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A Study on Financial Impact of Lean Manufacturing Systems in Enhancing Production

Dhanush Rahul M[1], S. Satheesh Kumar[2]

[1]Student, Master of Business Administration, Panimalar Engineering College, Chennai
[2]Associate Professor, Master of Business Administration, Panimalar Engineering College, Chennai

Abstract:
Focusing on the 5S Methodology and the removal of non-value-added (NVA) activities to increase production efficiency, this study examines the financial effects of lean manufacturing systems. To evaluate the connection between lean practices and important financial metrics like cost reduction, inventory turnover, machine downtime, and profitability, information was gathered from 169 employees using a standardized questionnaire. The findings showed a significant positive relationship between better financial performance and the use of lean tools. Benefits like lower operating costs, better use of resources, and higher-quality products were mentioned by respondents. The significance of these findings was validated by statistical tools such as Chi-Square, Mann-Whitney U, and correlation analysis. The study's overall findings demonstrate how successful lean methodologies can promote both long-term financial gains and operational efficiency.

1. INTRODUCTION

Organizations use lean manufacturing systems to increase productivity, reduce expenses, and enhance financial performance in the fast-paced manufacturing environment of today. Lean, which has its roots in the Toyota Production System, emphasizes resource optimization, waste reduction, and ongoing development. Using a structured survey approach, this study investigates the financial impact of lean practices, particularly the 5S methodology and the removal of non-value-added (NVA) activities. It looks at how these methods affect profitability, production efficiency, resource use, and cost reduction. Managerial and employee data offers useful insights into the advantages and difficulties of implementing lean. Key financial metrics like cash flow, ROI, inventory turnover, and cost savings are the focus of the analysis. The goal of the study is to demonstrate how process efficiency and organized workplaces lead to quantifiable financial benefits.

2. OBJECTIVES

- To study the impacts of lean manufacturing on cost reduction in production processes.
- To study employees perspective on financial success with lean manufacturing in terms of reduction in lead times and increasing efficiency.
- To measure the financial impact of reducing non-value-added activities in manufacturing processes.
- To identify how lean strategies affect overall productivity and operational efficiency.

3. SCOPE

This study will investigate the financial impacts of applying lean manufacturing principles in a production setting using a survey-based methodology. Employees in the production, operations, and finance departments evaluate the scope, which includes cost reductions, waste reduction, increased inventory turnover, and overall financial performance. By using structured questionnaires to collect primary data, the study aims to obtain real-time insights into how lean practices like 5S and Non-Value-Added Activities [NVA] lead to increased efficiency and profitability. The study concentrates on the financial advantages of lean methodologies and is restricted to internal components of the organization.

4. REVIEW OF LITRRATURE

D'Souza and Banerjee (2025) discovered that by reducing downtime and resource misalignment, lean practices increased financial efficiency. According to the study, cost savings were achieved by optimizing workforce utilization and batch sizes, which ultimately increased productivity and profitability. It came to the conclusion that lean approaches greatly improve financial and operational performance.

Venkatesh and Ramesh (2024) Found that lean practices enhanced financial agility by reducing working capital requirements and improving production responsiveness. Their study showed gains in ROI, ROA, and throughput, highlighting lean's impact on both operational efficiency and financial performance.

Owusu and Mensah (2023) investigated how lean methods affected the manufacturing industry in Africa and discovered that the cost of goods sold (COGS) had significantly decreased. Higher gross profit ratios were the result of more efficient production and less overproduction. Process optimization and improved supplier integration were strongly associated with financial gains. Their study highlights the ways in which lean methods lower costs and increase profitability.

Rajendran and Iyer (2022) Lean concepts were found to improve receivables turnover and liquidity, which shortened the cash conversion cycle. These improvements made it possible for more efficient production planning and improved working capital management. The study emphasizes the importance of lean in enhancing financial operations.

Taylor and Simmons (2021) Lean manufacturing has been shown to increase profitability in the automotive sector by lowering warranty claims, rework expenses, and defect rates. Businesses that combined lean and Six Sigma benefited financially more. The study emphasizes how operational and financial gains are driven by quality improvements.

5. RESEARCH METHODOLOGY

The methodology used in this study was a descriptive research design. Using the Morgan Table, 169 trainees were chosen through purposive sampling from a population of 300. Data was collected from the participants using a structured questionnaire that included Likert scale questions. Non-parametric tools such as the Kruskal-Wallis H-Test and Spearman's Rank Correlation were employed for analysis because the Kolmogorov-Smirnov normality test did not reveal that the data was normally distributed.

6. DATA ANALYSIS AND INTERPRETATION

5.1 PERCENTAGE ANALYSIS

Table 1: Demographic profile of respondents

Categories	Sub categories	No. of respondents	Percentage (%)
Age	18-25 years	52	30.8
	26-35 years	80	47.3
	36-45 years	28	16.6
	45-55 years and above	9	5.3
Gender	Male	116	68.6
	Female	53	31.4
Designation	Entry-Level	38	22.5
	Mid-Level	95	56.2
	Senior-Level	36	21.3
Experience	Less than 1 year	19	11.2
	1-3 years	63	37.3
	4-6 years	57	33.7
	7-10 years	20	11.8
	More than 10 years	10	5.9
Total	**All categories**	**169**	**100.00**

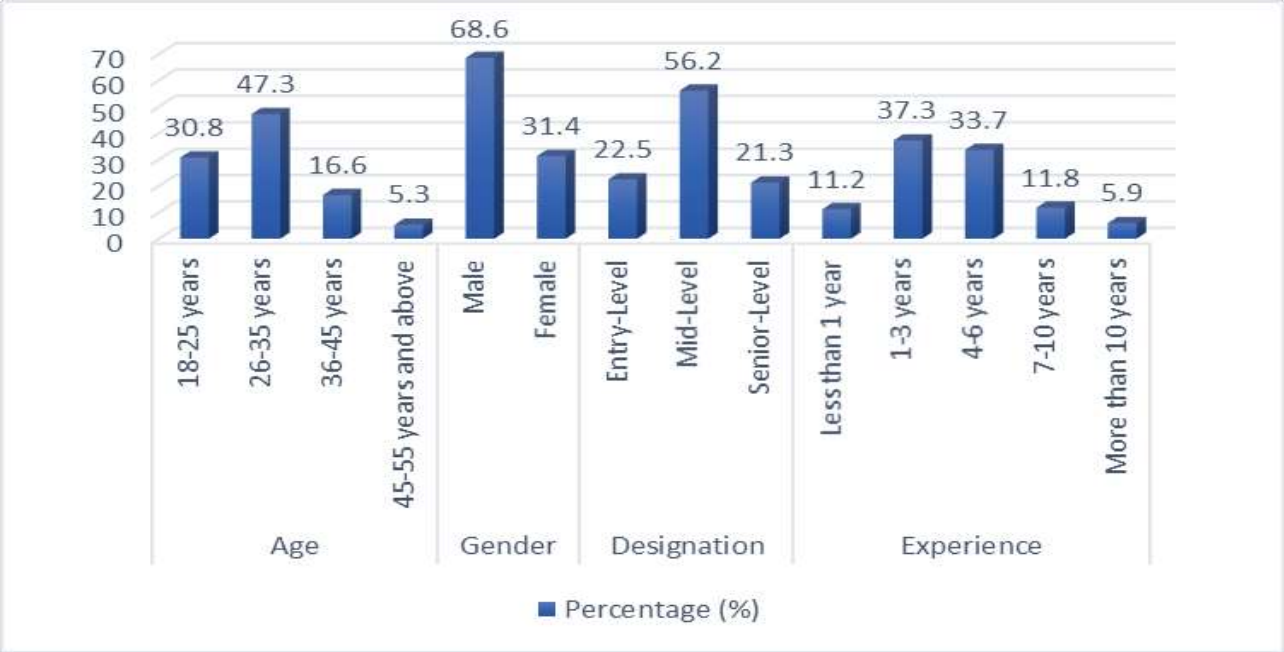
5.1.1 FINDINGS

According to their age distribution, 30.8% of the respondents are between the ages of 18 and 25, 47.3% are between the ages of 26 and 35, 16.6% are between the ages of 36 and 45, and 5.3% are over the age of 45. Male respondents make up 68.6% of the sample, whereas female respondents make up 31.4%. Of those surveyed, 22.5% hold entry-level positions, 56.2% hold mid-level positions, and 21.3% hold senior-level positions. In terms of work experience, 11.2% have less than a year's experience, 37.3% have one to three years, 33.7% have four to six years, 11.8% have seven to ten years, and 5.9% have more than ten years.

5.1.2 INFERENCE

- Those between the ages of 26 and 35 make up the majority of respondents (47.3%).
- The majority of respondents (68.6%) are Male.
- The majority of respondents (56.2%) work in mid-level roles.
- Most responders (37.3%) have one to three years of experience.

Figure 1: Demographic profile of respondents



5.2 SPEARMAN'S RANK CORRELATION

Null Hypothesis H0: The variables are not correlated with each other.

Alternative Hypothesis H1: The variables are correlated with each other.

Table 2: Showing spearman's rank correlation.

Correlations				
			Impact of lean manufacturing on cost reduction.	Financial success of reducing lead time and increasing efficiency.
Spearman's rho	Impact of lean manufacturing on cost reduction.	Correlation Coefficient	1	.672**
		Sig. (2-tailed)	.	.000
		N	169	169
	Financial success of reducing lead time and increasing efficiency.	Correlation Coefficient	.672**	1
		Sig. (2-tailed)	.000	.
		N	169	169

5.2.1 Interpretation

Based on the test results, the variables' significance value (p-value) is less than 0.05, or $P < 0.05$. Consequently, the null hypothesis is rejected. There is a correlation between the variables.

5.3 KRUSKAL-WALLI'S H-TEST:

Null Hypothesis H0: There is no significant impact of lean manufacturing on cost reduction or the financial success from reducing lead time and increasing efficiency.

Alternative Hypothesis H1: There is a significant impact of lean manufacturing on cost reduction and financial success through reduced lead time and increased efficiency.

Table 3: Showing KRUSKAL-WALLI'S H-TEST.

Ranks			
	GENDER	N	Mean Rank
Impact of lean manufacturing on cost reduction.	Male	116	79.74
	Female	53	96.51
	Total	169	
Financial success of reducing lead time and increasing efficiency.	Male	116	80.72
	Female	53	94.38
	Total	169	

Test Statistics[a,b]		
	The financial impact of reducing non-value-added activities.	Productivity and operational efficiency.
Chi-Square	0.397	0.695
df	1	1
Asymp. Sig.	0.528	0.404

5.3.1 Interpretation

Since the p-values are greater than 0.05, we are unable to rule out the null hypothesis (H0). Lean manufacturing has little effect on cutting costs or the financial gain that comes from shortening lead times and boosting productivity.

6. SUMMARY OF FINDINGS

- Those between the ages of 26 and 35 make up the majority of respondents (47.3%).
- The majority of respondents (68.6%) are Male.
- The majority of respondents (56.2%) work in mid-Level roles.
- Most responders (37.3%) have one to three years of experience.
- The variables are correlated with each other.
- There is no significant impact of lean manufacturing on cost reduction or the financial success from reducing lead time and increasing efficiency.

7. SUGGESTIONS

- Improving lean training for staff members will guarantee that they fully comprehend lean methods and tools. This will lead to better execution, less waste, and increased departmental operational efficiency.
- Working with the finance team enables you to plan investments in lean projects strategically and find potential savings. Lean initiatives are guaranteed to be both financially viable and consistent with the organization's long-term goals thanks to this partnership.
- All industries, including finance, logistics, and maintenance, can greatly increase overall efficiency by implementing lean approaches. This all-encompassing application enhances waste identification, enhances process flow, and fosters a continuous improvement culture that extends beyond production.

8. CONCLUSION

This study looked at how lean manufacturing affected financial performance, with an emphasis on waste reduction, efficiency, and cost savings. Lean techniques like 5S and getting rid of non-value-added tasks greatly increased product quality, decreased downtime, and decreased inventory and storage expenses, according to data from 169 respondents in various departments. Better financial efficiency, resource use, and profitability resulted from these adjustments. Strong correlations between lean methods and reduced operating costs, increased inventory turnover, and shorter lead times were validated by statistical analysis. According to the study's findings, lean manufacturing can be used as a tool for process improvement and financial enhancement when properly applied.

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