

Efficacy of Kaizen Implementation on Productivity Among the Mechanical Industries at Maraimalainagar, Chennai

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Abstract

This study with analyzing the concepts of improving productivity with the kaizen implementation on how it influences the executions in production and operation with CNC machining, grinding, inspection, and logistics. The study will provide insight into productivity gains and operation enhancement Added to that, it covers the waste reduction, identifying how kaizen helps in minimizing defects, reducing rework, and eliminating non-value-adding activities can lead to significant cost saving and resource optimization. Additionally, it includes Employee Involvement by understanding the role of workers in implementing kaizen will highlight the importance of engagement, training, study will examine how standardizing work instruction and best practices contribute to consistent quality and efficiency in manufacturing operations. The major objectives with explore in manufacturing flow the continuous improvement process, analyze the kaizen concept adapted in various mechanical industries which implemented the kaizen methodology and identify the effective in kaizen in the production, evaluate employee involve in kaizen practice, and measure the effectiveness of standardized work instruction. A group of 98 Respondent data has been collected with a structured questionnaire and done the analysis statistical tools like Mann Whitney, Kruskal Wallis with the dependent variables and independent variable.

Keywords: Kaizen, CIP, Mechanical Industries, Productivity, Efficiency of Kaizen.

1. Introduction

In the modern manufacturing industry, achieving high productivity and efficiency is essential for maintaining competitiveness and profitability. One of the most effective methodologies for continuous improvement is kaizen, a Japanese philosophy that focuses on incremental enhancement in processes, quality, and workplace culture. By encouraging employee involvement at all levels, kaizen fosters a structured approach to identifying inefficient, reducing wastage, and improving operational performance. This study aims to evaluate the efficacy of kaizen implementation in improving productivity within mechanical industries in Maraimalai Nagar. It

will assess kaizen-driven initiatives, their impact on production efficiency and defects reduction, and the challenge in sustaining kaizen practices. By analyzing key performance indicators and case studies this research will provide practical insight into how kaizen enhances productivity. The finding will help manufacturing industries strengthen their continuous improvement effort ensuring long-term growth and sustainability [1][2].

2. Need of The Study

- **Improving Productivity:** By analyzing how kaizen influences CNC machining, grinding, inspection, and logistics the study will provide

insight into productivity gains and operational enhancements.

- **Waste Reduction:** identify how kaizen helps in minimizing defects, reducing rework, and eliminating non-value -adding activities can lead to significant cost savings and continuous improvements
- **Employee Involvement:** understanding the role of workers in implementing kaizen will highlight the importance of engagement, training, and motivation in sustaining continuous improvement.
- **Process Standardization:** The study will examine how standardizing work instruction and best practices contribute to consistent quality and efficiency in manufacturing operation.

3. Objectives

- To analyze the kaizen concept adapted in company.
- To identify the effective in kaizen in the production.
- To explore in manufacturing flow the continued improvement process.
- To evaluate employee involvement in kaizen practice.
- To measure the effectiveness of standardized work instruction.

4. Deliverables

Kaizen implementation and its impact on productivity defect reduction and operational efficiency in mechanical industries at Maraimalai Nagar, Chennai the research will provide quantitative and qualitative insight through key performance indicators cases studies and employee feedback to evaluate kaizen -driven improvement additionally it will offer strategic recommendation for optimizing challenges and fostering a culture of continuous improvement. these finding will serve as a valuable guide for industry leaders, manager, and policymakers, helping them enhance manufacturing efficiency minimize waste and drive sustainable growth [3-5].

5. Historical Research

- Bhamu. J & Sangwan. K.S (2014). This paper reviews lean manufacturing tools, including, kaizen, and their impact on operational

efficiency.it highlight case studies demonstrating defect reduction and improved production flow in manufacturing

- Glover. W.J, Farris.J.A & aken.E.M.(2011). This study examines the role of kaizen events in improving productivity and employee engagement it present data-driven insight on how structured continuous improvement programs enhance production line efficiency
- Gopalakrishnan. M., & skoogh. A. (2018). This study explores how digital tools and data analytics enhance kaizen implementation in manufacturing .it discuss predictive maintenance and real-time monitoring as key productivity drivers research
- Brunet. AP.,&New. S. (2003). This paper analyzes the impact of kaizen events on organizational culture and continuous improvement. It suggests that sustained kaizen effort led to increased efficiency and workforce motivation.
- Mowday. R. T., Porter. L. W., & Steers. R. M. (1982). This classic work examines organizational commitment and its impact on employee retention. It explains how commitment links to absenteeism and turnover. Employees who identify with company values tend to stay longer. The book suggests strategies to enhance employee loyalty.
- Doolen. T.L, Vanaken. E.M, Farris. J (2008). This research examines employee engagement in kaizen activities it discusses how leadership support and cross-functional collaboration drive successful kaizen implementation.
- Mishra. P.& Kumar. A (2021). This study explores the impact of kaizen on defect reduction in precision grinding operation. Its present empirical evidence from case studies showing improved productivity in CNC machining.
- Bhasin. S. (2020). This study evaluates the challenges and benefits of kaizen implementation in SME. It discusses common obstacles such as resistance to change and lack of top management commitment.
- McLean.R, S,Antony. J., &Danlgaard.J.J.(2017). This research assesses the long -term impact of

kaizen on production efficiency it presents a framework for integrating continuous improvement with strategic business objectives.

- Malik.R.K. &Grag. R.K. (2022). This study examines kaizen influences on the logistics flow in a manufacturing setting.as key productivity enhancers.
- Bateman.N.(2005). This paper explores the sustainability of kaizen initiatives in production environment. it emphasizes the need for continuous monitoring and feedback mechanisms.
- Kumar.s &Dhingra. A.K. (2018). This Research focuses on applying lean kaizen in SEMS to improve productivity it discusses challenges and strategies for successful lean kaizen implementation.
- Singh. G & Bhatia. O.S (2023). This study revisit kaizen role performance improvement reinforcing its effectiveness journal of continuous improvement.
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6. Research Gap

The study aims to explore the effectiveness of Kaizen implementation in small and medium-sized mechanical industries in Maraimalai Nagar, Chennai. Despite its recognition for continuous improvement, there is limited empirical data on how these industries adopt and sustain Kaizen-driven improvements. The research also aims to address practical challenges faced by these industries in terms of Kaizen Implementation and resource limitations. The study will provide real-world case studies, empirical data, and strategic recommendations to ensure long-term productivity growth [11].

7. Research Design

The analysis uses a descriptive research design to look at how efficacy of kaizen implementation on productivity among the mechanical industries. Employers' numeric data is gathered using a

quantitative research design. Observational questionnaire-based cross-sectional research was carried out. The research concentrates on examining answers from staff members in manufacturing fields. Hypothesis testing is used to assess statistical correlations. Table 7 shows Descriptive Statistics.

8. Data Collection

Structured questionnaires facilitate collection of primary information. Secondary data consists industry publications, scholarly articles, and HR regulations. The surveys of employees reflect their factors for job retention in addition to their experiences of well-being [6-10]. Survey method is used to gather responses from employees. The questionnaire includes Likert scale-based responses to measure perceptions. Responses are collected both online and through in-person distribution. Confidentiality is maintained to encourage honest feedback. The collected data is processed for statistical analysis.

9. Sampling Design

The study follows a probability sampling method i.e., simple random sampling is adopted in this study. Totally 98 respondents participated in the study. The sample size ensures statistical validity in hypothesis testing. Covers employees from various job roles and experience levels.

10. Hypothesis (Assumptions)

- H^0 : There is no identical difference between Gender and satisfaction towards kaizen implementation.
- H_1 : There is identical difference between Gender and satisfaction towards kaizen implementation.
- H^0 : There is no association difference between Education and how clear and understandable are the standardized work instructions provided
- H^1 : There is association difference between Education and how clear and understandable are the standardized work instructions provided.
- H^0 : There is no statistically difference between Employment type and how involved are employees in Kaizen Initiatives.

- **H¹:** There is statistically difference between Employment type and how involved are employees in Kaizen Initiatives.
 - **H⁰:** There is no relationship between How involved are employees in Kaizen initiatives and Do employees receive proper training on Kaizen practices.
 - **H¹:** There is relationship between How involved are employees in Kaizen initiatives and Do employees receive proper training on Kaizen practices.
 - **H⁰:** There is no Linear Relationship between How do you feel satisfy with the Kaizen process and How well Kaizen concept implemented in your organization.
 - **H¹:** There is Linear Relationship between How do you feel satisfy with the Kaizen process and How well Kaizen concept.
- Table 8 shows Descriptive statistics.

11. Analysis and Interpretation

Out of 98 respondents it is found that 93 are from Male and 5 from female workers among the manufacturing industries located at Maraimalai Nagar, Chennai, an industrial hub, Chennai. The respondents diversified from SSLC, HSC, Diploma, UG and PG respectively [12-15].

11.1 Testing of Hypothesis

11.1.1 From the Mann-Whitney U-Test

As the Hypothesis framed that There is no identical difference between Gender and satisfaction towards kaizen implementation and the response for their feedback to Management. Table 1 shows Mean Rank of Gender.

Table 1 Mean Rank of Gender
Independent-Samples Mann-Whitney U Test

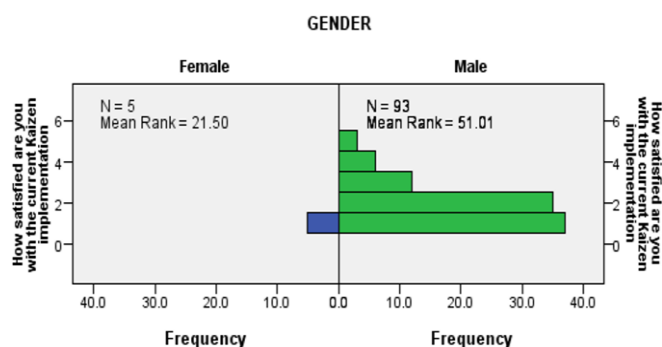


Table 2 Significance value

Total N	98
Mann-Whitney U	92.500
Wilcoxon W	107.500
Test Statistic	92.500
Standard Error	57.895
Standardized Test Statistic	-2.418
Asymptotic Sig. (2-sided test)	.016

Table 3 Hypothesis Test Summary
Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
1	The distribution of How satisfied are you with the current Kaizen implementation is the same across categories of GENDER.	Independent-Samples Mann-Whitney U Test	.016	Reject the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

From the Mann-Whitney U Test, Interpretation: Since the p-value (0.016) is less than the significance level (0.05), we reject the null hypothesis. This means there is a statistically significant difference in satisfaction levels with the Kaizen implementation between genders. Table 2 shows Significance value and Table 3 shows Hypothesis Test Summary.

11.1.2 Kruskal Wallis-F-Test

Table 4 The Mean

Ranks			
	Educational qualification	N	Mean Rank
How clear and understandable are the standardized work instructions provided	SSLC	10	55.50
	ITI	6	55.75
	HSC	7	61.93
	DIPLOMA	53	43.10
	Undergraduate	22	56.52
	Total	98	

Table 5 Test Statistics a,b

Test Statistics ^{a,b}	
	How clear and understandable are the standardized work instructions provided
Chi-Square	6.960
df	4
Asymp. Sig.	.138
a. Kruskal Wallis Test	
b. Grouping Variable: Education	

Table 6 Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
1	The distribution of How clear and understandable are the standardized work instructions provided is the same across categories of EDUCATIONAL QUALIFICATION.	Independent-Samples Kruskal-Wallis Test	.138	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

From the Kruskal-Wallis Test, it is inferred that the null hypothesis is accepted since the significance value (0.138) is greater than 0.05. Table 4 & 5 shows The Mean and Test Statistics a,b. This indicates that there is no significant difference in how clear and understandable the standardized work instructions are across different categories of educational qualifications. Therefore, educational qualification does not appear to influence perceptions of standardized work instructions. Table 6 shows Hypothesis Test Summary.

11.1.3 Kolmogorov-Smirnov Test

Table 7 Descriptive Statistics

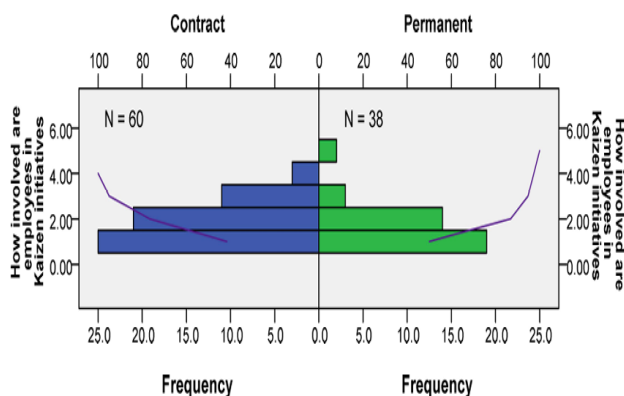


Table 8 Descriptive statistics

Descriptive Statistics					
	N	Mean	Std. Dev.	Mini.	Maxi.
Employment Type	38	2.4	0.75	1.0	4.0
How involved are employees in kaizen initiatives	60	2.1	0.85	1.00	4.00

Table 9 Kolmogorov - Smirnov test

		How involved are employees in Kaizen initiatives
Most Extreme Differences	Absolute	.102
	Positive	.053
	Negative	-.102
Kolmogorov-Smirnov Z		.491
Asymp. Sig. (2-tailed)		.970
a. Grouping Variable: EMPLOYMENT TYPE		

Table 10 Hypothesis Test Summary

Hypothesis Test Summary			
	Null Hypothesis	Test	Decision
1	The distribution of How involved are employees in Kaizen initiatives is the same across categories of EMPLOYMENT TYPE.	Independent t-Samples Kolmogorov-Smirnov Test	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

From the K-S test, The sig.value (p=0.97000), which is less than p>0.05., So, we accept the null hypothesis. Table 9 shows Kolmogorov - Smirnov test. Hence there was no statistically significance difference between Employment type and how involved are employees in Kaizen Initiatives. Table 10 shows Hypothesis Test Summary.

11.1.4 Correlation Analysis

Table 11 Descriptive Statistics

Descriptive Statistics						
		Statistic	Bootstrap ^a			
			Bias	Std. Error	95% Confidence Interval	
					Lower	Upper
How involv	M	1.8163	.0036	.0951	1.642	2.0204
	S	.9344	-.006	.08486	.7679	1.1037
	N	98	0	0	98	98
Do employ	M	1.9898	.0000	.0941	1.8163	2.183
	S	.9791	-.012	.08268	.8084	1.1248
	N	98	0	0	98	98
a. Unless otherwise noted, bootstrap results are based on 1000 bootstrap samples						

Table 12 Correlation Test

Correlations						
				How involve d are employ ees in Kaizen initiativ	Do employ ees receive proper trainin g on Kaizen practic	
How involved are employees in Kaizen initiatives	Pearson Correlation			1	.201*	
	Sig. (2-tailed)				.047	
	N			98	98	
	Bootstrap ^c	Bias		0	.007	
		Std. Error		0	.106	
		95% Confidence Interval	Lower	1	.014	
			Upper	1	.420	
Do employees receive proper training on Kaizen practices	Pearson Correlation			.201*	1	
	Sig. (2-tailed)			.047		
	N			98	98	
	Bootstrap ^c	Bias		.007	0	
		Std. Error		.106	0	
		95% Confidence Interval	Lower	.014	1	
			Upper	.420	1	
*. Correlation is significant at the 0.05 level (2-tailed).						
*. Correlation is significant at the 0.05 level (2-tailed).						
c. Unless otherwise noted, bootstrap results are based on 1000 bootstrap samples						

It can be interpreted that there was a positive correlation with the experience, How involved are employees in Kaizen initiatives Do employees receive proper training on Kaizen practices which was not statistically significant relationship

($r=0.201$., $n=100$, $p=0.047$). Table 11 shows Descriptive Statistics and Table 12 shows Correlation Test.

Table 13 Model Summary

Model Summary ^b										
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.128 ^a	.016	.006	.99687	.016	1.590	1	96	.210	2.197
a. Predictors: (Constant), How do you feel satisfy with the Kaizen process										
b. Dependent Variable: How well Kaizen concept implemented in your organization										

Table 14 Model Summary

Bootstrap for Model Summary					
Model	Durbin-Watson	Bootstrap ^a			
		Bias	Std. Error	95% Confidence Interval	
				Lo wer	Up per
1	1.912	-.680	.162	.950	1.579
a. Unless otherwise noted, bootstrap results are based on 1000 bootstrap samples					

Table 15 Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.801	.127		14.234	.000
	How do you feel satisfy with the Kaizen process	.038	.030	.128	1.261	.210

Table 16 Bootstrap for Coefficients^a

Bootstrap for Coefficients							
Model		B	Bootstrapa				
			Bias	Std. Error	Sig. (2-tailed)	95% Confidence Interval	
						Lower	Upper
1	(Constant)	1.801	-.019	.170	.001	1.409	2.129
	How do you feel satisfy with the Kaizen process	.038	.008	.059	.098	-.074	.203
a. Unless otherwise noted, bootstrap results are based on 1000 bootstrap samples							

From the Table 13 provides the R & R² Values. The Value R represents the Simple correlation and is 0.128(the “R” column), which indicates a normal degree of correlation. Table 15 shows Coefficientsa. The R² Value (the “R square column) indicates how much of the total variation in the dependent variable. In this case, 1% can be explained, which is very low. Table 16 indicates that the regression model predicts the variable significantly well. Here, $p < 0.05$, $\text{sig} = 0.001$, and indicates that, overall, the regression model statistically significantly predicts the outcome variable. To present the regression equation as: Decision ended up in Maintaining (y) = (1.801+0.038) with the felt satisfied with the Kaizen process.

12. Results and Discussion

Kaizen has significantly improved productivity in key operational areas such as CNC machining, grinding, inspection, and logistics, with measurable enhancements in cycle times, throughput rates, and overall equipment effectiveness. The application of statistical tools like Mann-Whitney and Kruskal-Wallis tests confirms these productivity improvements. Kaizen has also led to significant reductions in defect rates, rework percentages, and non-value-adding activities, resulting in cost savings through optimized resource utilization and reduced waste. Table 14 shows Model Summary. The systematic application of Kaizen principles leads to improved product quality and fewer production errors. Employee involvement and engagement are crucial for the success of Kaizen initiatives, with a positive trend in worker engagement, awareness, and satisfaction [16][17]. Standardized work instructions

have led to improved consistency in product quality and reduced operational errors, with adherence to standardized work processes demonstrating a direct correlation with enhanced productivity levels. Statistical findings validate the statistical significance of improvements in production efficiency, but industry-specific constraints, such as machine downtime and workforce skill gaps, also impact the efficiency of Kaizen practices. Addressing these challenges through proactive strategies like enhanced training programs and strong management support is essential for ensuring long-term Kaizen sustainability and effectiveness.

Conclusion

The Kaizen implementation in mechanical industries in Maraimalai Nagar, Chennai has improved productivity, defect reduction, and operational efficiency. However, the effectiveness of these initiatives is influenced by workforce engagement, training programs, and leadership commitment. Young, inexperienced employees require structured training and continuous development opportunities. Strong managerial support is needed to sustain engagement and motivation. Resistance to change and lack of timely feedback mechanisms remain challenges. Improving feedback responsiveness and performance evaluations can enhance job satisfaction. Prioritizing well-being initiatives and work-life balance programs can increase job satisfaction and retention, ultimately maximizing the benefits of Kaizen for sustainable industrial growth.

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