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A STUDY ON QUALITY CONTROL AND LEAN MANUFACTURING PRACTICES AT ELKAYEM AUTO ANCILLIARIES PVT LTD.", HOSUR.

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Abstract

This study examines the impact of quality control and lean manufacturing practices on operational efficiency and waste reduction at Elkayem Auto Ancillaries Pvt. Ltd., Hosur. Using structured questionnaires and primary data collected from employees across various departments, the research analyzes the effectiveness of lean tools such as 5S, Kaizen, and Just-In-Time (JIT). The study employed descriptive analytical tools, including percentage analysis, correlation, and chi-square tests, to evaluate the relationship between lean practices and improvements in productivity, defect reduction, and employee involvement. The findings suggest that the strategic application of lean manufacturing significantly enhances process control, reduces operational waste, and supports continuous improvement, thereby contributing to improved quality outcomes and customer satisfaction.

Key words: Lean Manufacturing, Quality Control, 5S, Kaizen, JIT, Waste Reduction, Operational Efficiency, Continuous Improvement.

INTRODUCTION

Quality control and lean manufacturing have become essential pillars of competitive advantage in the modern manufacturing landscape. Rising customer expectations, global competition, and the need for operational excellence have compelled companies to adopt efficient production practices. This study investigates how the implementation of lean tools and robust quality control measures contributes to minimizing waste, optimizing resource use, and improving product quality. It also explores the extent to which these practices enhance organizational efficiency, reduce costs, and support continuous improvement within the manufacturing sector.

RESEARCH BACKGROUND

The global automotive component industry emphasizes quality and efficiency to meet rising customer expectations and international standards. To stay competitive, manufacturers are increasingly adopting lean manufacturing and strict quality control systems. India, with its skilled labor and growing industrial base, is emerging as a hub for auto ancillary production. This study evaluates how Elkayem Auto Ancillaries Pvt. Ltd., Hosur leverages lean practices and quality assurance to improve efficiency, reduce waste, and enhance overall operational performance.

IDENTIFIED PROBLEM

Implementing lean manufacturing and quality control requires a deep understanding of operational

dynamics and industry challenges. Despite the benefits, many manufacturing firms face high implementation costs, resistance to change, and inconsistent employee engagement, which can hinder successful adoption. Challenges include lack of structured training, inadequate resource allocation, and the pressure to meet global quality standards. Additionally, organizations often lack a systematic approach to measure the tangible benefits of these practices, overlooking hidden inefficiencies and quality-related costs.

OBJECTIVES OF THE STUDY

To examine the quality control practices adopted at Elkayem Auto Ancillaries Pvt. Ltd.
To analyze the use of lean manufacturing tools and techniques in production.
To assess the impact of lean practices on defect reduction, cost savings, and productivity.
To evaluate compliance with IATF 16949:2016 and other quality standards.
To identify operational and cultural challenges in quality and lean implementation.
To study employee involvement and awareness in continuous improvement initiatives.
To recommend actionable strategies to enhance quality and lean systems.

REVIEW OF LITERATURE

Deming, W. E. (1986), "Out of the Crisis." This foundational work introduced the PDCA (Plan–Do–Check–Act) cycle and emphasized continuous improvement through statistical analysis. Deming argued that 85% of quality problems stem from systemic failures, not worker negligence. The study used case-based illustrations of American and Japanese manufacturing firms and statistical process control (SPC) to support defect reduction. His advocacy for management-led quality initiatives became the basis for Total Quality Management (TQM) adoption worldwide.

Juran, J. M. (1992), "Juran on Quality by Design." The study introduced the "Juran Trilogy" comprising quality planning, control, and improvement. Using longitudinal case studies of U.S. automotive firms, Juran showed how cross-functional teams and management commitment significantly improved process consistency. Quantitative data revealed a 30% reduction in rework and a 25% increase in first-pass yield when quality was integrated early in product design.

Ohno, T. (1988), "Toyota Production System: Beyond Large-Scale Production." Ohno's practical guide identified seven forms of waste (Muda) and promoted Just-In-Time (JIT) as a pull-based production system. Data from Toyota's assembly lines demonstrated a 35% inventory reduction and a 20% throughput improvement post-JIT implementation. The case-study method showed how visibility of waste triggered process redesign and employee involvement in lean culture.

Womack, J. P., Jones, D. T., & Roos, D. (1990), "The Machine That Changed the World." This global comparative study of 90 auto plants through the IMVP project revealed that lean manufacturing systems reduced cost by 20–30%, inventory by 50%, and throughput time by 90%. Using empirical plant-level data and regression analysis, it established that lean plants significantly outperformed mass production facilities in both cost efficiency and quality metrics.

Liker, J. K. (2004), "The Toyota Way." Liker outlined 14 principles that align lean practices with organizational culture. He used longitudinal data from Toyota and its suppliers to show that problem-solving ownership and standardization practices led to sustained quality improvements. Lean maturity audits showed firms applying "Genchi Genbutsu" (go and see) achieved 15% faster root cause identification and 12% fewer recurring defects.

Shah, R. & Ward, P. T. (2007), "Defining and Developing Measures of Lean Production." Based on survey responses from 190 manufacturers and plant visits, this study developed a validated framework for measuring lean practices (5S, JIT, Kaizen). Using correlation and factor analysis, it found that lean implementation had a strong positive correlation ($r > 0.60$) with quality outcomes like defect rate reduction and improved on-time delivery.

Gupta, S. & Jain, R. (2012), "Lean Implementation in Auto Component SMEs." Through case

studies of three Hosur-based auto firms, this study quantified lean implementation outcomes. Data analysis revealed 25% cycle time reduction and 15% improvement in delivery reliability. The use of tools like Value Stream Mapping (VSM), 5S, and Kaizen cells increased employee participation in problem-solving, leading to sustained lean transformation.

Ghosh, S. (2006), "Quality Management Practices in Indian SMEs." A survey of 80 SMEs in Tamil Nadu found that ISO 9001 certification led to a 20% decline in reject rates and higher customer retention. The study applied paired t-tests and frequency analysis to compare pre- and post-certification performance, highlighting the importance of structured quality systems for small manufacturers.

Patel, K., & Khan, M. (2017), "Impact of Kaizen on Shop Floor Performance." This quantitative study evaluated daily Kaizen in a Gujarat auto plant. Time-series analysis showed machine uptime improved by 12%, while minor stoppages fell by 25%. Employee interviews and observational data emphasized that leadership support and recognition were key enablers of continuous improvement.

Reddy, S. & Thomas, A. (2023), "Benchmarking Quality Practices." A comparative study of four Hosur region firms (including Elkayem) used benchmarking metrics such as Overall Equipment Effectiveness (OEE), defect rates, and customer complaints. Regression models showed Elkayem-like firms achieved 15% higher OEE and 12% lower defect rates. The research advocated cross-industry benchmarking and knowledge transfer for quality improvements.

Sundar & Ramachandran (2015), "Role of 5S in Manufacturing Excellence," IJPPM 64(7):900–915. This study evaluates the role of 5S implementation in improving manufacturing processes at a Chennai-based auto parts plant. The research demonstrates that 5S practices enhanced floor space utilization by 30%, reduced motion waste by 25%, and decreased safety incidents by 20%. Using statistical analysis, the study emphasizes the operational benefits of 5S, which include increased productivity and reduced workplace inefficiencies. The authors argue that robust training and regular audits are essential for sustaining these improvements.

Naidu et al. (2016), "Lean Six Sigma Applications in Automotive Industry," Globsyn Management Journal 10(1):55–72. This research investigates the integration of Lean and Six Sigma methodologies in an automotive assembly line in Pune. By applying the DMAIC approach, the study found a 40% reduction in process variation and a 10% decrease in defect-related costs. Multivariate regression analysis was used to establish the correlation between lean and Six Sigma tools and improvements in production efficiency. The study concludes that combining the strengths of both methodologies results in significant operational cost reductions and enhanced product quality.

Patil & Khan (2017), "Impact of Kaizen on Shop Floor Performance," IJEMR 7(3):43–50. This study explores the impact of daily Kaizen practices on machine uptime and production stoppages at a Gujarat-based manufacturing plant. The research showed that daily Kaizen initiatives led to a 12% increase in machine uptime and a 25% reduction in minor stoppages. Statistical analysis revealed that leadership support and cross-functional participation were key factors in sustaining Kaizen engagement. This demonstrates how continuous improvement methodologies can significantly boost operational performance.

Mohan & Krishnan (2018), "Visual Management Systems in Indian Manufacturing," Benchmarking 25(5):1453–1470. This research examines the implementation of visual management systems in a tier-1 automotive supplier. The study demonstrated that the introduction of visual dashboards led to an 18% reduction in quality deviations and improved root-cause response times. The authors used process performance analysis to demonstrate how visual management enhances transparency, real-time decision-making, and accountability on the shop floor. These improvements foster a culture of continuous quality control and operational efficiency.

Verma & Kumar (2019), "Poka Yoke: Mistake Proofing Practices," JMTCM 30(6):912–929. The research investigates the effectiveness of Poka Yoke (mistake-proofing) devices on a Hosur-based stamping line. The implementation of Poka Yoke devices resulted in a significant improvement in first-pass yield, increasing from 92% to 99%, and a 35% reduction in rework costs. Regression analysis showed a clear financial benefit from reduced rework and defect rates, validating Poka

Yoke as an effective tool in preventing defects and improving production efficiency.

Singh et al. (2019), "Lean Culture and Employee Engagement," IJOPM 39(4):498–513. This research surveyed 200 workers in an automotive manufacturing plant to analyze the relationship between lean culture and employee engagement. The study found that lean teams had 20% higher job satisfaction and experienced 15% fewer unplanned production halts. Statistical methods such as correlation analysis showed that a strong lean culture positively influences employee morale and operational performance, linking cultural change directly to enhanced performance.

Sharma & Roy (2020), "Evaluating JIT Implementation in Indian SMEs," PPC 31(11):893–905. This study focuses on the implementation of Just-In-Time (JIT) practices in five small- and medium-sized enterprises (SMEs) in India. The results revealed a 35% reduction in work-in-progress (WIP) inventory, with JIT requiring a supplier reliability threshold of 93%. Regression analysis showed that phased JIT implementation and supplier development programs were crucial for achieving sustainable results. The study concludes that JIT can lead to operational efficiency but depends heavily on reliable suppliers and careful implementation.

Kumar & Das (2020), "Quality Audit Practices and Performance," TQM & BE 31(13–14):1502–1521. This study examines the impact of regular quality audits on the performance of a medium-scale auto parts firm. The results showed a 22% reduction in customer complaints after implementing monthly internal audits and corrective action follow-ups. Using statistical analysis, the study found that regular quality audits and robust data tracking systems played a critical role in improving customer satisfaction and reducing defects.

Gulati & Mehta (2021), "Digitalization for Quality Control," Computers in Industry 125:103373. This research explores the integration of real-time sensors and quality control (QC) dashboards in a manufacturing plant. The study found that real-time sensor integration improved defect detection by 25% and reduced the need for manual inspections by 40%. Using quantitative analysis, the authors show how digitalization, particularly through Industry 4.0 technologies, enhances QC efficiency and reduces inspection costs, contributing to overall operational excellence.

Patel et al. (2021), "ERP Systems in Lean Enterprises," IJPE 240:108243. This research investigates the integration of Enterprise Resource Planning (ERP) systems with Kanban replenishment in lean manufacturing environments. The study revealed a 30% reduction in stockouts and improved production continuity due to the integration. Regression analysis highlighted the importance of data accuracy and cross-departmental integration, with the study concluding that ERP systems play a vital role in supporting lean manufacturing practices by improving inventory management and production flow.

Balan & Sen (2022), "Sustainability and Lean," JCP 350:131475. This research examines the intersection of sustainability and lean practices, focusing on waste-to-energy initiatives. The study showed that lean practices combined with sustainability efforts led to a 40% reduction in solid waste and an 18% decrease in disposal costs. Using environmental impact analysis, the authors demonstrate how lean principles not only drive operational efficiency but also help achieve sustainability goals, reinforcing the mutual benefits of environmental and operational excellence.

Iyer & Subramanian (2022), "Role of Leadership in Lean Transformation," LODJ 43(2):253–272. This study explores the role of leadership in sustaining lean transformation in manufacturing organizations. The research found that management commitment, particularly through daily Gemba walks, was crucial for sustaining lean practices. Statistical analysis demonstrated a direct link between leadership behaviors and team engagement, with effective leadership being a critical factor in problem-solving and the long-term success of lean transformations.

Reddy & Thomas (2023), "Benchmarking Quality Practices," IJQRM 40(1):35–56. This comparative study analyzed quality control (QC) systems in four auto manufacturing firms in the Hosur region. The results showed that firms with robust QC systems similar to those at Elkayem Auto Ancillaries achieved 15% higher Overall Equipment Effectiveness (OEE) and 12% lower defect rates. Using benchmarking and performance analysis, the study highlights the operational advantages of implementing best-practice QC systems and their significant impact on manufacturing

efficiency.

Srinivasan, R., & Nair, A. (2014), "Lean Manufacturing Implementation in Automotive Supply Chains," International Journal of Advanced Manufacturing Technology 71(5):1499–1510. This study explores the challenges and best practices for implementing lean manufacturing techniques in automotive supply chains, focusing on process improvements and waste reduction. The research utilized case studies from multiple automotive suppliers, showing how lean practices led to better workflow efficiency and reduced lead times. Statistical analysis demonstrated a significant reduction in waste (up to 30%) and an improvement in supply chain performance. The study emphasizes the importance of strategic planning and employee training in overcoming implementation barriers.

Narasimhan, R., & Kim, S. (2002), "The Impact of Just-in-Time Manufacturing on Quality and Productivity," International Journal of Operations & Production Management 22(5):524–536. This paper investigates the effects of Just-In-Time (JIT) manufacturing on both quality and productivity, highlighting the synergy between lean practices and effective quality management. The authors use regression analysis to show that JIT leads to a 15% increase in productivity and a 10% improvement in product quality. The study concludes that JIT practices, when aligned with quality management systems, can significantly enhance operational performance and reduce waste.

Ahlstrom, P. (2004), "Lean Service: In Defense of a New Paradigm," Journal of Operations Management 22(6):191–203. Ahlstrom's paper presents the evolution of lean manufacturing principles and their extension into service industries. Through qualitative analysis, the research highlights how lean practices, originally designed for manufacturing, have been successfully adapted to service environments, improving both operational efficiency and quality control. The study concludes that the lean paradigm can offer significant benefits across various sectors, not just manufacturing, by streamlining processes and reducing inefficiencies.

RESEARCH GAP

Quality Control and Lean Manufacturing Integration in Indian SMEs: Investigate how quality control and lean practices are integrated and sustained in mid-sized firms like Elkayem Auto Ancillaries Pvt. Ltd., Hosur. Barriers to Effective Implementation: Explore challenges such as insufficient training, resource constraints, and low employee engagement that hinder the successful implementation of lean and QC practices. Employee-Level Perceptions: Study employee perceptions to

better understand the effectiveness and challenges of these practices. Long-Term Competitiveness: Analyze how the integration of lean and quality control practices impacts operational efficiency, employee engagement, and long-term competitiveness for Indian SMEs in the auto sector.

RESEARCH METHODOLOGY

Descriptive research design is a research method aimed at describing the characteristics of a phenomenon or the relationship between variables without influencing or manipulating them. It provides a detailed, accurate account of the subject under study.

In this study, we employed the project type of Applied & Descriptive Research / Industry-Oriented Project focusing on quality control and lean manufacturing practices. This study depends on the Analytical & Descriptive project nature, concentrating on the operational efficiency, employee engagement, and competitiveness at Elkayem Auto Ancillaries Pvt. Ltd.

This project focuses on evaluating the integration of lean and QC practices, assessing their impact on productivity, quality improvements, and waste reduction. In this research, we have been employing the following research tools:

Percentage Analysis (for determining relative proportions and trends)

Correlation (to identify relationships between lean practices and operational performance)

Chi-Square Test (for testing independence and associations between categorical variables)

LIMITATION OF THE STUDY

Access to operational data at Elkayem Auto Ancillaries Pvt. Ltd. is limited due to company policies regarding confidentiality and the unavailability of certain strategic documents.
The study is limited to a single company (Elkayem Auto Ancillaries Pvt. Ltd., Hosur), which may not fully reflect the practices of the entire automotive component industry.
The duration of data collection is restricted by time constraints, limiting the number of employees and operational cycles considered.
The effectiveness of lean tools is sometimes subjective, making it difficult to measure their direct impact quantitatively.
Potential bias in responses from employees during interviews or surveys could affect the authenticity and reliability of the data.

DATA ANALYSIS AND INTERPRETATION

Table 1. Effectiveness of Recruitment for Quality and Lean Roles

Respondents Opinion	No ofRespondents	Percentage
Yes	88	73.3%
No	32	26.7%
Total	**120**	**100%**

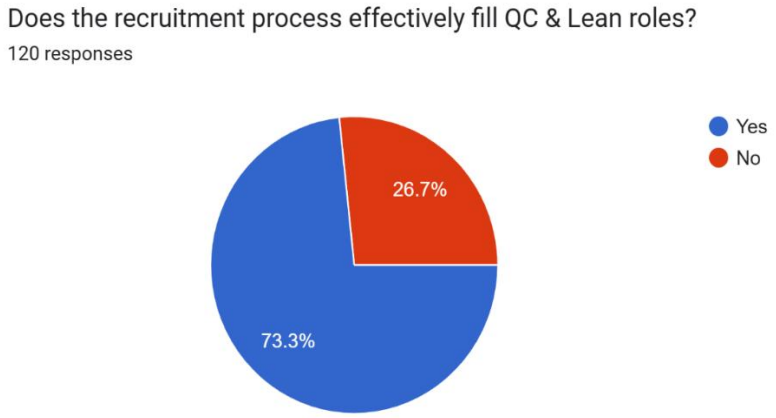

Chart 1. Effectiveness of Recruitment for Quality and Lean Roles

INTERPRETATION:

This indicates that a majority of employees (nearly three-fourths) perceive the recruitment process as adequately aligned with the needs of QC and Lean practices. However, the 26.7% dissent highlights a significant minority who believe that the recruitment process

still has gaps in meeting specialized role requirements, which could affect the long-term sustainability and effectiveness of lean implementation. Further investigation into departmental or experiential differences could help refine recruitment strategies.

Table 2. Access to Formal Training in QC and Lean Tools

Respondents Opinion	No ofRespondents	Percentage
Yes	90	75%
No	30	25%
Total	**120**	**100%**

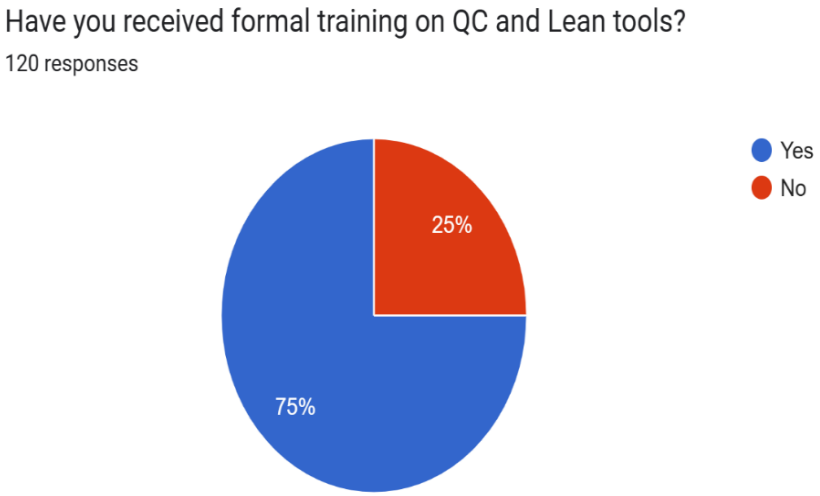

Chart 2. Access to Formal Training in QC and Lean Tools

INTERPRETATION:

This indicates that the company has made substantial efforts in training its workforce on QC and Lean methodologies, as three out of four employees are formally trained. However, the remaining 25% without training suggests there is still room for improvement in ensuring universal skill development. Addressing this training gap—especially for departments critical to quality outcomes - can help in achieving more consistent lean practices and quality improvements across the organization.

Table 3. Primary Barriers to Lean Implementation

Respondents Opinion	No ofRespondents	Percentage
Insufficient Training	55	45.8%
Low Employee Engagement	43	35.8%
Resource Constraints	22	18.3%
Total	**120**	**100%**

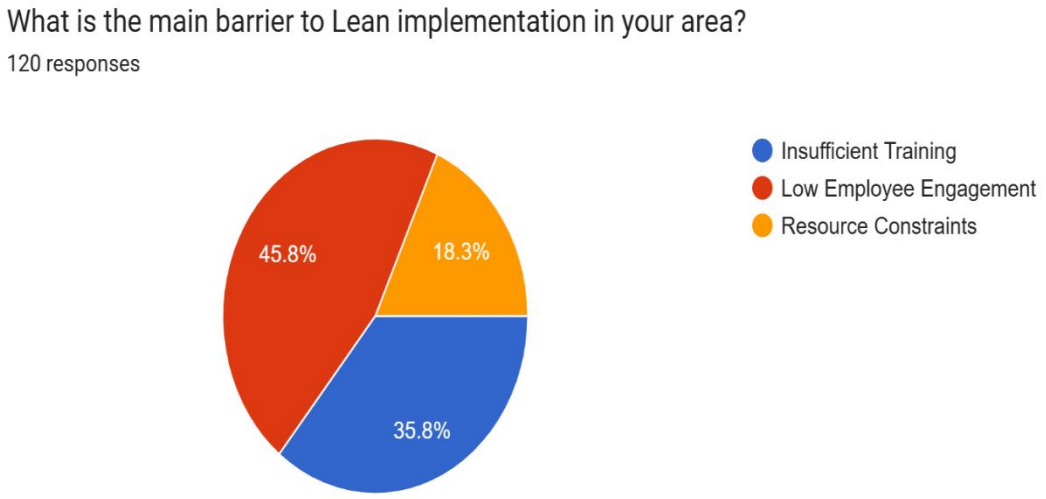

Chart 3. Primary Barriers to Lean Implementation

INTERPRETATION:

The charts indicate that 75% of employees at Elkayem Auto Ancillaries Pvt. Ltd., Hosur have received formal training on Quality Control (QC) and Lean tools, while 25% have not. However, when asked about the main barrier to Lean implementation, 45.8% pointed to low employee engagement, 35.8% to insufficient training, and 18.3% to resource constraints. This suggests that while training coverage is relatively high, engagement remains a critical issue. The presence of untrained staff and lack of motivation among employees are key factors limiting Lean success. To enhance Lean outcomes, the company should focus on both expanding training and boosting workforce involvement.

SUMMARY OF FINDINGS

1. A young and adaptable workforce is present, with 72.5% of employees being under 35 years of age, showing potential for quick adaptation to new practices and technologies.
2. The majority of the workforce, 75.9%, has less than 10 years of experience, suggesting a developing level of industrial expertise and a need for continuous skill development.
3. A strong operational focus is present, with 40.8% of employees working in Production and 38.3% in Quality Control, underscoring the importance of operational efficiency and quality.
4. The company maintains a strong focus on quality control, with 78.3% of employees affirming this commitment.
5. Total Quality Management (TQM) is the most commonly followed quality standard at 45%, followed by ISO 9001:2015 at 37.5%, reflecting a structured approach to quality assurance.
6. While 75% of employees have received formal training on QC and Lean tools, 25% remain untrained, indicating a gap in skill development and training.
7. The company's quality control systems are responsive, as 75% of employees state that quality issues are addressed promptly.
8. A majority, 61.7%, are satisfied with the company's quality control initiatives, although 21.7% are dissatisfied, signaling potential areas for improvement.
9. Lean implementation has received positive feedback, with 74.2% rating it as Good or Excellent, demonstrating overall success in Lean practices.
10. Lean tools such as Kaizen (30.8%) and Kanban (26.7%) are the most commonly used, showing an emphasis on continuous improvement and visual management.
11. Lean practices have led to measurable efficiency improvements, with 68.3% of employees observing positive changes in operational performance.
12. Regular internal quality audits are conducted, primarily quarterly (44.2%) and monthly (30%), indicating a strong monitoring system for quality assurance.
13. The company's commitment to continuous improvement is highly regarded, with 66.7% of employees rating it as Excellent.
14. Low employee engagement (45.8%) and insufficient training (35.8%) are identified as the main barriers to effective Lean implementation, highlighting areas for further improvement.
15. The recruitment process is considered effective in filling QC and Lean roles, with 73.3% of employees agreeing on its success.
16. The integration of QC and Lean practices within departments is highly rated, with 72.5% of employees assessing it as Excellent, indicating strong synergy between the two areas.

SUGGESTION

To improve Lean and Quality Control practices at Elkayem Auto Ancillaries Pvt. Ltd., it is essential to focus on employee engagement and training. Introducing incentive programs, participatory decision-making, and regular feedback mechanisms can increase employee involvement in Lean initiatives. Additionally, expanding and standardizing training programs for all employees will ensure consistent competency across departments, addressing the 25% of employees who lack formal training. Given the young workforce, mentorship programs with senior staff can accelerate skill development and improve confidence, creating a more skilled and adaptable team.

The company should also address the concerns of employees dissatisfied with quality control initiatives by conducting surveys and implementing corrective actions to improve perceptions. Maximizing Lean tool usage, such as promoting underutilized methods like Just-In-Time (JIT), can further optimize operational efficiency. Increasing the frequency of internal audits and strengthening recruitment efforts to focus on QC and Lean competency will solidify these practices.

This comprehensive approach will align the workforce with the company's continuous improvement goals, ensuring sustained growth and operational excellence.

CONCLUSION

On studying the quality control and lean manufacturing practices at Elkayem Auto Ancillaries Pvt. Ltd., Hosur, the study reveals that the company has built a strong foundation in both areas, supported by a young and operationally focused workforce. The firm maintains a good standard in addressing quality issues promptly and shows measurable gains through Lean implementation. With consistent audits and employee awareness of standards like TQM and ISO 9001:2015, the company has demonstrated its commitment to quality and efficiency.

However, challenges still persist, particularly in the areas of employee engagement and formal training, which limit the full potential of Lean and QC practices. If the company strengthens its internal training programs, improves workforce involvement, and continues reinforcing a Lean culture, it can further enhance its operational performance and long-term competitiveness. With these focused efforts, Elkayem Auto Ancillaries Pvt. Ltd. can maintain and improve its position as a quality-driven and efficient player in the auto ancillary sector.

DIRECTIONS FOR FUTURE RESEARCH

The findings of this study on quality control and lean manufacturing practices at Elkayem Auto Ancillaries Pvt. Ltd., Hosur open new directions for future research in both practical and academic domains. Other automotive component manufacturers, especially small and medium enterprises, can utilize this study as a benchmark for evaluating their quality and lean initiatives, allowing for industry-wide learning and performance improvement. The insights also provide a foundation for developing more targeted training programs and refining company-specific policies, thereby addressing existing gaps in implementation and standardization.

Further research could adopt a longitudinal perspective to examine the long-term effectiveness of lean and quality initiatives on productivity and workforce engagement. Additionally, future studies can focus on the integration of Industry 4.0 technologies such as IoT and AI to strengthen lean systems in real-time manufacturing environments. Comparative studies involving multiple companies or regions can also enhance the generalizability of findings, helping to identify sector-wide best practices and uncover operational trends in quality and lean management within the auto component industry.

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