

Relation between practical use of the lean practices in the industries and size of the industries: A case study on central India manufacturing Industries

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Abstract In today scenario, only big companies are not only enjoying the success of lean manufacturing but small and medium enterprise is also adopting the lean practices rapidly. Size of the industries is classified by various ways but most common way is to determine the size of industry through the concept of number of employees on roll in the company. It is the most common parameter to label particular industry whether it comes under the category of large, medium or small. This research paper establishes the relation between size of the industry and use of lean practices in central India based industries.

Keywords: Lean practices, Size of the Industry.

1. INTRODUCTION

Industries located in central India are continuously facing cutthroat competition not only from the industries located in other region of the country but also from foreign industries. This condition also becomes more critical because industries based in central India are facing one more volatile issue that is low productivity levels. The concept of Lean manufacturing offers a good solution for increasing the overall productivity of the industry. Lean Manufacturing focuses on elimination of waste in any form by implementing the lean practices. It is clear that size of the industry is one of the important aspects in order to use the lean practices and provide the platform to study the effect of size of industry on the implementation of lean practices in the industries. In research study researcher has characterized the industries having a total employees less than one hundred fifty under the small category, industries having a total employees between one hundred fifty to four hundred fifty labeled as medium industries and industries having more than four hundred fifty employees are labeled as large industries. In this research study, the size of the industry aspect has been considered and its relation with the implementation of lean practices has also been studied.

2. LITERATURE REVIEW

According to Matt and Rauch (2013), lean production methods and instruments are not equally applicable to large and small companies. Small and medium enterprises (SME) are defined by the European Commission as having less than 250 persons employed, (Matt & Rauch, 2013). SMEs are still not confident of the cost of lean manufacturing implementation and the tangibility of the results and benefits they may achieve through lean manufacturing. Most of these

companies fear that implementing lean manufacturing is costly and time consuming (Achanga et al., 2006). It is also discussed in past research that lean manufacturing can provide the potential benefits like improved productivity to even small size industry also. As suggested by Marasini et al., (2014), small scale industries as compared to large scale industries have various issues like finance and budget, lack of skilled manpower etc. The management is sometimes not ready to implement a new method of improvement because of fear of failure even they are aware of about the potential benefits associated with new method. Besides, in such industry the decisions are always made for short duration rather than going for a long run. Shah and Ward (2003) articulated that theoretical arguments can be made both in support of a positive and a negative association between large size and implementation of lean practices, empirical evidence overwhelmingly supports a positive relationship.

3. OBJECTIVE

A research question is a more suitable way in designing the research project framework as compare to other methods of addressing the research problem. This study addressed following objective related to application level of lean practices and its relation with important aspect i.e. size of the industry. In this way the objective of this research paper is "To study the relation between practical use of the lean practices in the industries and size of the industries".

4. RESEARCH METHODOLOGY

In this research study, for collecting the primary data a dedicated questionnaire has been prepared and used for data collection. The main method of

data collection for the survey strategy is the questionnaire. The questionnaire was developed in line with the theoretical framework and factors identified in the literature review and described in the form of statements or questions. The next step of instrument (questionnaire) development was item construction. Section A section was designed to get the general information about the organization, Section B was designed to gather information about the level of awareness and the use of lean practices in the organization. The making of questionnaires includes the listing of questions leading to provide the answers to the research question. All the questions were close ended and this ensures that responses would be valid. To reflect the purpose of this instrument, a Likert-type scale is used. When using a Likert-type scale, the responses are numerical, and the respondents make an evaluation of the statement based on magnitude (Leedy & Ormrod, 2010). For sections B and C (the use of lean practices and factors responsible for facilitating and hindering the use of lean practices), the scale was as follows: strongly disagree (1), disagree (2), neutral (3), agree (4) and strongly agree (5); Content validity and discriminant validity has been checked and established during the analysis of the data. The ranges of observation for this study were sampled from Indian manufacturing industries, which included automotive, steel, motor, forging and casting. The questionnaires were distributed to 250 industries located across the central India and 128 usable questionnaires were returned. This constituted a response rate of 51 % which is well accepted in literature. To study the relation between practical use of the lean practices in the industries and size of the industries have been done by using the crosstab calculation tool through SPSS software version 20. The data collected from the respondents were coded and entered into the MS excel software program and then moved into SPSS software (statistical package for social sciences) for detailed analysis.

5. ANALYSIS

In this research study, descriptive and inferential statistics both are applied. Descriptive statistics are simply explaining what data is or what data show. Inferential statistics is about reaching conclusion that extends beyond the present data. In this way the data which was collected by means of questionnaires is analyzed and the findings are presented with the help of statistical software.

5.1 Size of the industry

Industries are categorized in groups according to the number of full-time employees. Industries with 0 to 150 equals to 14% of the respondents. Industries with 151 to 300 number of employees equals to 13% of the respondents. Industries with 301 to 450 number of employees equals to 28% of the respondents. Industries with more than 450 numbers of employees are equal to 45% as shown in figure 1.

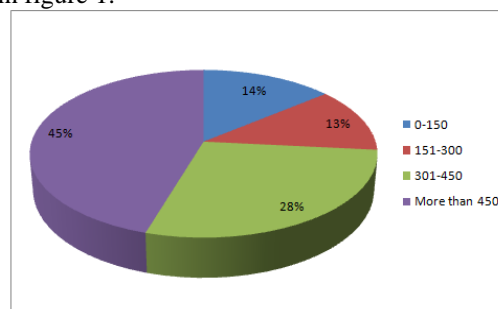


Figure 1: Size of the industry

5.2 Relationship between lean practices and size of the industry

Chi-Square test has been used in this research study for determining the relation between each 25 lean practices and size of industry. Cross tabulation is the format where data of two variables are placed in the form of table to determine the relationship between two variables. One variable is placed in column and another in data is placed in row. Crosstab is widely used to find out interrelationships and interactions between variables. In questionnaire the section 'A' is dealing with demographic details of the company as well as size of the industry. In questionnaire the section 'B' is dealing with practical use of 25 lean practices coded B1 TO B25. With the help of crosstab feature the relationship of all these 25 lean practices with the three aspects namely size of the industry (SIZEIND), has been investigated, with the help of SPSS software. SPSS software has been used for performing the chi-square test to establish the relationship between variables. Chi-square test determines the relationship between two variables. The Chi-square is written as χ^2 and measures the independence of association. If test shows the independence relationship that means there is no relation between two variables on which test was performed and vice-versa. In some cases "Fisher's Exact Probability Test" is used. Researchers like Pallant (2005) have suggested that Fisher's test can be used in the place of the Chi-square test. Fisher's test can be used in a case where a 2x2 table is used and the rule of Chi-square of a minimum count in a cell of the table is violated. Data analysis using chi-square was done to observe the effect of size of industry, year of establishment and lean starting year on different lean practices. The obtained result is shown in the table below. Wherever frequencies in the cell were less than 5 and $p < .05$, Fisher's

exact test has been reported in place of Pearson chi-square test. (Note: * p<.05)

Table.1: Chi Square Test

Coding	Lean Practices	Size of Industry
B1	Cellular Manufacturing	7.27
B2	Single Minute Exchange of Dies (SMED)	2.69*
B3	Kanban	10.73*
B4	Small Lot Size	2.06
B5	Line Balancing	10.01*
B6	Cycle Time Reduction	4.59
B7	Value Stream Mapping	0.617*
B8	Bottleneck Removal	5.29
B9	Standardized Work	6.66
B10	Supplier Involvement	6.84
B11	Customer Involvement	4.88*
B12	On time Delivery	7.56
B13	Five S (5s)	12.7
B14	Visual Management	18.14*
B15	Continual Improvement	8.36
B16	Poka Yoke	8.3
B17	Bench Marking	2.2
B18	Quality Circle	5.19
B19	Cross Functional Teams	15.29
B20	Takt Time Production	6.28
B21	Multiskilled Employee	8.78
B22	Employee Involvement	20.29
B23	Overall Equipment Effectiveness (OEE)	9.22
B24	Total Productive Maintenance (TPM)	9.85
B25	Safety Improvement Program	9.47

6. RESULT AND DISCUSSION

The detailed analysis revealed that practical use of the lean practices (implementation of lean practices) is also affected by the size of the industry. The size of the industries is gauged on the basis of number of employees in the company. Data is collected on four pointer; 1 for 0-150, 2 for 151-300, 3 for 301 to 450 and 4 for more than 450 employees. The relationship between the practical use of lean practices and the size of industry is studied statistically through SPSS software. The relationship between each individual lean practice and size of industry has been studied through chi square test. The result of first level study shows that practical use of SMED, Kanban , line balancing, value stream mapping, customer involvement, in sample industries does affected by the size of industry because the p value is significant for these lean practices. This result can be justified because lean practices such as value stream mapping, SMED and kanban require a considerable financial budget and infrastructure to implement them. This requirement creates difficulty for small sized industry to implement these above stated lean practices.

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Appendix 1: Actual part of questionnaire

Section A: General Information

1. **Name of the company:**
2. **Job Designation of Respondent's:** Which of the following best describe your current designation?
 1. Senior Engineer
 2. Manager
 3. Senior Manager
 4. Assistant General Manager
 5. Other (Please Specify).....
3. **Respondent's Qualification:** Please indicate your highest qualification:
 1. Diploma in Engineering
 2. Bachelor Degree in Engineering
 3. Post Graduation in Engineering
 4. Other
4. **Respondent's Experience:** Please indicate your experience:
 1. Less than 5 years
 2. 5-10 years
 3. 11-20 years
 4. More than 25 years
5. **Size of the Industry:** How many employees are employed in your industry?
 1. 0 - 150
 2. 151-300
 3. 301- 450
 4. More than 450
6. **Years of Establishment:** How many years has it been since plant start-up?
 1. Less than 5 years
 2. 5-10 years
 3. 11-20 years
 4. More than 20 years

Section B: Level of understanding and practical use of the Lean practices

Please tick (√) as per your work experience:

S.No	Lean Tools	Never Used 1	Rarely Used 2	Partially Used 3	Frequently Used 4	Continuous Used 5
B1	Cellular Manufacturing					
B2	Single Minute Exchange of Dies					
B3	Pull System/Kanban					
B4	Small Lot Size					
B5	Line Balancing					
B6	Cycle Time Reduction					
B7	Value Stream Mapping					
B8	Bottleneck Removal					
B9	Standardised Work					
B10	Supplier Involvement					
B11	Customer Involvement					
B12	On time deliveries to customer					
B13	5S					
B14	Visual Management & Control					
B15	Continual Improvement					
B16	Poka Yoke					

B17	Benchmarking					
B18	Quality Circle					
B19	Cross Functional Teams					
B20	Takt Time Production					
B21	Multiskilled Employees					
B22	Employee Involvement					
B23	Overall Equipment Effectiveness					
B24	Total Productive Maintenance					
B25	Safety Improvement Programs					