is done on the data reporting practices and the gaps therein. Since one of the major reasons for the disclosure being the investor education, the information disclosed should be comprehended easily for making the decisions. A qualitative analysis performed in this research reveals several gaps in the way the data is presented in the Sustainability Reports by the companies. **Snee, R. D. (2010)** It appears that companies are more interested in the compliance or portraying a positive picture rather than being proactive leaders of sustainable development. Equal responsibility lies on the agencies who help in preparing the Sustainability Reports for the companies. A quantitative analysis done in this research establishes several process improvement opportunities and Lean Six Sigma project opportunities. Some of the process improvements require tools like Kaizen or simple Problem-Solving Tools, however, there are some complex processes which would require a rigorous xvi approach of Lean Six Sigma. A systematic approach would also provide a confidence to the stakeholders, especially investors, about the seriousness of the efforts by the company. Lean Six Sigma is a proven methodology used by several

organizations to achieve sustainable improvement results. This research provides a road map for integrating the Lean Six Sigma methodology into the Organizational Strategic framework. It suggests integration of Sustainability objectives with organizational goal tree. The research emphasizes certain Lean Six Sigma tools which are important for the Sustainability related improvement projects. Lean Six Sigma improves the process efficiency, eliminates waste and makes the Sustainability initiatives profitable for the organization. The approach suggested in this research builds a win-win situation for the business organizations and enforcing agencies to drive process improvement and efficiency and at the same time significantly contribute to the global challenge of climate change.

Keywords: Lean, Six Sigma, Lean Six Sigma, SMEs, Systematic review..Etc..!

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1.1 INTRODUCTION

Today's realities that are driving business:

According to Black, K., & Revere, M. (2022) Increased global competition and emerging Information technology is forcing changes in all aspects of society namely business, government, education, health care and people.

In today's buyers market condition, Customers are demanding more with competitive cost and quality, just in time delivery and requisite quantity. Ultimately this develops tremendous pressure on manufacturing system and people working around. Therefore, we have to change the way we work and manage all aspects of organization and all processes we use to do our work. Lean is primarily focused on reducing cycle time to bring a reduction in lead time to the customer. Lean was highly popularised after the publication of the book "The Machine that Changed the World" by Womack in 1990. There are many challenges in adopting the Lean methodology. The lean methodology uses five stages which start with identifying value. When this has been done the next steps are map the value stream, create flow, establish pull and finally seek perfection. The process then starts again. The goal is to remove non-value activities from the process. One of the challenges in Lean is developing a culture that will accept and sustain the use of the tools and techniques required within this methodology.

Breyfogle, F. W. (2023) We have to live in new e-age era where we need to do our regular work effectively and efficiently with improve on how we do our work... To satisfy customers and make profits, organizations are focusing to

improve quality, productivity, reduce cost and speed up product development cycle times. Organisations have tried and tested variety of methodologies like Business Process Reengineering, Quality Policy Deployment, ERP packages, Gemba Kaizen, ISO: 9000, QC tools, TQM

and lately Six Sigma in their effort to achieve business needs. We are hearing lot about Six Sigma methodology through books written by MIKEL HARRY, KJELL MAGNUSSON, FORREST

Lean manufacturing emphases on waste reduction and worthless activities in manufacturing (**Kumar et al. 2006; Snee 2010**). Outcome provided by Lean Manufacturing idea would be no use if the answer has great difference. Six Sigma focused on reduction in difference outcomes in deprived facility due to extensive principal period.

BREYFOGLE III and soon. With the Indian context very few books written by Indian authors using Six Sigma in Indian industry are available, as the methodology has recently being used by Indian companies. "THE POWER OF SIX SIGMA " book written by **SUBIR CHOWDHURY**, an Indian author is also very useful in Six Sigma context but he has practiced Six Sigma in American industries. Taking the historical review through these prominent books and field study of Six Sigma methodology in manufacturing industries, I am going to unfold before you the role of Six Sigma in manufacturing sectors in Pune. Very little information was available about Indian Industries executing Six Sigma

methodology when I started studying it in newspapers and books from the year August 2003.

1.2 Need Of Studying Six Sigma In Manufacturing Industry: Makwana, A. D., & Patange, G. S.(2019/2021) After globalisation, Customers are demanding more with greater expectations; lot of competition asking innovation for buyer's market, Change taking place in all aspects of industry. It's not that the business environment is changing, but change is the business environment. Creating, managing, mastering and surviving change is the agenda for everyone in business who aims to make difference. Ultimately this develops tremendous pressure on manufacturing system and people working around for greater productivity, reliability, repeatability, accuracy and flexibility in manufacturing.

Therefore, manufacturing organisations in India should focus

1. People to work with increasing responsibility.
2. Process to deliver consistently improved performance.
3. Profitable growth in more complex and cutthroat competitive environment.

1.3 Objectives Of the Study

- 1.To explore the Sustainability Reports published by select Indian companies to discover the insights of sustainable development practices followed and challenges faced by companies.
 2. To examine Lean Six Sigma methodology from the view point of its applicability for the Sustainability initiatives.
 3. To develop the systematic applicability of Lean and Six Sigma for prioritizing, goal setting, problem analysis, Innovation, implementation planning, and execution.
 4. Identify Lean Six Sigma project opportunities under sustainable development initiative. Methodology: Following methodology was used for the re
- Naveen (2013) specified that The obligation of Lean six sigma manufacturing has amplified

due to waste and following upsurge in price of the manufacturing properties.

1.4 Scope of the study:

The research has included - 1. Assessment of Sustainability guidelines prescribed by Global Reporting Initiative (GRI) on Social, Environmental and Economic activities.

2.. Study of various strategies, approaches used for Sustainability reporting by business organizations in India (BSE Top 100 Companies).

3.Special focus of the study was on the environmental impacts, their measurements and improvement initiatives only. The analysis did not include initiatives and improvements under Social impact areas or CSR or economic area.

1.5 Limitations of Study :

Sustainability deals with economic, environmental and Social issues.

Sunder, M., & Antony, J. (2018) This research specifically has focused the management of environmental aspects of the problem only. Environmental science is a large subject by itself. This research is limited to use of a process improvement methodology or a framework in dealing with the challenges arising out of the environmental impact of the business.

The source of the data generated is from the sustainability reports. Therefore, analysis has the limitation to the extent the companies have disclosed the information. The quality of reports could have impact on the analysis and the inferences.

Following could be the possible limitations- -
- The data and analysis done is based on the amount of information disclosed by companies in their Sustainability Reports. Out of top 100 companies, only 47 companies have published at least one Sustainability report and only 15 companies have published sustainability reports for at least five years. Therefore, the sample of study was limited to that extent. The research has not include

1. Study of Core "Sustainability" or environmental science subject, assessment of

environmental impact and solutions to reduce / eliminate the impacts.

2. . Social Responsibility or CSR related activities or processes

1.6 Review of Literature

1.According to Federation of Small Businesses (2018), it can be seen that in the United Kingdom, SMEs accounted for 99.9% of all business. SMEs can present a special suite of challenges when implementing continuous improvement methodologies. These challenges can range from resource issues to leadership **1.According to Federation of Small Businesses (2018)**, styles. SMEs are the largest employer of personnel. SMEs employ 15.7 million in the UK which represents 60% of all private sector employment in the UK. SMEs act as suppliers to large organisations and therefore the “footprint” of SMEs is much larger than may be seen at a first glance. Moreover, due to the growing importance of supply chain management issues, SMEs should provide high quality products or services at low cost to larger firms.

2.A few researchers (Antony, 2016; Snee, 2010) 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. While top management should provide strategic and transformational leadership, LSS also needs leadership at execution and project management level from mid-management. Leadership at all levels needs to be consistent, in order to face and resolve the deployment.

3.Leadership is very important is deploying continuous improvement **efforts (Antony et al., 2010)**. Many leaders may not put

continuous improvement as a priority as they only are concerned with short term gains at the expense of the longer strategic goals of improving the business. Kumar (2014) recognized numerous Lean manufacturing systems recognized by Indian manufacturing as a skilled scheme in enhancing structural presentation by concentrating on removal of waste from the manufacturing organization and therefore refining efficiency of the group

1.7 Research Methodology:

Methodology: Following methodology was used for the research - **1. Assessment of Sustainability Reports of selected Indian companies as per guidelines prescribed by Global Reporting Initiative (GRI) on Social, Environmental and Economic activities was done. Md Nazmus Sakib, Md Kawsar, 2. Sustainability reporting practices and trends of selected companies under environmental impact areas were studied.**

3. Based on Six Sigma principles of data measurement and understanding of variation, gaps in the data reporting were identified

The study is based on survey method. Both primary and secondary

sources were used to collect the data. Thus predesigned and tested

questionnaire was used for the purpose of collecting the primary data.

Before collecting the data, Six Sigma training imparted,

Organisational hierarchy, roles and responsibilities, methodology used

with intentions all this information from that company was gathered

through interview and discussion.

Prieto-avalos (2014) deliberate that Lean manufacturing delivers a method to classify and remove waste and all pointless doings through constant developments.

1.8 Research Design:

1. Scope Time Span The sustainability reports of BSE Top 100 companies were considered for the scope of this research. The Sustainability Disclosure Database maintained by Global Reporting Initiative

(GRI) has been referred to access the reports.

2. The analysis included the reports for the latest year available in the database. Therefore, the reports of 2016 or 2017 were studied. For the consistency of reporting and the patterns in the data reporting, earlier period reports available on the Sustainability Database were also downloaded and studied.

Sample Method

The Sustainability Reporting has not been very largely adopted by Indian companies so far. Most of the companies publishing the Sustainability Reports are progressive and majority of them are included in the BSE (Bombay Stock Exchange) Top 100 companies. Therefore, the sample used for this research was reports of only those companies who figure in BSE Top 100. BSE Top 100 list was accessed on 14th Nov. 2017 and has been considered as base throughout this research.

Sample Size:

Out of the 100 companies, 89 companies' reports are published on the Sustainability Disclosure Database of GRI. Out of these 89 companies 47 companies have actually used the GRI framework and published independent Sustainability Reports. Remaining 42 companies have published Business Responsibility Report in their Annual Report. Business Responsibility Reports do not provide adequate information to analyze their data and improvement journey. Hence, finally a sample size of 47 Sustainability Reports is considered for the study. Further, from these 47 Sustainability Reports, only 30 companies are such who have published at least 5 reports so far. These 15 reports were further shortlisted for a detailed analysis.

Source of Data Collection:

The data is primarily sourced from the information available in the Sustainability Reports published by Indian companies on the GRI Sustainability Disclosure Database. At times whenever, any additional information was required, the researcher has accessed

information publicly available on the respective company's website.

Data Collection:

This research has used the sustainability reports published by companies on the Sustainability Disclosure Database on the Global Reporting Initiative website.

Tamizharasi (2014) deliberated about numerous waste management methods used in Indian MSME recommended welfares of applying lean idea and emphases on Value Stream Mapping (VSM) and Single Minute Exchange of Dies (SMED) in Carriage workshop.

1.9 Qualitative Analysis

– A qualitative analysis of the Sustainability Reports of BSE Top 100 companies has been done. The reports published on the Sustainability Disclosure Database available of GRI website were accessed. The gaps in the reporting were identified by studying the sustainability reporting practices of thesis.

Data Analysis:

Data generation for Hypothesis Test: The Sustainability Reports (BSE Top 100 companies) that are available on the GRI database as of Feb. 2018 were accessed. Since the reports based on GRI guidelines are in details giving the data of various performance measures, only those reports are considered for analysis and review. As mentioned in the research scope, the performance on the Environmental parameters and the actions for improvement are considered in this study.

Out of top 100 companies, 47 companies have published their Sustainability reports in recent past using GRI guidelines. Hypothesis Testing – H01

For testing of hypothesis, this list of 47 reports was further filtered to a list of 15 companies who have been consistent in publishing the reports for at least 5 years. These companies were

Table4.2- BSE Top 100 companies having published at least 5 or more Sustainability Reports (as of November, 2017) N

Sr.No	Company	Sector	No. of Reports
1.	ACC Limited	Construction Materials	8
2.	Aegis Ltd.	Technology Hardware	5
3.	Ambuja Cement	Construction Materials	7
4.	BPCL	Energy	9
5.	CLP India	Energy	5
6.	Dr. Reddy's Laboratories India	Healthcare Products	8
7.	Hindalco Industries	Mining	6
8.	Hindustan Petroleum Corporation Ltd.	Conglomerates	5
9.	Indusind Bank	Financial Services	7
10.	Infosys Limited	Commercial Services	10
11.	ITC Limited	Conglomerates	14
12.	JSW Steel Limited	Metal Products	10
13.	Mahindra & Mahindra Limited	Automotive	10
14.	Tata Chemicals	Chemicals	5
15.	Wipro Limited	Other	9

In each of these 15 sustainability reports, under the Environment Impact areas, the actions / initiatives disclosed by companies were classified in two distinct categories – Actions or initiatives pertaining to ‘Process Improvement’ and actions or initiatives pertaining to ‘Technology Improvement’. Here Process Improvement meant the actions such

as optimization, waste elimination, efficiency improvement, etc. Whereas, Technology Improvement meant the actions such as bringing a new technology, new equipment or new methods altogether etc. Based on these guidelines all the reports were marked in above categories. Based on this exercise following level of process improvement and technology improvement initiatives are seen across 15 companies’ reports.

Bartlett, Jonathan, 2013, The Stats Geek, <https://thestatsgeek.com/2013/09/28/the-t-test-and-robustness-to-non-normality/> 88 Snijders, Tom A. B., 2011, Statistical Methods: Robustness,

http://www.stats.ox.ac.uk/StatisticalMethods_MT2011_Snijders

Results of Two-Sample t Test using Minitab software:

Descriptive Statistics:

Sample	N	Mean	StDev	SE Mean
Process Improvement	30	3.07	2.35	0.43
Tech Improvement	30	5.80	4.07	0.74

Estimation for Difference

Difference -2.733	95%CI for Difference (-4.461, -1.006)
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Test :

Null hypothesis $H_0: \mu_1 - \mu_2 = 0$

Alternative hypothesis $H_1: \mu_1 - \mu_2 \neq 0$

T-Value	DF	P-Value
-3.19	46	0.003

P-value = 0.003 which is lower than 0.05 hence we rejected the null hypothesis. This means there is no significant evidence to believe that the means for Process Improvement actions and Technology Improvement actions are same. Emphasis on the process improvement was seen lesser as compared to the technology improvement.

From the Histogram it was seen that the Process Improvement actions data was not normal. However, Two Sample t-test is

considered robust to a non-normal data Page77 | 155 Page78 | 155 (Bartlett Jonathan89, 2013; Snijders, Tom A.B90., 2011). Snijders states that t-test is robust against non-normality and the test is doubtful only if there are serious outliers (long tailed distribution) in the data or sample sizes are too small. The histogram above does not have any unusual skew. Therefore, the results of the Two Sample t-Test were considered right.

1.10 Findings:

Sustainability Reporting in India – The objective of Sustainability reporting is less to measure the impact and more to the awareness of the impact and strive to reduce it in every possible way. This is covered in the literature relating to the sustainability reporting practices in India. The research papers available are mostly exploring the reporting trends in the Indian industry. Some of the papers are also focused on the Corporate Social Responsibility (CSR) trends in India. This research has also studied various reports published by organizations such as United Nations, GRI, World Bank as well as some of the leading consulting firms such as **McKinsey114, EY115** etc. Latest data from the Sustainability Disclosure Database was taken to see how many top BSE companies have been publishing the Sustainability Reports and how consistent they are. The trend of reporting is increasing. Companies have realized that sustainability reporting would add value to their business in terms of stake holder confidence and their overall image in the society. The researcher has studied the Sustainability Reports of BSE Top 100 companies. The list of top 100 companies was accessed on 14th Nov. 2014 and the same list of companies was retained throughout the research. Summarily, as of November 2017, out of the top 100 companies, only 47 companies were publishing the Sustainability Reports as per GRI guidelines on the GRI Sustainability database. About 42 companies were reporting Business Responsibility Report as per the National Voluntary Guidelines on Social, Environmental and Economic

Responsibilities of Business released by Ministry of Corporate Affairs. Not many companies were consistent with reporting every year. Out of 47 companies, only 15 companies were reporting the sustainability performance for 5 years or more. Similar story is seen with the other companies (other than BSE top 100). Majority of the companies have published 1 or 2 reports so far. **McKinsey & Company, 2009**, Environmental and Energy Sustainability: An Approach for India, <https://www.mckinsey.com/business-functions/sustainability/our-insights/environmental-and-energy-sustainability-an-approach-for-India> 115 EY, (2011) report titled as 7 Questions CEOs and Boards Should Ask About “Triple Bottom Line” Reporting accessed from EY website.

Following are the key observations in the sustainability reporting –

- Most of the reports show a colourful picture of companies’ approach towards Sustainability. Every attempt is made to impress the reader about the organization’s commitment.

- There is very limited negative information disclosed by companies.

- Even though GRI guidelines recommend the organizations to report the data pertaining to reporting year and preceding two years, some of the companies report only two years data. Only two years’ data fails to give stake holders adequate information as to if the organization is acting on the material impact areas or not.

- Measurement is the key in the reporting. Firming up of baseline performance is important in the measurement. Companies reporting only two- or three years data have not stated which year is considered as baseline and the reason thereof.

- GRI reporting guidelines require absolute performance measurements as well as ratio with total production, or sales or turnover. For example, Gross Direct GHG emission and GHG intensity ratio. Similarly, total volume of water recycled and reused and also as a percentage. Not all reports had such disclosures.

- Tweaking of graphical representation so as to appear significant improvement in performance, whereas actually the improvement not very significant.

1.11. Recommendations:

Recommendations for Data Reporting The key recommendations on the basis of gaps in the data reporting of companies are summarized below – The data presented should be at least for 5 years. GRI guidelines stipulate the data requirement of 3 years at least. However, 5-year data would present more meaningful value.

Many companies have published the Sustainability Reports for more than 5 years. Therefore, these companies have the requisite data for a greater number of years. There is no harm in disclosing data for a greater number of years, if it is available. Data be presented in absolute terms as well as in the rate or ratio form.

The rate should convert the data independent of production or sales activity. The production or the sale should have a strong correlation with the data. If they are not correlated or there is some other metric which impacts the data, the report should disclose the same with proper explanation for use of certain metric.

For each data disclosure, organization need to state the future targets for improvement for at least next two years. A brief action plan for achieving the targets in next two year would give added confidence to the reader of Sustainability Reports.

The data should present a trend of improvement. Just reduction or increase between two values can be only a random variation generally present in any two values of a data. It is the assessor organization's duty to separate variation due to any special cause i.e. a variation which can be caused due to some effort or external action.

Complete transparency is important. If certain data is showing unfavorable results, it is fine if the organization states the explanation and corrective action plan rather than showing a blind eye.

Finally, for the certifying or assessing agencies, even though, the information and data is provided by the company, it is the agency's responsibility to make sure that the report and data can be easily consumed and analysed by the stakeholders. The inferences drawn on the basis of any data must represent the facts.

1.12 Suggestions :

While there are recommendations to the business organizations to embrace Lean Six Sigma for the process improvement, this research also has some suggestions to Global Reporting Initiative (GRI) organization for modifying their reporting guidelines. Similarly, the assessing agencies who work with organizations in preparing their sustainability reports, also need to adopt some changes in their approach.

1. **Salah, S., Rahim, A., & Carretero, J. A. (2020)** Suggestions for Global Reporting Initiative Organization Based on the study of sustainability reports of 30 companies and the practices followed. Even though, more and more companies are joining the pool of companies which are regularly reporting sustainability performance, there is a lot yet to be done. It has been more than two decades now that the world has underlined the importance and urgency of Sustainable Development. As of now the sustainability performance reporting is not mandatory but only recommended. To make the reporting more meaningful, this research suggests following improvements – a) For the Environment related disclosures, the data reported should be for a minimum of last five years.

Organizations should disclose if they are using any structured methodology for the improvement actions. Use of time series charts should be recommended for the data which is reported on a time scale in Sustainability Reports.

Smith, B. (2023) Organizations should explain the reasons for positive as well as negative trends in the reported data. Negative trend should be backed by a corrective action plan.

Publishing of Sustainability Report on the company website is most commonly followed by the companies.

The reports on the website are referred by stakeholders such as investors, employees or Government. However, customers may not refer the sustainability performance of the company before they make any buying decision. GRI should come up with some identity mark on the product which states compliance level of the company on the Sustainability Standards or guidelines. Above suggestions would enhance the purpose of GRI guidelines in a significant way.

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