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The Study on Effects of Lean Six Sigma in Manufacturing Industries under Operational Performances

LEELESH SUNDARAM.B[1]

ABSTRACT

Studies have revealed that several managerial concepts or aspects has helped in growth of manufacturing companies in India. One of the most interesting and important aspect of management concept attracting manufacturing companies is the concept of implementation of lean six sigma which is a method that relies on a collaborative team effort to improve performance by systematically removing waste and reducing variation has also grown in manufacturing industries. Though it is evident from various studies and reports that lean six sigma concepts are used in the industries for the purpose of controlling waste and curing defects, the effect of the same is still unknown. As a result of which the real nature of lean six sigma is unknown and a natural question arises as to whether there is any form of benefit in applying lean six sigma in industries. In various other countries the effect of six sigma and its consequences after application has severed them in a better way, but in India this is uncertain or couldn't be determined as the effect is still unknown to individuals. Therefore manufacturers are unaware about the effect of implementation of lean six sigma and are in such position to recommend it to others, therefore this research is carried out with an aim to identify the effect of lean six sigma in Manufacturing industries under operational performances. With the help of non probability convenience sampling it could be found out that there is a positive effect of lean six sigma in manufacturing industries under operational performances, with the help of chi square and correlation tests. Thus the study recommends that manufacturing industries must follow immediate effect ascertainment of lean six sigma or any process that is been applied in the manufacturing sectors

Keywords: *Lean Six Sigma, Effects, Manufacturing Industries, Operation Performances, Manufacturers.*

I. INTRODUCTION

The primary function or the source of employment in India was agriculture, but after the

[1] Author is a LLM student, India.

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process of globalization and industrialization several manufacturing industries mushroomed in India, contributing to more than 50 percent of the country's GDP(Goldar 2016). Manufacturing holds a key position in the Indian economy by employing about 12.0 per cent of India‟s labour force. Growth in the sector has been matching the strong pace in overall GDP growth over the past few years(Goldar 2016; Goldar n.d.).

The term manufacturing Industry or sector means and includes, any industry or establish which is the production of products for use or sale using labour and machines, tools, chemical and biological processing, or formulation. When the history of Indian manufacturing sectors is analyzed though the trajectory was on a growing plane, effective and efficient performances of these industries was subjected to criticism ever from its institution(Goldar n.d.). For this problem the modern methods of management provided effective solutions. The modern methods including motivation, satisfaction and goal achievement gave reliable benefits for the manufacturing Industries in the Indian context(Das et al. n.d.).

Studies has revealed that the several managerial concepts or aspects has helped in growth of manufacturing companies in India(Cudney & Elrod 2011). One of the most interesting and important aspect of management concept attracting manufacturing companies is the concept of implementation of lean six sigma which is a method that relies on a collaborative team effort to improve performance by systematically removing waste and reducing variation has also grown in manufacturing industries(Gupta & Jain 2015). It is evident that management concepts have helped in the growth and development of Manufacturing industries, especially in the operational performances, which include quality and waste control functions (Zahraee 2016). But the question or the ambiguity arises with respect to the effect of application of lean Six Sigma Concepts in Manufacturing Industries under the operational functions(Goshime et al. 2018). In various other countries the effect of six sigma and its consequences after application has severed them in a better way, but in India this is uncertain or couldn't be determined as the effect is still unknown to individuals(Muganyi et al. 2018). Therefore manufacturers are unaware about the effect of implementation of lean six sigma and are in such position to recommend it to others, therefore this research is carried out with an aim to identify the effect of lean six sigma in Manufacturing industries under operational performances.

(A) Objectives

1. To know the features and perspectives of lean six sigma
2. To identify the role of operational performances in manufacturing industries
3. To analyse the application of lean six sigma in manufacturing industries

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4. To study the impact of lean six sigma in manufacturing industries in India
5. To give effective recommendations for application of six sigma in manufacturing industries in India

(B) Review of Literature

1. Purpose of operational performances in manufacturing industries

All manufacturing industries are embarked to play out a similar essential function of transforming resources into finished goods. To perform this function in the present business condition, makers constantly endeavor to improve operational productivity(Grando et al. 2007). They should calibrate their generation procedures to concentrate on quality, to hold down the expenses of materials and work, and to wipe out all costs that increase the value of the finished item(Heck et al. 2014). Therefore in order to follow such efficiency operational performances and management is required(Anon n.d.).

2. History of six sigma in manufacturing sectors

The story started around 100 years prior when Frederick Taylor reasoned that the most ideal approach to improve profitability was to isolate the execution of work from its arranging and improvement forms utilized for execution(Topf & Stiepani 2007). Be that as it may, in the time of industrialization, the foundations of present day improvement projects can be followed back to activities embraced by a few organizations amid the later-50% of the nineteenth century(Topf & Stiepani 2007; Epps et al. 2014). Amid this period, representative driven upgrades and motivating force programs realized positive changes in the mechanical condition (Woo 2009). In the later 50% of twentieth century, in excess of 69 quality related activities were accounted for . As per Montgomery, Six Sigma has been extremely fruitful and is fairly the best business improvement system created in amid the most recent 50 years(Goldfrank 1943). Management specialists like Walter Shewhart, Joseph Juran, and W. Edwards Deming who advocated the reason for Total Quality, brought the possibility of Continuous Process Improvement as a Formal Methodology to the Limelight. An Example of Early Process Improvement approach is the Deming Cycle of PDCA. Throughout the decades, the requirement for ceaseless improvement inside the association wound up objective. For this reason, various consistent improvement philosophies were created dependent on a fundamental idea of procedure improvement, squander minimization, generation framework and quality improvemen(Porter 1970)t. Directly, its application has stretched out past manufacturing industries to support, government, open division, social insurance and non-profit associations. The truth of the matter is additionally fortified by the review report distributed by Dyn Corp

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that Six Sigma is the best quality improvement procedure this overview further uncovered that the idea of Six Sigma is appraised high when contrasted with numerous different procedure improvement systems(Tanner n.d.).

3. Role of Lean Six Sigma

Lean Six Sigma is a synergized managerial concept of Lean and Six Sigma. Lean generally centers around the disposal of the eight sorts of waste/muda delegated deserts, over-creation, pausing, non-used ability, transportation, stock, movement and additional preparing(Tanner n.d.; Porter 1970). Six Sigma looks to improve the nature of procedure yields by recognizing and evacuating the reasons for deformities (mistakes) and limiting inconstancy in (manufacturing and business) forms. Synergistically, Lean plans to accomplish persistent stream by fixing the linkages between procedure steps while Six Sigma centers around lessening process variety (in the entirety of its structures) for the procedure steps consequently empowering a fixing of those linkages. So, Lean uncovered wellsprings of procedure variety and Six Sigma means to lessen that variety empowering a highminded cycle of iterative upgrades towards the objective of consistent stream(Arreola & Carroll 2004).

Lean Six Sigma utilizes the DMAIC stages like that of Six Sigma. Lean Six Sigma ventures involve parts of Lean's waste disposal and the Six Sigma center around lessening surrenders, in light of basic to quality attributes(Ruegg & Jordan 2011). The DMAIC toolbox of Lean Six Sigma contains all the Lean and Six Sigma apparatuses. The preparation for Lean Six Sigma is given through the belt based preparing framework like that of Six Sigma(Adler 1993).

(C) Statement of Problem

Though it is evident from various studies and reports that lean six sigma concepts are used in the industries for the purpose of controlling waste and curing defects, the effect of the same is still unknown. As a result of which the real nature of lean six sigma is unknown and a natural question arises as to whether there is any form of benefit in applying lean six sigma in industries.

(D) Research Methodology and Materials

1. Study area

As the researcher intends to understand the effects of lean six sigma public opinion is taken into account, the study is divided into 2 categories –

1. Public opinion on reduction of waste in current production practice

2. Public opinion on effect of training and educating in control of waste in production

2. Methodology

This research is primarily based on lean six sigma and operational performance; for the purpose of determining the effect opinion of general public is taken into account, because they are the end user and customer of the produced goods. Hence the study includes both qualitative as well as quantitative method. Since application of behavior of individuals to ascertain the effect under the study is needed, the study also includes applied method.

In this study behavior of individual from various age groups are tested to know the effect, the effect is ascertained by the response of individuals based on their age groups since the nature of the question is in such a way that the difference before and after could be ascertained.

3. Data collection

Present study is based on Primary as well as Secondary sources of data, which are as –

1. Primary Sources – Primary data is collected by collecting questionnaire from general public
2. Secondary Sources – Secondary data is collected through literature of N.G.O. reports, Government Reports, Websites, Research Articles, Newspapers

4. Variable used:

1. Independent variable: Share investment

2. Dependent variable

1. Consumer opinion on waste reduction in manufactured products

2. Consumer opinion on reduced defects in manufactured products

5. Statistical Tool used:

1. chi square analysis

2. Symmetric measures

(C) Sample size and frequencies

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	below 20 years	373	25.3	25.3	25.3

	21-25years	402	27.2	27.2	52.5
	26-30years	575	39.0	39.0	91.5
	above 30years	126	8.5	8.5	100.0
	Total	1476	100.0	100.0	

(D) Sample size Calculation

A sample size of 1476 is chosen by which 373 respondents are below 20 years, 402 respondents are between 21-25 years and 575 respondents in the age group between 26-30 years and 126 respondents are above 30 years as the study includes a non-probability convenience sampling method.

(E) Tables and Calculation

In this study for each issue a survey is done where a sample size mentioned is taken and the percentage is also mentioned, to determine the validity and the determine the study results chi-square analysis and correlation symmetric measures method is used. when the pearson value or spearman correlation value of 'Asymp. Sig' value is less than 0.05, the alternate hypothesis is considered and when the pearson value or spearman correlation value 'Asymp. Sig' value is greater than 0.05, the null hypothesis is accepted. For the determining the hypothesis the variables are cross tabulated.

(F) Hypothesis

H_0: There is no significant positive impact of lean sigma in operational performances of Indian manufacturing industries

H_1: There is significant positive impact of lean sigma in operational performances of Indian manufacturing industries

(G) Concept Analysis

1. Consumer opinion on waste reduction in manufactured products

H_0: There is no relationship between consumer opinions on waste reduction in manufactured products and age group

H_1: There is relationship between consumer opinions on waste reduction in manufactured

products and age group

Table 1. Relationship between consumer opinions on waste reduction in manufactured products and age group

Crosstab

Count

		Consumer opinion on waste reduction in manufactured products in the recent years			
		yes	no	maybe	Total
1.Age	below 20 years	192	142	39	373
	21-25years	268	72	62	402
	26-30years	71	201	303	575
	above 30years	41	54	31	126
Total		572	469	435	1476

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	415.712[a]	6	.000
Likelihood Ratio	442.314	6	.000
Linear-by-Linear Association	187.377	1	.000
N of Valid Cases	1476		

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Lean six sigma is mainly focused on waste reduction, the older generation state that there is no significant development in manufactured products. But the younger generation states that there is significant development in waste reduction in the manufactured products, which in turn proves that in the recent years there is significant development in waste reduction in manufactured products.

Pearson chi square 'Asymp Sig'value is 0.00 which value is less than 0.05, which proves that there is a relationship between independent and dependent variable. independent variable chosen is age group which is tested against the dependent variable Public Opinion . Therefore from the analysis and statistics, It could infer that there is a conflicting opinion between the younger and the older generations, therefore alternate hypothesis is proved.

2. Consumer opinion on reduced defects in manufactured products

H_0: There is no relationship between consumer opinions on reduced defects in manufactured products and age group

H_1: There is relationship between consumer opinions on reduced defects in manufactured products and age group

Table2. Relationship between consumer opinions on reduced defects in manufactured products and age group

Crosstab

		consumer opinions on reduced defects in manufactured products				
		disagree	neutral	agree	strongly agree	Total
1.Age	below 20 years	147	45	51	130	373
	21-25years	123	100	54	125	402
	26-30years	77	21	316	161	575
	above 30years	38	37	39	12	126

Total	385	203	460	428	1476

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	370.077[a]	9	.000
Likelihood Ratio	386.432	9	.000
Linear-by-Linear Association	14.723	1	.000
N of Valid Cases	1476		

Symmetric Measures

		Value	Asymptotic Standardized Error[a]	Approximate T[b]	Approximate Significance
Interval by Interval	Pearson's R	.100	.027	3.855	.000[c]
Ordinal by Ordinal	Spearman Correlation	.084	.028	3.245	.001[c]
N of Valid Cases		1476			

Another interesting fact or factor of lean six sigma is preventing defects in the products that are manufactured. In the recent years the manufactured products are with less defects when

compared to the past, this analysis is framed with the help of the above analysis. The younger generation agree that products are manufactured with very less defects whereas in the older generation do not agree to the same, thus it proves that there is an improvement in the process.

Spearman correlation 'Asymp Sig'value is 0.01 which value is less than 0.05, which proves that there is a relationship between independent and dependent variable. independent variable chosen is age group which is tested against the dependent variable Public Opinion . Therefore from the analysis and statistics, It could infer that there is a conflicting opinion between the younger and the older generations, therefore alternate hypothesis is proved.

(H) Discussions

The study reveals that There is relationship between consumer opinions on waste reduction in manufactured products and age group and it could also be found out that There is relationship between consumer opinions on reduced defects in manufactured products and age group. From these findings it could be found out in detail or derived that In the recent years the manufactured products are with less defects when compared to the past and the older generation state that there is no significant development in manufactured products. But the younger generation states that there is significant development in waste reduction in the manufactured products, which in turn proves that in the recent years there is significant development in waste reduction in manufactured products.

The current study is influenced by awareness of constitutional rights among individuals, The systematic nature of science involves the use of both inductive and deductive research strategies. Inductive reasoning involves the formulation of a general principle or theory based on a set of specific observations. Conversely, deductive reasoning involves the formulation of specific observational predictions based on a general principle or theory, this principle is magnified or becomes easy to implement when educational knowledge of individuals.

The study includes 2 main parameters which is discussed in the study , the parameters included in the study are Consumer opinion on waste reduction in manufactured products in the recent years and consumer opinions on reduced defects in manufactured products.

When the study is compared with the situation in manufacturing sectors in the United States, it could be found out that the situation is as same as that in the case of India. But in the case of the United States, it could be found out that the effect of lean six sigma was ascertained immediately after the application of the same.

Therefore the study recommends that the manufacturing industries must follow immediate effect ascertainment of six sigma or any process that is been applied in the manufacturing

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sectors.

II. FINDINGS

1. There is relationship between consumer opinions on reduced defects in manufactured products and age group

2. There is relationship between consumer opinions on waste reduction in manufactured products and age group

3. In recent years the manufactured products are with less defects when compared to the past.

4. In recent years there is a significant development in waste reduction in manufactured products.

III. RECOMMENDATIONS

1. Manufacturing industries must follow immediate effect ascertainment of six sigma or any process that is been applied in the manufacturing sectors

2. Awarness of lean six sigma should be made.

3. Employees should be equipped with application and evaluation of lean six sigma.

IV. CONCLUSION

From the above discussion it could be ascertained that There is relationship between consumer opinions on waste reduction in manufactured products and age group and it could also be found out that There is relationship between consumer opinions on reduced defects in manufactured products and age group. From these findings it could be found out in detail or derived that In the recent years the manufactured products are with less defects when compared to the past and the older generation state that there is no significant development in manufactured products. But the younger generation states that there is significant development in waste reduction in the manufactured products, which in turn proves that in the recent years there is significant development in waste reduction in manufactured products. Thus it could be concluded that there is a positive effect of lean six sigma in manufacturing industries under operational performances. the study recommends that the manufacturing industries must follow immediate effect ascertainment of six sigma or any process that is been applied in the manufacturing sectors.

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