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

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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.

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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

Table 1: Cross tabulation between issues and rating

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,

	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

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

Table 4: Report (descriptive analysis)

Lean implementation issues	Ν	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	82	3.8171	4	0.50008	0.05522	3.00	0.250	-1.556	3.601
time									
Lack of practical implementation	82	4.2073	4	0.40788	0.04504	1.00	0.166	1.471	0.167
knowledge within the company									
Lack of knowledge about the	82	4.5488	5	0.50068	0.05529	1.00	0.251	-0.200	-2.010
existing specialists									
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	82	2.9268	3	0.30552	0.03374	2.00	0.093	-1.912	6.794
management									
Ouality 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	82	3.1463	3	0.35562	0.03927	1.00	0.126	2.039	2.209
can purchase)									
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	82	2.5976	3	0.49341	0.05449	1.00	0.243	-0.405	-1.882
requirement (vs.) availability of									
manpower									
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 deviation; S.E.	tandard e	rror 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



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.



Res. J. App. Sci. Eng. Technol., 7(13): 2680-2686, 2014

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 H₀**:** The five types of issues play the role uniformly in the Indian market.

Alternative hypothesis H₁: The five types of issues do not play the role uniformly in the Indian market.

Spearman's rank coefficient of correlation Spearman's rank coefficient of correlation Issues Issues Ratings Issues Ratings Issues Ratings Issues Ratings Issues Ratings Issues Ratings Issues Test Degrees of the officient of correlation Issues Test Degrees of the officient of correlation Paired differences Issues/second colspan="2">Test Degrees of the officient of correlation Paired differences Issues/second colspan="2">Test Degrees of the officient of correlation Paired differences Issues/second colspan="2">Test Degrees of the officient of correlation Issues/second colspan="2">Test Degrees of the officient of correlation Second colspan="2">Issues/second colspan="2">Test Degree of the officient of correlation	Table 5: Correlation co-	efficient										
Issues Lean implementation issues Lean implementation issues Lean implementation issues Ratings Issues - 0.976 -0.209 - 0.978 -0.300 Lean implementation -		Karl Pears	on's coefficien	t of co	orrelatio	on		Spearman'	pearman's rank coefficient of correlation			
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	Null Hypothesis	Test	Sig.	Decision
1	The distributions of Rating, Lo Implementation Issues and Company are the same.	Related- Samples ealFriedman'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.

Supplier | issues

Employee

Customer

lissues

Issues

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

Manageene issues

000

Fig. 7: Control chart rating

under control or not.

	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

Table 12: Lean consultants results

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 smalland 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.