

Lean Manufacturing in Indian Industries A Review

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Abstract — The purpose of this research is to first identify the critical lean manufacturing factors responsible for implementation of lean manufacturing in the Indian manufacturing sector and then to incorporate these factors into a framework, which can be represent the present status of lean practices in Indian industries. Also to identify barrier and benefits of lean manufacturing in industries. The approach of the research includes a literature review, in-depth interviews and questionnaire surveys. The most important criteria of lean manufacturing are identified through an extensive survey conducted in manufacturing industries encompassing various fields like engineering, automobile, processing and others. Statistical Package for the Social Sciences (SPSS) software is used for checking the reliability and validating the obtained results in order to incorporate both tangible and intangible criteria of lean manufacturing practices.

Keywords – Lean Manufacturing, framework, Indian industries, lean tools.

I INTRODUCTION

Manufacturing has been recognized as the main engine for growth of the economy. Ever changing globalized environment has been posing challenges of competitiveness and survival to all the constituents of the economy. Manufacturers in the Indian industry have always faced heightened challenges such as rising customers' expectation, fluctuating demand, and competition in markets. There is no doubt that these manufacturers are always embracing changes and improvements in their key activities or processes to cope with the challenges. One way to stay competitive in this globalized market is to become more efficient. Lean manufacturing has been receiving a lot of attentions in the industry. India is a developing country so many industries are struggling to be world class. Adoption of lean principles is still found to difficult. Here we have tried to identify the factors responsible for lean practices. Lean Manufacturing is a set of techniques, which have evolved over a long period and are based on various minor to major breakthroughs that help in reducing cost and hence increase productivity.

Lean is a philosophy of manufacturing that incorporates a collection of principles, tools and techniques into the business processes to optimize time, human resources, assets, and productivity, while improving the quality level of products and services to their customers. Lean production as a business and production philosophy that shortens the time between order placement and product delivery by eliminating waste from a product's value-stream [1].

II LITERATURE REVIEW

The works on the lean manufacturing are abundant; those that concern lean manufacturing in India are rather limited. Approaches towards lean manufacturing practice have been identified by various researchers.

Abdulmalek et al.[2] described a case where lean principles were adapted for the process sector for application at a large integrated steel mill. Value Stream Mapping was the main tool used to identify the opportunities for various lean techniques. They also described a simulation model that was developed to contrast the “before” and “after”

scenarios in detail and in order to illustrate potential benefits such as reduction in production lead time and work in process inventory.

Panizzolo [3] divided the lean practices into six areas which are process and equipment; manufacturing, planning and control; human resources; product design; supplier relationships; and customer relationships. This study confirms that, many firms seem to have difficulty in adopting lean tools that concern with external relationships with suppliers and customers even for high performance firms. Empirical results from this study also prove that lean tools in internal areas are adopted most widely in the firms, where the operation and management methods are more direct.

Shah and Ward [4] defined Lean manufacturing as an integrated system composed of highly inter-related elements and a wide variety of management practices, including Just-in-Time (JIT), quality systems, work teams, cellular manufacturing.

Achanga *et al.* [5] suggested that the success of Lean Manufacturing implementation depends on four critical factors: leadership and management; finance; skills and expertise; and supportive organizational culture of the organization. Some researchers also suggested that applying the full set of lean principles and tools also contribute to the successful Lean Manufacturing transformation.

Gurumurthy *et al.* [6] made an attempt to demonstrate the application of a Multi Attribute Decision Making model, namely Performance Value Analysis (PVA) to analyze the alternatives production system like Traditional manufacturing, Computer Integrated Manufacturing, and Lean Manufacturing among various performance measures. A detailed algorithm of the PVA model is demonstrated using a hypothetical case situation, which shows that Lean Manufacturing System is the best as it results in overall improvement in the performance of the organization.

III RESEARCH METHODOLOGY

The methodology played a very important role in corroborating the findings. Based on the literature reviewed, lean manufacturing tools were grouped under different criteria. The questionnaire was developed after conduction of pilot survey which was used to modify and eliminate the number of variables. Academic experts and industrial professionals were consulted for their comments and feedback for developing the questionnaire. Based on their feedback, the criteria list was modified and put into a structured form, with each sub-criteria falling under their respective criteria/major criteria. The questionnaire consisted of two parts ;(1) General information of the respondent companies, (2) lean manufacturing implementation tools, benefits of lean manufacturing, and obstacles in adoption of lean practices.

The final questionnaire consisted of 11 major criterion and 51 sub-criteria. Each criterion in the questionnaire was judged on a five point Likert Scale, where, 1 = very low, 2 = low, 3 = moderate, 4 = high and 5 = very high. Likert scale is a tried and tested scale has been successfully used in many cases, including supplier selection. Reliability indicates the extent to which an experiment, test or any other measuring procedure yields the same results [15]. The reliability assessment was conducted on Statistical Package for the Social Sciences (SPSS) software. The methodology adopted was similar to the one described by Pallant J. in her book on SPSS.

The responses were obtained from various manufacturing firms and small workshops. Executives/Managers/ higher level authority in different level of organizations were interviewed. This was made to obtain accurate information and data to help in the formulation of the most practiced lean manufacturing tools.

To measure internal consistency Cronbach's alpha was used which was carried out using SPSS. According to sekaran [20], reliability measure is an indication of the stability and consistency of the instrument .The value ranges from 0 to 1, with higher values indicating greater reliability. Nunnally (1978) recommended a minimum value of 0.7, although it may be as low as 0.60 in exploratory research [21] Reliability analysis was conducted for each of the 11 criteria and 51sub-criteria separately. All the results obtained proved that survey instrument has very good internal consistency i.e. ≥ 0.60 and hence it is reliable.

Principal component analysis was used to assess construct validity. KMO and Bartlett's test of sphericity analysis of the major criteria selected for the study. The Bartlett's test indicates that all the criteria are significant ($p < 0.05$). All the factors loading has Eigen value exceeding the minimum threshold of 1.0 and the Kaiser-Meyer-Olkin (KMO) values for sampling adequacy are exceeding the minimum score 0.5.Hence it can be concluded that all the criteria and sub-criteria are reliable and valid and thus can be used for further analysis.

Table -1 Reliability Analysis

Criteria	No. of items	Cronbach's alpha	Eigen value	KMO
Improvement Strategies	3	0.689	1.858	0.662
Just In Time Practices	4	0.758	2.348	0.715
Human Relation Management	3	0.638	1.782	0.550
Defect Control	4	0.661	2.11	0.549
Standardization	3	0.638	1.782	0.550
Resource Reduction	5	0.748	2.560	0.658
Supply Chain Management	2	0.784	1.633	0.500
Scientific Management	6	0.670	2.413	0.672
Bundled Techniques	4	0.845	1.911	0.507
Benefits	8	0.845	4.016	0.758
Obstacles	9	0.721	4.139	0.663

Table -2 General profile of respondent company

Type of organizations	Medium	Large
No of employees	50 \geq 150	\geq 150
n	17	14
%	55	45
Respondent's Designation	No.	%
Managers	13	42
Executives & others	18	58

IV RESULT ANALYSIS AND DISCUSSIONS

The Indian Industrial Directory was one of the many sources to find survey respondents. The questionnaire was circulated mainly in the Mumbai and Navi Mumbai region. This belt is home to various manufacturing industries and is generally considered to be the hub of manufacturing in Maharashtra state. It therefore became possible to approach these companies personally to conduct face to face interviews. Initially, the data collection involved sending out the questionnaire through e-mail. Out of the 50 questionnaires floated initially, only 10 responses were obtained in spite of repeated reminders which gave a low response rate of 20 %. Need for a different approach was felt and it was decided to collect the responses through face to face interviews and sometimes, indirectly through third party channels. This approach worked and a total of 38 valid responses were obtained in the end out of 65 questionnaires. Out of the responses obtained only 31 responses were chosen for analysis as they were from large and medium organizations, giving a decent response rate of 47 %. This response rate could be considered adequate for surveys conducted.[11]

A. General Profile of the respondent companies

Descriptive statistics for given the respondent companies is shown in table II.

Majority of the responses were from managers (production ,operations, QC) and executives(QC , production) as they are directly involved in the lean manufacturing implementation programs in their organization. All the respondent organization has quality management system certified by ISO9001 /ISO 14000.

B. Important Lean Manufacturing practices in India

While doing this study it was observed that among the nine criteria of Lean tools, improvement strategy was the most preferred criteria, followed by standardization and human relation management. Fig.1 shows the mean values (M) and standard deviation (S.D) of the criteria.

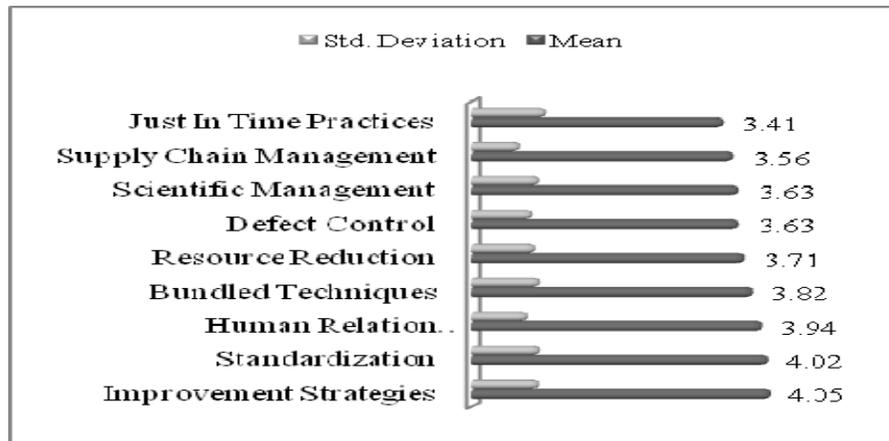


Fig.1 Important Lean criteria in Indian industries

Responses obtained from various respondents shows that most practiced lean tool is Kaizen followed by invent reduction, TPM and 5s. Fig.2 show the important lean tools practiced in the descending order of their means. Higher mean values indicate more important criteria.

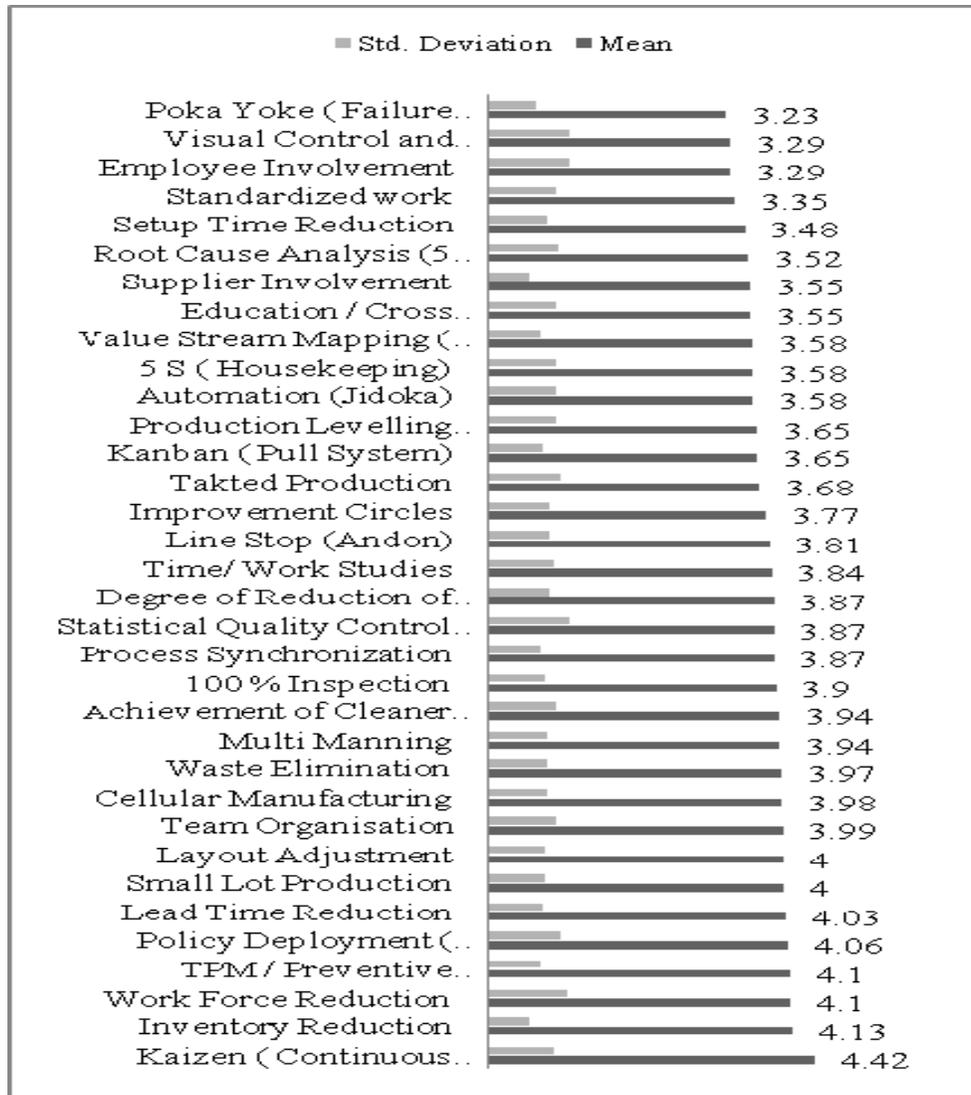


Fig 2 Important Lean practices in Indian industries

C. *Benefits of Lean manufacturing practices in India*

The respondents were also asked to identify the benefits of lean manufacturing in their respective companies. It was clear that they gained various benefits after practicing lean manufacturing the highest benefit is reduced cost, followed by reduced waste and improved productivity, flexibility after implementing it. Based on the results, there is a clear relationship between lean manufacturing and productivity.

Fig.3 shows the mean values (M) for benefits.

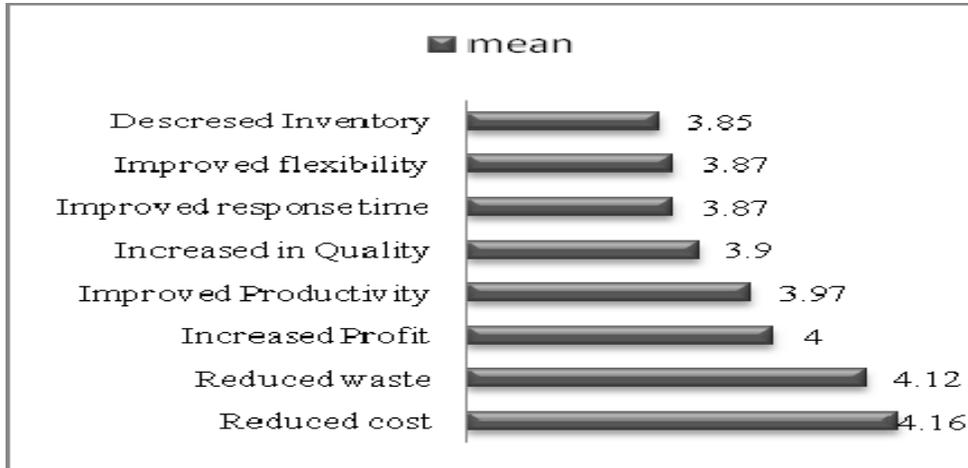


Fig 3 Benefits of Lean Manufacturing

D. Obstacles in adoption of Lean Practices in Indian Organisations

To implement lean manufacturing system is not an easy task. For any change in organization to take hold and success, the resistance forces or barriers need to be identified and understood. The lean barriers /obstacles are analyzed based on the status of lean implementation by the respondent companies and found that reorganization of financial benefits after lean implementation is the most rated barrier followed by top management support, lack of understanding, employee resist to change. Interestingly, all firms recognize the main barrier is the lack of lean understanding.

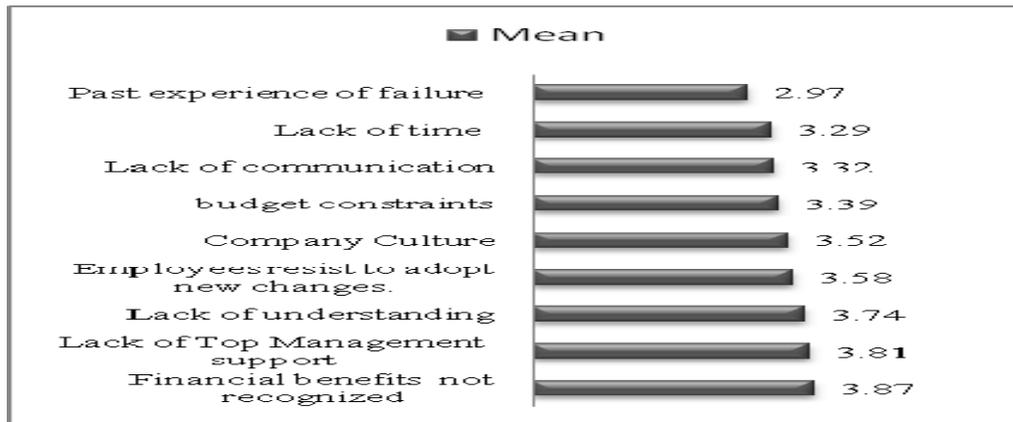


Fig 4 Obstacles in Lean Manufacturing Implementation

v CONCLUSION

Though Lean Manufacturing is not a relatively new term for the majority of Indian industries, still the adoption rate of lean practices is average. The present empirical study investigated the Lean Manufacturing practices adopted by different industries in Maharashtra, India. The study investigated the important Lean practices adopted in Indian industries by “mean method”. The findings from the research show that Lean manufacturing system is regarded as intended direction, rather than a steady state. For the transformation towards lean system, people should have a better understanding about lean and also need to be aware about the change management principles. For successful organizational change towards lean organization, the critical factors are strong employee involvement, effective communication, top management support.

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