Research Journal of Applied Sciences, Engineering and Technology 7(13): 2680-2686, 2014
DOI:10.19026/rjaset.7.585
ISSN: 2040-7459; e-ISSN: 2040-7467

Submitted: July 22, 2013 Accepted: August 16, 2013 Published: April 05, 2014

Research Article

Critical Issues of Lean Implementation in Indian Micro, Small and Medium Enterprises-an Analysis

[1]M.M. Ravikumar, [2]K. Marimuthu, [3]P. Parthiban and [4]H. Abdul Zubar
[1]Anna University, India
[2]Department of Mechanical Engineering, Coimbatore Institute of Technology, Coimbatore, Tamilnadu, India
[3]National Institute of Technology, Trichy, Tamilnadu, India
[4]Knowledge Institute of Technology, Salem, Massachusetts

Abstract: Lean manufacturing is a strategic tool, which is used to reduce waste and to improve the efficiency of an organization. Indian MSME's are struggling to implement these techniques. The aim of the study is to investigate the various critical issues faced by the Indian MSMEs while implementing lean. A questionnaire containing 29 problems under five categories was prepared and sent to 200 MSME's all over India. Eighty two companies responded and their responses were analyzed using the IBM SPSS statistics 20 package to find the rating on various issues. Ratings were also obtained from three lean consultants and compared to find the closer value. This enables to have better understanding on critical issues for successful implementation.

Keywords: Implementation issues, Indian industries, lean manufacturing, MSME's, SPSS 20

INTRODUCTION

Indian MSME's are an integral part of Indian economy. The contribution to the economic development of the country is indeed significant, due to liberalization and globalization; Indian MSME's are facing tremendous challenges. Imports and MNCs and especially china are becoming major threats to Indian industries. Raje (2000) have discussed about the important threats and opportunities offered by globalization. For many industries abroad, Lean thinking is a way of life. But in India Lean implementation is still in its eagerly stage. LM have-not received due attention in MSME's globally Gunasekaran (2000). Indian government has also started focusing on MSME's by cluster formation to implement Lean. Many issues and constraints in MSME's made them to delay implementing Lean techniques. Many Indian MSME's failed to implement Lean successfully. These MSME's, those who started implementing LM in piecemeal, were found difficult to implement totally. In order to implement LM successfully in future, it is necessary to identify various issues faced by them while implementing LM tools.

LITERATURE REVIEW

LM was originally developed in Japanese auto industry by Taiichi ohno. It requires focus on making product flow through value adding process. It intends to eliminate the waste from productive system. Liker (2004) and Mothani (2000) have clearly explained the important elements of lean manufacturing. Paransaker *et al*. (2003) have discussed that the organizations that have mastered LM methods have substantial cost and quality advantages over those who still using mass production. Womeck *et al*. (1990) said that LM combines the best features of both mass and craft production. Theoretically, LM can be applied to all the industries and it is considered as Strategic tool in the competitive market (Womeck *et al*., 1990; Billesbach, 1991; Bamber and Date, 2000; Achanga *et al*., 2006) discussed that LM has been implemented successfully in LS industries, but has only little evidence at SME's. Anthony and Kumar (2005) described in detail that small companies have more advantages such as agility, easier in petting management support etc. Spann *et al*. (1999) addressed that implementation of Lean manufacturing in SME's will lead to huge benefits such as quality improvement, reduction in cycle time. Many researchers says that, SME's fail much more frequently by market competition Anthony and Kumar (2005) indicated that cellular manufacturing and Kanban system were not so easy to implement and suggested to implement JIT in phased manner. Nitin *et al*. (2010) described in detail that most important barrier are Non uniformity, corruption, power problem, transport, infra structure, cultural resistance, family setup.

Corresponding Author: M.M. Ravikumar, Anna University, India

RESEARCH METHODOLOGY

From the literature review it is very clear that, very little research has been done (or) far related with Indian MSMEs. Nearly 29 Lean implementation issues were identified by consulting industry personals, consultants and divided them under five important categories, i.e., problems related with Employees, Management, Supplier, Customer and organization.

Further these issues were analyzed and rated to find their importance by using latest IBM SPSS statistics 20 package tools. Three Lean consultants were used to give their expert opinion and compared with their ranking.

RESULTS AND DISCUSSION

A questionnaire was prepared after identifying 29 problems of lean implementation with discussion to industrial personals, consultants and sent to 200 Indian MSME's. The responses of 82 industries were received on a four-point scale ranging from low to very high. Later 29 lean issues in reduced in to five broad categories, i.e., customer's issues, organizational issues, supplier issues, employee issues and management issues. Further descriptive statistics was used to find the importance of lean issues to Indian industry by using the latest IBM SPSS statistics 20 package which has the recent statistical tools.

First we have organized our data in the form of cross tabulation to find out the major issues from the above five issues (customers issues, organizational issues, supplier issues, employee issues and management issues) which are given in the Table 1 and 2.

The measures of central tendency gives the main idea (central part) of the data and the measures of dispersion gives the complete idea of the data. Hence,

Table 1: Cross tabulation between issues and rating

	Rating				
Issues	Low	Medium	High	Very high	Total
Organizational issues	10	116	373	75	574
Management issues	114	366	12	0	492
Customer issues	0	191	137	0	328
Supplier issues	8	112	284	6	410
Employee issues	81	442	51	0	574
Total	213	1227	857	81	2378

Table 2: Cross tabulation between lean implementation issues and rating

	Rating				
Lean implementation issues	Low	Medium	High	Very high	Total
High inventory	0	0	73	9	82
High rejection rate	2	12	66	2	82
Employee absenteeism	6	10	66	0	82
High contract labors	0	81	1	0	82
High set up time/high change over time	2	13	65	2	82
Lack of practical implementation knowledge within the company	0	0	65	17	82
Lack of knowledge about the existing specialists	0	0	37	45	82
Frequent break downs	10	72	0	0	82
Lack of funds	3	78	1	0	82
Skilled man power	0	72	10	0	82
Lack of support from top management	7	74	1	0	82
Quality consciousness	22	60	0	0	82
Owner cum managers	72	10	0	0	82
High response time	0	2	80	0	82
To reduce rejection rate	0	62	20	0	82
To reduce cost	0	46	36	0	82
To reduce delivery time	0	81	1	0	82
Poor communication	0	2	76	4	82
High lead time	2	13	65	2	82
Unreliable transport	6	10	66	0	82
High competitions	0	6	76	0	82
Frequent changes in supply	0	81	1	0	82
Lack of job security	0	65	17	0	82
Poor salary and wages	15	67	0	0	82
High customer pressure	7	73	2	0	82
Lack of knowledge	0	62	20	0	82
To reduce misunderstanding (we can purchase)	0	70	12	0	82
To reduce bought out products	26	56	0	0	82
To reduce gap between requirement (vs.) availability of manpower	33	49	0	0	82
Total	213	1227	857	81	2378

Table 3: Report (descriptive analysis)

Issues	N	Mean	Median	S.D.	S.E.M.	Range	Variance	Skewness	Kurtosis
Organizational issues	574	3.8937	4.0000	0.62596	0.02613	3.00	0.392	-348	0.603
Management issues	492	2.7927	3.0000	0.46212	0.02083	2.00	0.214	-671	0.200
Customer issues	328	3.4177	3.0000	0.49393	0.02727	1.00	0.244	0.335	-1.899
Supplier issues	410	3.7024	4.0000	0.52725	0.02604	3.00	0.278	-967	0.628
Employee issues	574	2.9477	3.0000	0.47711	0.01991	2.00	0.228	-153	1.337
Total	2378	3.3389	3.0000	0.68668	0.01408	3.00	0.472	0.078	-0.194

S.D.: Standard deviation; S.E.M.: Standard error of mean

Table 4: Report (descriptive analysis)

Lean implementation issues	N	Mean	Median	S.D.	S.E.M.	Range	Variance	Skewness	Kurtosis
High inventory	82	4.1098	4	0.31451	0.03473	1.00	0.099	2.544	4.581
High rejection rate	82	3.8293	4	0.49203	0.05434	3.00	0.242	-1.652	4.118
Employee absenteeism	82	3.7317	4	0.58897	0.06504	2.00	0.347	-2.094	3.202
High contract labors	82	3.0122	3	0.11043	0.01220	1.00	0.012	9.055	82.000
High set up time/high change over time	82	3.8171	4	0.50008	0.05522	3.00	0.250	-1.556	3.601
Lack of practical implementation knowledge within the company	82	4.2073	4	0.40788	0.04504	1.00	0.166	1.471	0.167
Lack of knowledge about the existing specialists	82	4.5488	5	0.50068	0.05529	1.00	0.251	-0.200	-2.010
Frequent break downs	82	2.8780	3	0.32924	0.03636	1.00	0.108	-2.354	3.629
Lack of funds	82	2.9756	3	0.22086	0.02439	2.00	0.049	-2.008	18.224
Skilled man power	82	3.1220	3	0.32924	0.03636	1.00	0.108	2.354	3.629
Lack of support from top management	82	2.9268	3	0.30552	0.03374	2.00	0.093	-1.912	6.794
Quality consciousness	82	2.7317	3	0.44580	0.04923	1.00	0.199	-1.066	-0.887
Owner cum managers	82	2.1220	2	0.32924	0.03636	1.00	0.108	2.354	3.629
High response time	82	3.9756	4	0.15521	0.01714	1.00	0.024	-6.282	38.399
To reduce rejection rate	82	3.2439	3	0.43208	0.04771	1.00	0.187	1.215	-0.537
To reduce cost	82	3.4390	3	0.49932	0.05514	1.00	0.249	0.250	-1.986
To reduce delivery time	82	3.0122	3	0.11043	0.01220	1.00	0.012	9.055	82.000
Poor communication	82	4.0244	4	0.27106	0.02993	2.00	0.073	0.993	11.235
High lead time	82	3.8171	4	0.50008	0.05522	3.00	0.250	-1.556	3.601
Unreliable transport	82	3.7317	4	0.58897	0.06504	2.00	0.347	-2.094	3.202
High competitions	82	3.9268	4	0.26202	0.02894	1.00	0.069	-3.339	9.380
Frequent changes in supply	82	3.0122	3	0.11043	0.01220	1.00	0.012	9.055	82.000
Lack of job security	82	3.2073	3	0.40788	0.04504	1.00	0.166	1.471	0.167
Poor salary and wages	82	2.8171	3	0.38899	0.04296	1.00	0.151	-1.671	0.811
High customer pressure	82	2.9390	3	0.32764	0.03618	2.00	0.107	-1.220	6.090
Lack of knowledge	82	3.2439	3	0.43208	0.04771	1.00	0.187	1.215	-0.537
To reduce misunderstanding (we can purchase)	82	3.1463	3	0.35562	0.03927	1.00	0.126	2.039	2.209
To reduce bought out products	82	2.6829	3	0.46820	0.05170	1.00	0.219	-0.801	-1.393
To reduce gap between requirement (vs.) availability of manpower	82	2.5976	3	0.49341	0.05449	1.00	0.243	-0.405	-1.882
Total	2378	3.3389	3	0.68668	0.01408	3.00	0.472	0.078	-0.194

S.D.: Standard deviation; S.E.M.: Standard error of mean

next we focus on the report with the major central tendency, called mean, median, measures of dispersion, called standard deviation, variance and range. Moreover, the skewness and kurtosis are also obtained so that we can observe the main idea (Centre part) and the complete idea of our data. The Table 3 and 4 gives such reports (descriptive analysis).

Now, one can observe that the organizational issues have the highest average and standard deviation whereas the management issues have minimum aggregate with mean and standard deviation. Moreover, the skewness represents the lack of symmetry which indicates whether the frequency curve is turned more to one side than to the other. If the data is symmetric, then the skewness is zero. But, here except the customer issue, the remaining are all negatively skewed and hence the mode (maximum frequency) is greater than their average for them.

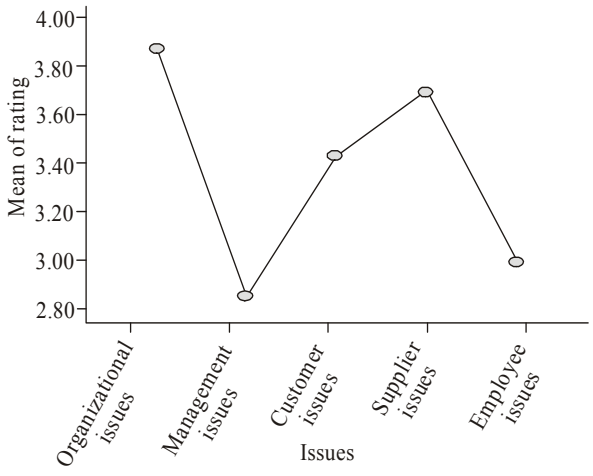

Fig. 1: Mean rating of issues

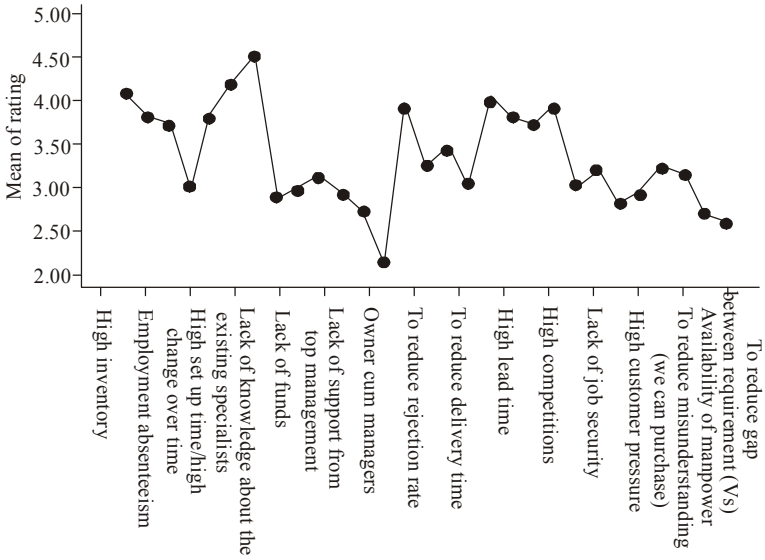

Fig. 2: Mean rating of lean implementation issues

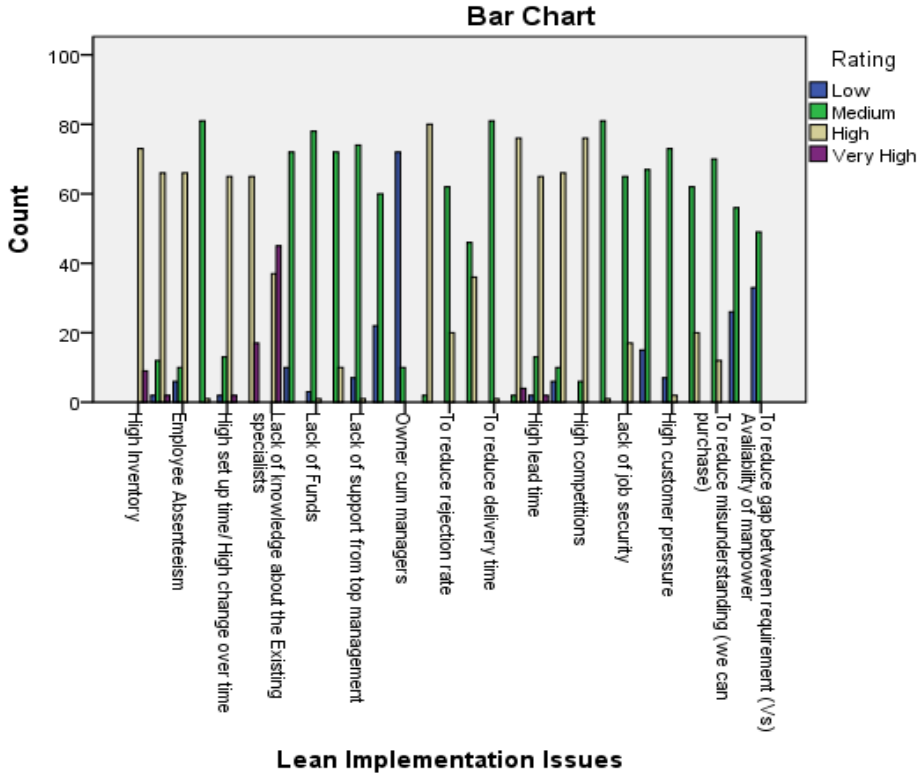

Fig. 3: Bar Chart for ratings on issues

The kurutosis represents the flatness of the frequency curve and depends on the number of items near to the mode (maximum frequency) and it is denoted by β_2. If $\beta_2 = 3$, then the frequency curve is moderately peaked or moderately flat and it is said to be mesokurtic. If $\beta_2<3$, then the frequency curve is largely flat and it is said to be platykurtic.

If $\beta_2>3$, then the frequency curve is highly peaked and it is said to be leptokurtic.

Also the excess of kurtosis is defined by $\gamma_2 = \beta_2 - 3$. Here, all the issues have the kurtosis less than 3 of which the kurtosis of management issue is very nearer to zero.

The mean rating of the issues and lean implementation issues are represented in the frequency curves in Fig. 1 and 2. So that one can easily identify that the organizational issues are with top rated and the management issues are with low average.

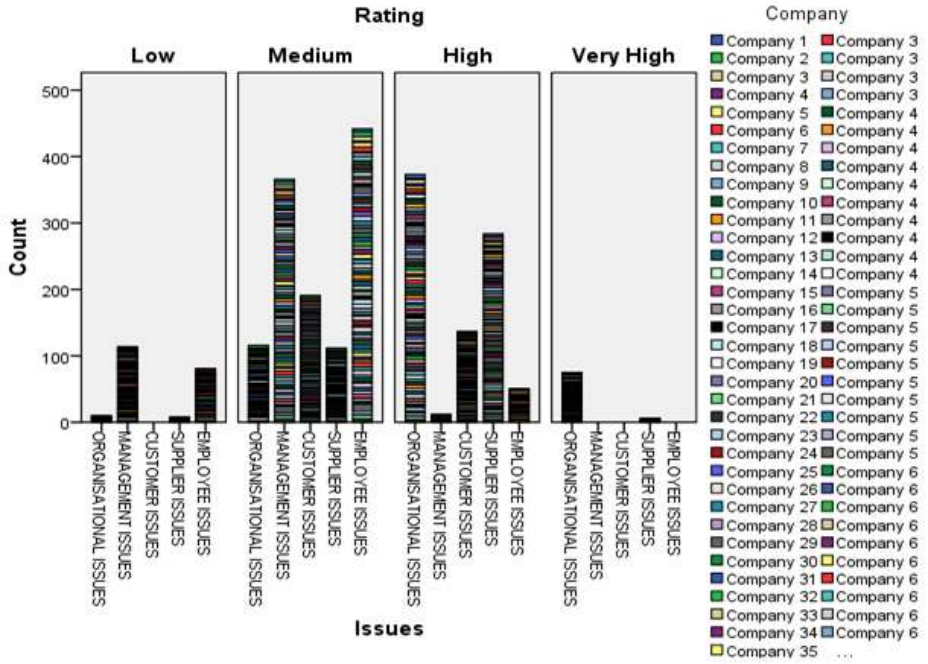

Fig. 4: Bar chart for ratings on lean implementation issues

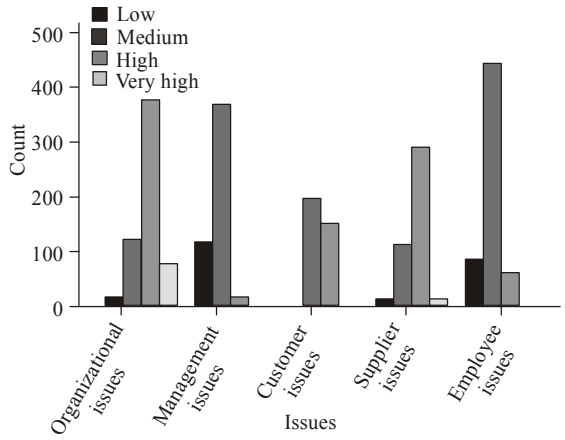

Fig. 5: Bar chart for ratings on issues over the companies

The bar charts are given for the number of frequencies of the different varieties of ratings for the issues and lean implementation issues in the Fig. 3 to 5, from which the ratings "high" and "very high" have the maximum points for organizational issues whereas it is very for management issues.

So Organizational issues play the vital role in Indian markets and the management issues become the negligible one.

Thus, it is observed that the lean issues play the roles in the following order: Organizational issues, Supplier issues, Customer issues, Employee issues, Management issues. It shows that the organizational issue plays the major role and the management issue has the less importance.

Hence, The Issues and Lean implementation issues are highly positive correlated (same direction):

- The Issues and the ratings are negatively correlated (opposite direction).
- Lean implementation issues and the ratings are negatively correlated shown in Table 5 (opposite direction).

The paired sample tests in Table 6 also show that there is significant difference between the below three pairs.

In Table 7 and 8 ANOVA provides a statistical test of whether or not the means of several groups are equal and its sums of squares indicate the variance of each component of the decomposition. Comparisons of mean squares allow testing of a nested sequence of models.

Chi square test: The sampling test is also the most important one in analysis of data. The chi square test can be used to test the uniformity of the distribution. Here, we used the chi square test to check whether the following five types of issues play the role uniformly in the Indian market or not (Table 9 to 11 and Fig. 6).

Null hypothesis H_0: The five types of issues play the role uniformly in the Indian market.

Alternative hypothesis H_1: The five types of issues do not play the role uniformly in the Indian market.

Table 5: Correlation co-efficient

	Karl Pearson's coefficient of correlation			Spearman's rank coefficient of correlation		
	Issues	Lean implementation issues	Ratings	Issues	Lean implementation issues	Ratings
Issues	-	0.976	-0.269	-	0.978	-0.300
Lean implementation Issues	-	-	-0.325	-	-	-0.329
Ratings	-	-	-	-	-	-

Table 6: Paired sample test

		Paired differences						
					95% confidence interval of the difference			
Pairs		Mean	S.D.	S.E.M.	Lower	Upper	Test statistic t	Degrees of freedom
Pair 1	Issues-rating	-0.37342	1.82863	0.03750	-0.44696	0.29989	-9.958	2377
Pair 2	Rating-lean implementation issues	-11.66106	8.61627	0.17669	-12.00754	11.31458	-65.997	2377
Pair 3	Lean implementation issues company	-26.50000	25.11006	0.51492	-27.50974	25.49026	-51.464	2377

Table 7: ANOVA

Issues	S.S.	d.f.	M.S.	F	Sig.
Between groups	549.830	3	183.277	88.053	0.000
Within groups	4941.342	2374	2.081		
Total	5491.172	2377			

S.S.: Sum of square; D.F.: Degree of freedom; M.S.: Mean of square

Table 8: ANOVA

Issues	S.S.	d.f.	M.S.	F	Sig.
Between groups	19953.884	3	6651.295	107.778	0.000
Within groups	146506.116	2374	61.713		
Total	166460.000	2377			

S.S.: Sum of square; D.F.: Degree of freedom; M.S.: Mean of square

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
1	The distribution of Rating is the same across categories of Issues.	Independent-Samples Kruskal-Wallis Test	.000	Reject the null hypothesis.
2	The distribution of Lean Implementation Issues is the same across categories of Issues.	Independent-Samples Kruskal-Wallis Test	.000	Reject the null hypothesis.
3	The distribution of Company is the same across categories of Issues.	Independent-Samples Kruskal-Wallis Test	1.000	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
1	The distributions of Rating, Lean Implementation Issues and Company are the same.	Related-Samples Friedman's Two-Way Analysis of Variance by Ranks	.000	Reject the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

Fig. 6: Hypothesis test summary

Clearly the calculated Chi square value is very high for both issues and ratings. Hence the five types of issues do not play the role uniformly in the Indian market.

Table 9: Issues

Issues	Observed N	Expected N	Residual
Organizational issues	574	475.6	98.4
Management issues	492	475.6	16.4
Customer issues	328	475.6	-147.6
Supplier issues	410	475.6	-65.6
Employee issues	574	475.6	98.4
Total	2378		

Table 10: Rating

Rate	Observed N	Expected N	Residual
Low	213	594.5	-381.5
Medium	1227	594.5	632.5
High	857	594.5	262.5
Very high	81	594.5	-513.5
Total	2378		

Table 11: Comparisons

	Issues	Rating
Chi-square	96.138	1477.186
Df	4	3
Asymp. sig.	0.000	0.000

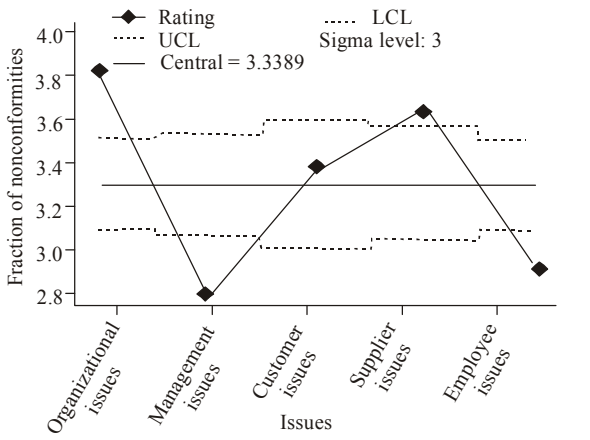

Fig. 7: Control chart rating

Control chart: The control charts are usually used to check whether the quality is under control or not. Here, we used this technique to test whether the issues are under control or not.

Table 12: Lean consultants results

	Rank				
Lean consultants	Management issues	Customer issues	Supplier issues	Employee issues	Organisational issues
L1	1	3	4	2	5
L2	1	2	4	3	5
L3	1	4	3	2	5
Mean	1	3	3.666667	2.3333333	5

The SP chart for the rating with respect to the issues is given as below in Fig. 6, in which out of five issues, except one issue (Customer issue), the remaining four values lie outside the control limits. Hence the rating is out of control due to the issues shown in Fig. 7. In particular, organizational issues play the key role whereas a management issue is not an important one.

CONCLUSION

This study has focused on Lean Manufacturing Implementation issues faced by the MSME's. In the Table 12, lean consultants ratings were shown accordingly. Through this research, lean implementation issues are identified through various testing techniques and ranked according to their usage in the Indian industry. The organizational issues appeared as very dominating issue, which plays the major role in MSME's. The second main issue is Supplier issues, i.e., large gap between the supplier and industries due to poor communication.

The third is Customer issue, which is also an important issue. Employee issue is slightly one of the problems in many industries in India. Though Top Management issues are important, but it is considered as last issue.

Lean implementation is not simple or easy; However results show that, understanding of the issues and creating awareness on those areas, lean lives up to its promises. All of the issues can be overcome by proper understanding and changing towards the requirement. Finally, we hope that this study has provided some insights to implement Lean Manufacturing.

REFERENCES

Achanga, P., E. Snehab, R. Roy and G. Nelder, 2006. Critical success factors for lean implementation within SME's. J. Manuf. Technol. Manag., 17(4): 460-471.

Anthony, J. and M. Kumar, 2005. Six sigma in small- and medium-sized UK manufacturing enterprises: Some empirical observations. Int. J. Qual. Reliab. Manage., 22(8): 60-874.

Bamber, L. and B.G. Date, 2000. Lean production: A study of application in a traditional manufacturing environment. Prod. Plan. Control, 11(3): 291-298.

Billesbach, J.J., 1991. A study of the implementation of just in time in the United States. Prod. Invent. Manage. J., 32(3): 1-4.

Gunasekaran, A., L. Forker and B. Kobu, 2000. Improving operations performance in a small company: A case study. Int. J. Oper. Prod. Manage., 3: 316-336.

Liker, J.K., 2004. The Toyota Way: 14Management Principles from the World's Greatest Manufacturer. McGraw-Hill, New York.

Mothani, J., 2000. A business process change framework for examining lean manufacturing: A case study. Ind. Manage. Data Syst., 103(5): 346-399.

Nitin, U., S.G. Deshmukh and G. Suresh, 2010. Lean manufacturing system for medium size manufacturing enterprises: An Indian case. Int. J. Manag. Sci. Eng. Manag., 5(5): 362-375.

Paransaker, S.J., J.K. Gershenson and A.B. Jambekar, 2003. Classification scheme for lean manufacturing tools. Int. J. Prod. Res., 41(13): 3075-3090.

Raje, V., 2000. Taking SST towards new millennium: Message of Hope. Laghu-Udyog J., 24: 1-6.

Spann, M.S., M. Adams, M. Rahman, H. Czarnocki and B.J. Schloer, 1999. Transferring lean manufacturing to small manufacturers: Stator associations for small business and entrepreneurship, the role of NIST-MEP. Proceedings of the United States Association for Small Business and Entrepreneurship, pp: 691-705.

Womeck, J., D.J. Jones and D. Roos, 1990. The Machine that Changed the World. Rawson Associates, New York.