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Leanness of Indian Industries: A questionnaire survey approach to find out the lean status of Indian industries

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Abstract: Lean manufacturing, a highly praised philosophy aimed at maximizing the output of a process by elimination of every factor related to the process that either is not useful at all or is not justifying its beneficence to a greater extent may be a new thing for Indian industries but it has proven itself in many other nations. Therefore requirement was felt to survey the extent of lean philosophies in context to Indian Industries. The survey helped to determine the various lean practices being opted out in various Indian industries along with the extent of their implementation. The survey was conducted through a questionnaire in which various lean practices as well as their magnitude of implementation was requested to fill in by the concerned representative of the industry. The conclusions of the survey are being discussed and the observation is that Indian industries are also taking advantage of various lean practices and some practices are definitely preferred over the rest.

Keywords: lean practices, lean philosophies, lean manufacturing, Indian industries, questionnaire survey.

1. Introduction

To perform the questionnaire survey regarding the implementation of lean philosophies, it was required to extract the methodology from the present literature that has been considered as a part of lean philosophies throughout the world. Literature survey provided following knowledge about lean practices. Lean practices or often called as lean tools are the techniques which are employed in order to reap the benefits claimed from lean manufacturing. Right from the beginning when the concept of lean manufacturing originated from Toyota production system, these lean tools & techniques are evolving very fast .In the beginning whole lean manufacturing was said to rest on the pillars of three major lean practices which are given as :-

1.1: Just in time 2:Continuous improvement 3:Jidoka

Now a days new lean practices are evolving from the pre-existed ones as well as new management practices are being confirmed to follow the principle of lean manufacturing. Therefore it was necessary to explore the extant literature to have the knowledge of various management and manufacturing practices which are confirmed as lean practices by the researchers of different regions. On the basis of a vast literature survey, individual practices that are found to be discussed in the reign of "Lean" are presented in the tabular form in table 1.1.1.

Table1.1. 1: List of lean practices and contributors:

S.No.	Lean practices	Contributors
1	Total quality management	Eswaramoorthi et al. (2011), Wong et al.(2009), Sahoo et al. (2008), Abdulmalek & Rajgopal (2007), Shah & Ward (2002)
2	Pull system /Kanban /pull production	Singh et al. (2011), Nordin et al.(2010), Singh & Sharma (2009), Wong et al. (2009), Arashpour et al. (2009)

3	Preventive maintenance	Nordin et al.(2010), Abdulmalek & Rajgopal (2007), Shah & Ward (2002), Cua et al. (2001), Feld (2000)
4	Lot size reduction /small lot size /batch size reduction	Eswaramoorthi et al. (2011), Nordin et al. (2010), Shah & Ward (2002), Flynn et al. (1999), White et al. (1999)
5	JIT /continuous flow production	Eswaramoorthi et al. (2011), Nordin et al. (2010), Wong et al. (2009), Arashpour et al. (2009), Sahoo et al. (2008)
6	Cycle time reduction	Singh et al. (2011), Shah & Ward (2002), Flynn et al. (1999), White et al. (1999), Sakakibara et al. (1997)
7	Cross functional team /flexible workforce /cross trained employees /multi-skill workers	Eswaramoorthi et al. (2011), Nordin et al. (2010), Shah & Ward (2007), Bonavia & Marin (2006), Shah & Ward (2002)
8	Continuous improvement program	Singh et al. (2011), Sahoo et al. (2008), Abdullah (2003), Shah & Ward (2002), Flynn et al. (1999)
9	Cellular manufacturing	Eswaramoorthi et al. (2011), Nordin et al. (2010), Singh & Sharma (2009), Wong et al. (2009), Pattanaik & Sharma (2009)
10	Single piece flow production/one piece flow	Eswaramoorthi et al. (2011), Arashpour et al. (2009), Singh & Sharma (2009), Wong et al. (2009), Pavnaskar & Gershenson (2003)
11	Zero defects	Singh et al. (2011), Abdullah (2003), Karlsson et al. (1996)
12	Value stream mapping (VSM)	Eswaramoorthi et al. (2011), Singh et al. (2011), Singh & Sharma (2009), Wong et al. (2009), Sahoo et al. (2008)
13	Synchronous manufacturing	Pavnaskar & Gershenson (2003), Russell & Taylor (1999)
14	Inventory management	Singh & Sharma (2009), Pavnaskar & Gershenson (2003), Russell & Taylor (1999)
15	Poka yoke/error proofing	Eswaramoorthi et al. (2011), Nordin et al. (2010), Singh & Sharma (2009), Wong et al. (2009), Arashpour et al. (2009)
16	Scrap reduction	Singh & Sharma (2009), Pavnaskar & Gershenson (2003), Russell & Taylor (1999)
17	Workplace organization	Singh & Sharma (2009), Pavnaskar & Gershenson (2003), Russell & Taylor (1999)
18	Standardized work	Eswaramoorthi et al. (2011), Singh & Sharma (2009), Wong et al. (2009), Abdullah (2003), Pavnaskar & Gershenson (2003), Russell & Taylor (1999).
19	kaizen	Eswaramoorthi et al. (2011), Singh et al. (2010), Nordin et al. (2010), Singh & Sharma (2009), Wong et al. (2009)
20	Agile manufacturing	Wan (2006), Christopher & Towill (2001), Naylor (1999), Goranson (1999).
21	2 bin auto replenishment system	Arashpour et al. (2009).
22	Heijunka/production smoothening/line balancing	Eswaramoorthi et al. (2011), Wong et al. (2009), Arashpour et al. (2009), Sahoo et al. (2008), Abdulmalek & Rajgopal (2007)
23	Single minute die exchange	Eswaramoorthi et al. (2011), Arashpour et al. (2009), Sahoo et al. (2008), Abdulmalek & Rajgopal (2007), Abdullah (2003)
24	5-S	Eswaramoorthi et al. (2011), Nordin et al. (2010), Wong et al. (2009), Arashpour et al. (2009), Sahoo et al. (2008)
25	Simulation	Abdulmalek & Rajgopal (2007), Abdullah (2003), Rentes (2002), Detty & Yingling (2000), White (1993)
26	Supply chain management	Daugnoraite & Slaitas (2010), Abdullah (2003).

27	Visual management/visual control/visual factory	Eswaramoorthi et al. (2011), Nordin et al. (2010), Singh & Sharma (2009), Bonavia & Marin (2006).
28	Production stop policy	Wan (2006), Detty & Yingling (2000), Monden (1998).
29	Autonomation/JIDOKA	Eswaramoorthi et al. (2011), Wong et al. (2009), Arashpour et al. (2009).
30	Human recourse management	Pont et al. (2008), Bonavia & Marin (2006), Shah & Ward (2002), Lowe et al. (1997), Flynn & Sakakibara (1995)
31	Group technology	Wong et al. (2009), Bonavia & Marin (2006).
32	Andon	Eswaramoorthi et al. (2011), Wong et al. (2009), Arashpour et al. (2009).
33	Takt time	Eswaramoorthi et al. (2011), Singh et al. (2011), Pattanaik & Sharma (2009), Singh & Sharma (2009), Álvarez et al. (2009)
34	Setup time reduction/quick changeover techniques	Singh et al. (2011), Nordin et al. (2010), Arashpour et al. (2009), Abdulmalek & Rajgopal (2007), Bonavia & Marin (2006)
35	Total productive maintenance	Eswaramoorthi et al. (2011), Wong et al. (2009), Arashpour et al. (2009), Abdulmalek & Rajgopal (2007), Abdullah (2003),

1.2 Formulation of questionnaire:-Formulation of questionnaire was carried out in such a manner that there should be a fine balance between the lucidity and the vastness of the required information. Participants were requested to fill the responses on a five point scale along with the basic specifications of the industry. The questionnaires were sent to various Indian industries and on the basis of responses conclusion was carried out.

2. Statistical analysis:

Statistical analysis was done from the responses obtained from 31 different Indian industries that is as follows:

2.1 Statistics of type of industries involved in the survey

It was intended to receive data from every type of Indian industries so questionnaire was sent to various different industries. Data related to industry type was gathered from the section in the questionnaire in which the respondent has to specify the type of industry. Statistics for type of industry are discussed with the figure 2.1.1.

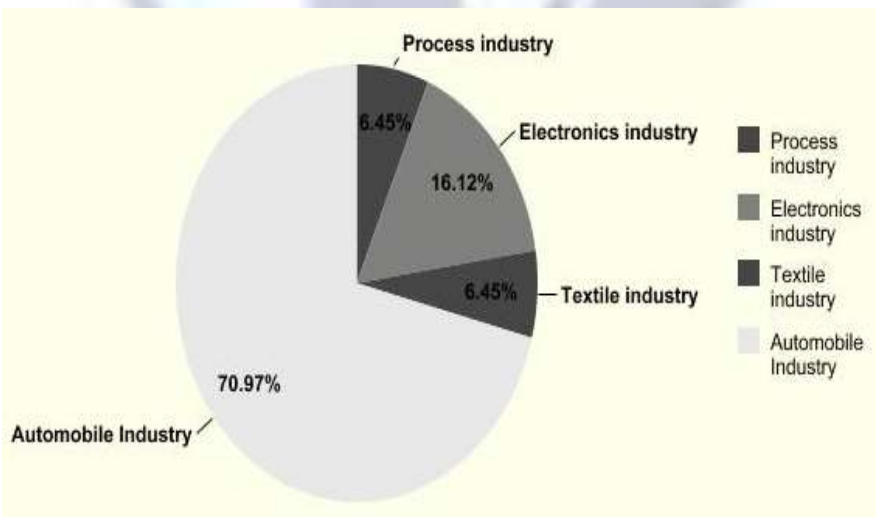

Figure 2.1. 1: Pie chart showing type of respondent industries.

It can be seen from the figure 2.1.1 that out of 31 responses received majority of industries belonged to automobile sector and their contribution is nearly 70 %. After automobile industries second largest respondents were Electronic companies

whose participation is nearly 16 %. After that process industries and textile industries have equally participated and their percentage is approximately 6 %.

2.2 Statistics of participation of industries based on number of employees

Questionnaire survey contained a section in which respondent had to mark number of employees. Number of employees was divided into 5 different categories which could be seen in the figure2.2.1 that illustrates the participation of industries based on number of employees working in the industry:-

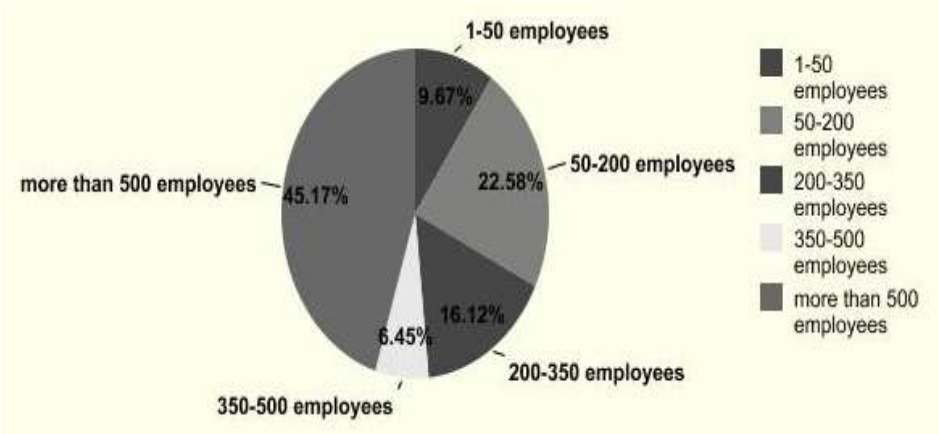

Figure 2.2.1: Pie chart showing type of respondent industry based on number of employees.

From figure 2.2.1 it can be seen that majority of respondents are companies which have employees more than 500 and their total percentage is nearly 45 %. After that there are companies which have 50-200 employees and their total participation is approximately 22 %. Then there are companies with employees 200-350 and their participation is nearly 16 %. Companies having 1-50 employees are at 4th number with approximately 9 % participation. In the last there are companies having 350-500 employees with approximately 6 % participation.

2.3 Statistics of participation of industries based on plant age

Survey questionnaire contained a column regarding the information of plant age in company's information section and based on the responses obtained from that section, facts are being discussed in

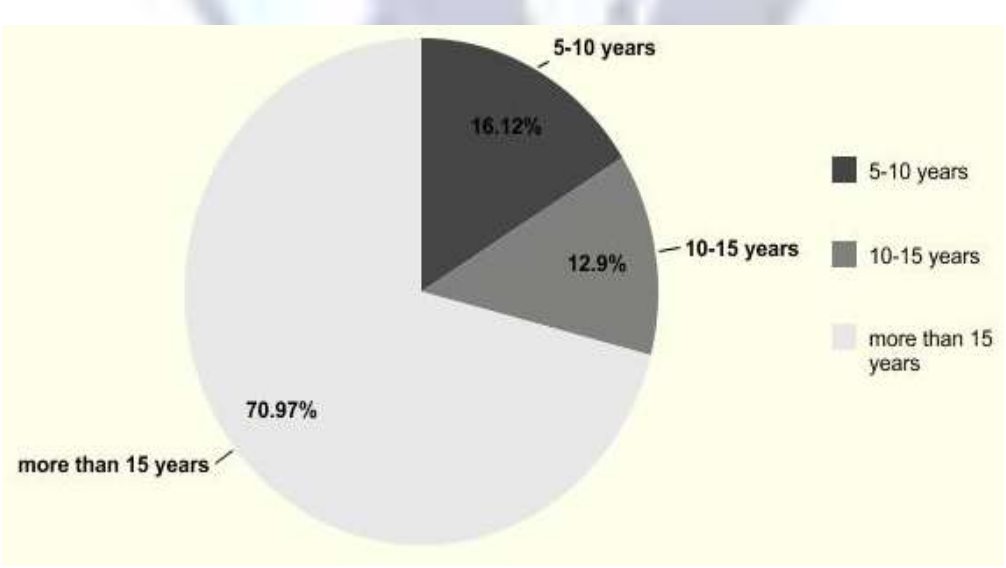

Figure 2.3.1: Pie chart showing type of respondent industry based on plant age.

Figure 2.3.1 in which it can be seen that nearly 70 %age of companies have completed 15 years of establishment. Nearly 16 % responses were received from companies who have completed 5 years but their age is less than 10 years. Nearly 12 % of respondents fall in the plant age category of 10-15 years.

2.4 Statistics of lean status of Indian industry

In the questionnaire survey, respondents were asked to give self assessment marks in context to lean implementation and based on the marks following conclusion is made. On an average all the industries gave 65 % marks in self assessment section to themselves that is shown in figure 2.4.1 which has a single bar showing average lean status. This lean status is the average collective lean status of all the 31 responding companies.

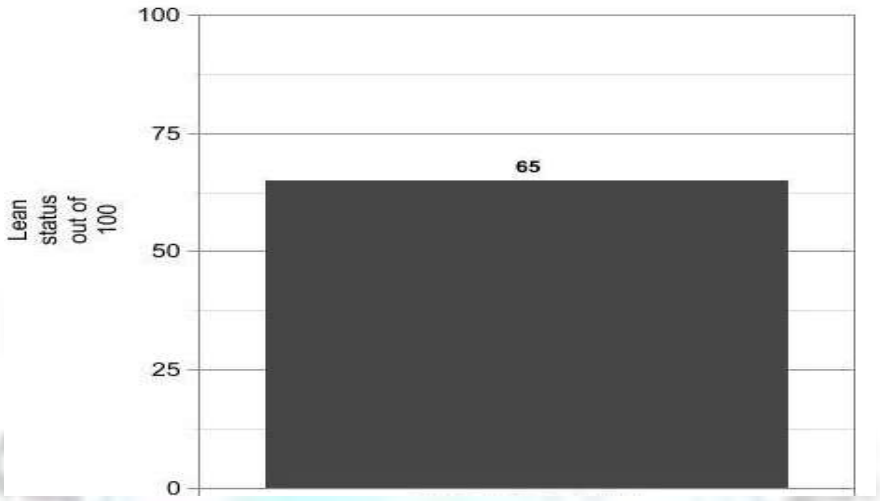

Figure 2.4.1: Bar diagram showing average lean status of Indian industries

2.5 Statistics of lean status based on the type of industry

Questionnaires were received from 4 different types on Indian industries that have been discussed earlier. Figure 2.5.1 shows the lean status of different type of industries:

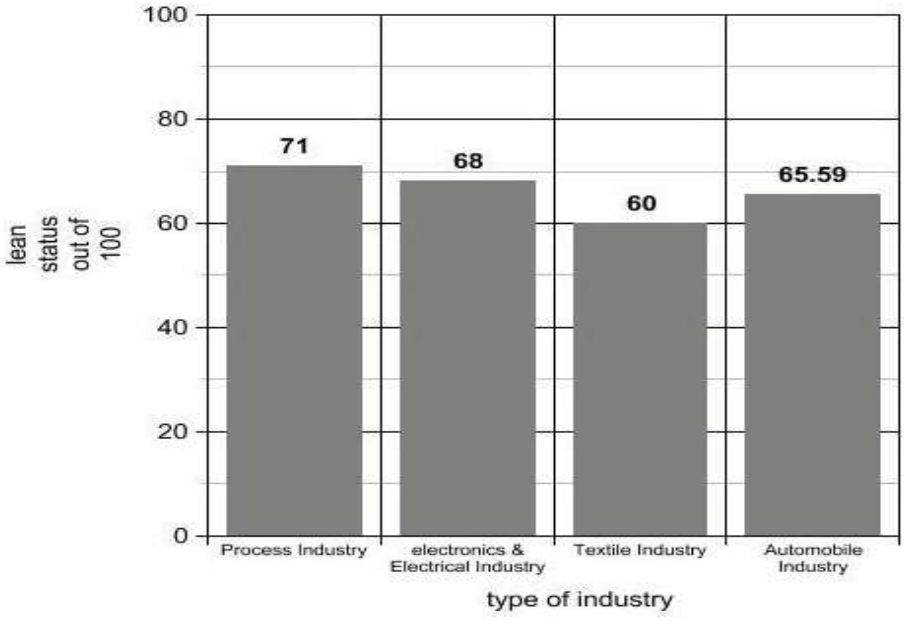

Figure 2.5.1: Bar chart showing average lean status based on type of industry

As it can be seen from figure 2.5.1 that process industries gave highest self assessment marks in context to lean implementation and the average of marks is 71 %. With 68 % average marks, Electronics and electrical industries are at 2nd place. Automobile industries are at 3rd place with nearly 65 % average marks. In the last there are textile industries which have 60 % average marks.

2.6 Statistics of lean status based on the plant size

In this section relation of plant size to the implementation of lean practices is being discussed.As number of employees can be assumed to be proportional to the plant size therefore conclusion regarding plant size are based on the number of employees in actual. Figure 2.6.1 shows the lean status of different companies based on their number of employees.

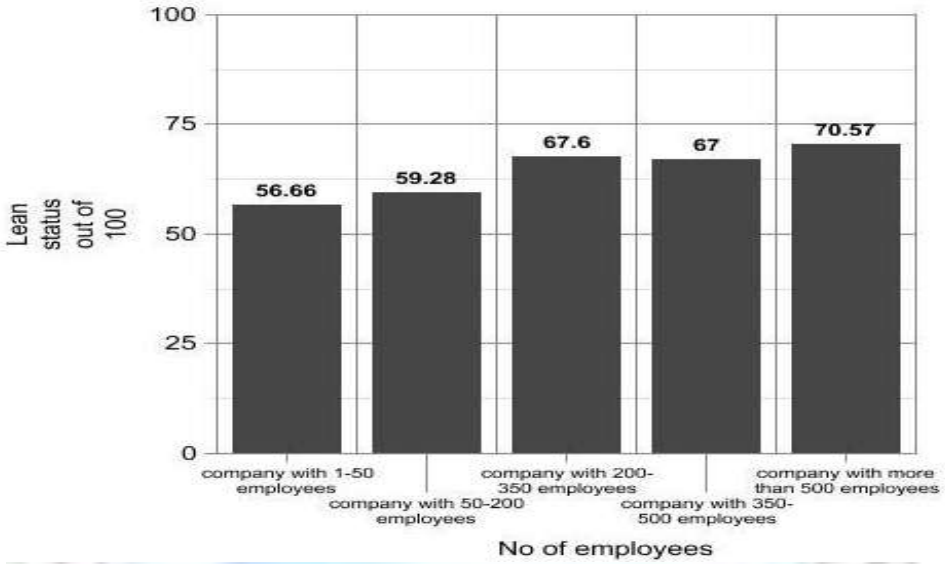

Figure 2.6.1: Bar chart showing average lean status based on plant size.

From figure 2.6.1 it can be seen that lean status of companies having more than 500 employees is greatest and is nearly 70 %. Companies with employees from the range of 200-500 can be assumed equal with nearly 67 % average lean status. Companies with 1-50 employees are at least position with approximately 56 % average lean status.

2.7 Statistics of lean status based on the plant age

Lean status marks based on the plant age are illustrated in figure 2.7.1:

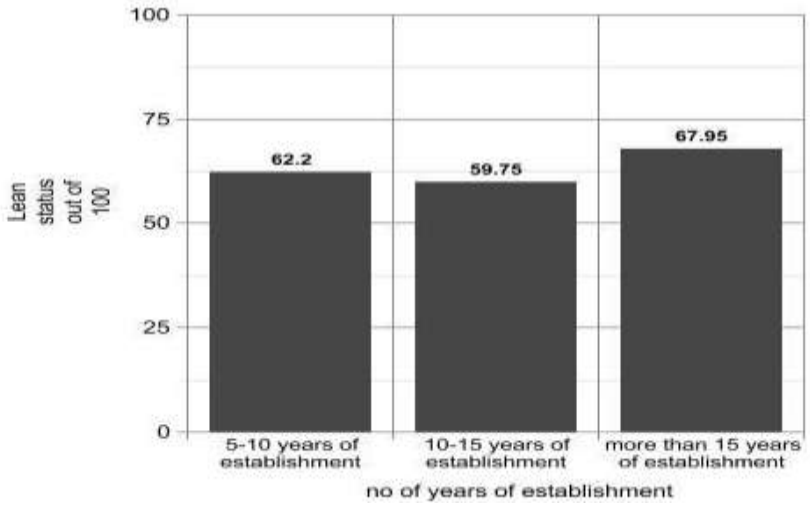

Figure 2.7.1: Bar diagram showing average lean status based on plant age

From figure 2.7.1 it can be seen that companies having more than 15 year plant age are at 1st position with approximately 70 % lean status. Companies with plant age 5-10 years are at 2nd position with approximately 62 % marks and in the last ,companies having plant age from 10 -15 years are present with approximately 59 % marks.

2.8 Statistics of responses of Individual lean practices

In the questionnaire, respondents were asked to give marks to various lean practices that were identified in the literature survey on a five point likert scale. One mark given for any practice reveals no adoption at all and 5 marks signify full implementation. As the number of responding companies are 31 so a maximum total of 155 can be achieved by any specific lean practice. Responses obtained are illustrated with the help of figure 2.8.1 which illustrates all lean practices in form of horizontal bars. More the length of the bar more is the total points received by the lean practice in front of the bar. It can be seen from the figure 2.8.1 that maximum marks are received by human resource management which got 118 marks out of 155.It shows the fact that Human resource management is the most implemented lean practice in Indian industries. Similarly other lean practices can be seen in the figure 2.8.1 and it can be interpreted that 2 bin auto replenishment system is the least adopted lean practice in Indian industries that were surveyed.

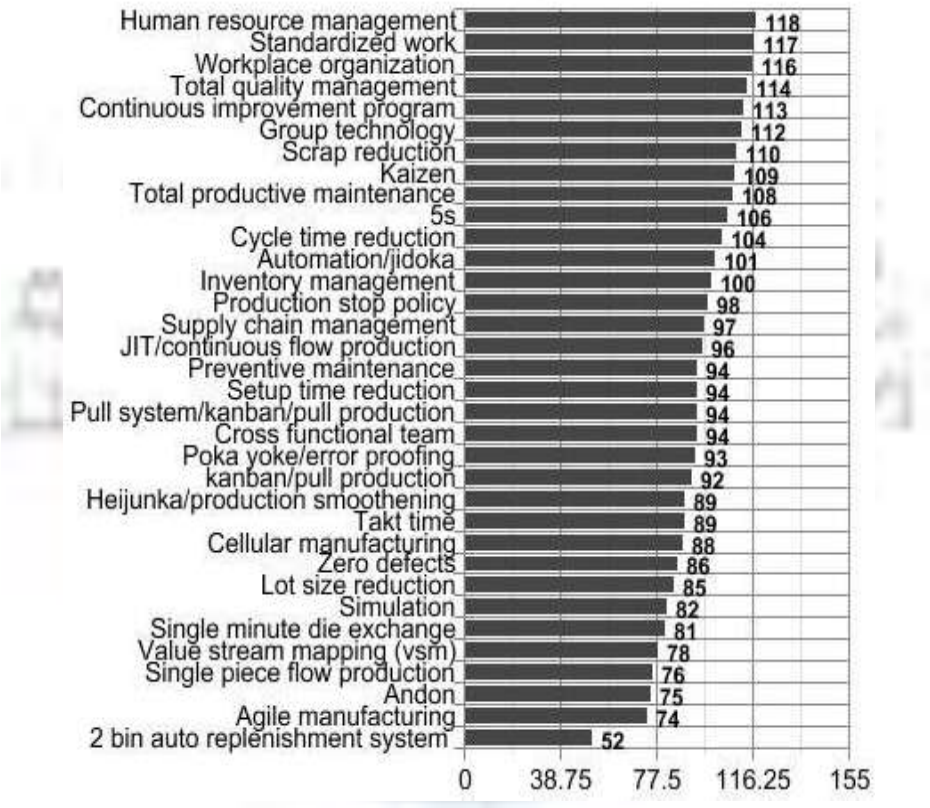

Figure 2.8.1: Bar diagram showing responses of different individual lean practices.

3. Results and Conclusion

Following conclusion can be said to have obtained from the research:

Conclusion 1:- Lean manufacturing technologies have been highly adopted by the plants who has age more than 15 years .it means that lean manufacturing adoption is directly proportional to age of the plant.

Conclusion 2: - Implementation of lean manufacturing is directly proportional to the size of plant. It is concluded from the research that plants having more number of employees adopt more lean practices.

Conclusion 3: - After statistical analysis, it is concluded that Average lean status of Indian industries that were surveyed is 65 percent. Textile industries lag behind other industries when it comes to implementation of lean philosophy.

Conclusion 4: - Human resource management is the most practiced lean practice followed by standardized work and workplace organization. 2 bin auto replenishment system is found to be the least adopted lean practice.

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