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Research Paper

A Study of Impact of Lean Manufacturing and Operational Efficiency in the Confectionery Production Sector: Lotte India Corporation Limited

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ABSTRACT

The present research explores the effect of LM principles on operational performance within a confectionary production setting, using structured questionnaire responses from 60 respondents in six functional departments IBM SPSS was used for conducting seven data analysis methods, which include cross-tabulation with Chi-Square test, reliability test (Cronbach's Alpha = 0.918), one-way ANOVA, multivariate regression, Pearson correlation coefficient, frequency distribution, and descriptive analysis. It was concluded that organization of work according to the 5S methodology ($\beta = 0.381$, $p = .022$) and Just-in-time ($\beta = 0.270$, $p = .016$) are the main predictors of productivity improvement and account for 56.8% variance ($R^2 = 0.568$). Pearson correlation confirms the interrelationship between managerial support and employee involvement as the most correlated variables ($r = 0.768$), which proves the person-based approach to implementing lean systems. Absence of training constitutes the biggest obstacle (35%).

Keywords: *Lean Manufacturing, 5S, Just-In-Time, Kaizen, Operational Efficiency, Confectionery Industry*

It is hard to find another discipline that has contributed to modern manufacturing as significantly as lean manufacturing does. Developed as part of the Toyota Production System over several decades and used widely in various industries such as automotive and aerospace, lean manufacturing fits very well into the food manufacturing industry, which deals with small margins, short shelf life, and immediate consequences for any inefficiencies. In particular, candy manufacturers face a unique challenge when they need to maintain high product quality, prevent wastage of ingredients, and respond flexibly to the changing demands of consumers. The essential lean toolbox includes five elements: 5S, Kaizen, Just-In-Time (JIT), Kanban, and Value Stream Mapping. These provide manufacturing managers with useful approaches for removing non-value-added activities, decreasing cycle time, and embedding quality into the process as opposed to inspection at the end of the process. However, while lean has a successful history, a research gap still exists. That is, most

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research on lean focuses on lean as an isolated phenomenon or in the context of large industries. This article closes the gap. Using primary survey data gathered from 60 employees working in production, quality, maintenance, stores, and human resources divisions of a factory for the manufacture of confections, the paper explores how awareness of lean practices, the application of tools used, participation of the staff members and managerial support contribute towards achieving tangible benefits such as increased productivity, improved product quality, and waste minimisation. Seven different statistical techniques are used in the article in order to provide a multi-dimensional analysis of the impacts of lean.

LITERATURE REVIEW

The discussion about lean manufacturing in literature has grown over the last decade. This is due to a shift from the discussion of lean applications in the automobile industry to its use in other industrial and service sectors. An important study in literature was carried out by Maware, Okwu, and Adetunji (2021), who conducted a systematic review on the use of lean manufacturing processes in both developed and developing nations, and found that lean manufacturing always brings process improvement and waste reduction, as well as increases labour productivity in organisations, even though the effectiveness of lean depends on the level of organisation's readiness and implementation. The role of culture and human aspects in lean has gained increasing academic attention. As evidenced by Bortolotti et al. (2021), the effects of lean on cost, quality, and delivery are determined by organizational culture; specifically, organizations with collaborative and flat structures realize greater benefits of lean compared to those with hierarchic structures based on command and control. In this regard, the findings of this paper align well with those obtained by Sahoo (2021) when considering Indian manufacturers, which showed that besides applying lean tools, employees' involvement and cultural compatibility are crucial for obtaining efficiency improvements with regard to obstacles to the implementation of the project, Raut et al. (2022) mentioned inadequate training, resistance to change, and lack of management support as the three significant obstacles. Recent studies have started mapping the development of lean in technological settings. According to Tortorella and Fettermann (2022), combining lean and Industry 4.0 technologies enhances the optimization of processes, whereas Singh, Gupta, and Arora (2024) have demonstrated the viability of lean in food processing and validated its ability to minimize wastage and streamline material flows. Collectively, the literature provides evidence that lean is a reliable and flexible approach to operations – provided that training, management involvement, and culture play an essential role in its successful implementation.

Table 1 — Key Literature: Lean Manufacturing and Operational Efficiency

Author(s) & Year	Focus Area	Core Finding	Relevance to This Study
Maware et al. (2021)	Lean in developing economies	Lean improves flow, waste, and productivity; outcomes depend on implementation maturity	Validates lean effectiveness in developing-country food manufacturing
Panigrahi et al. (2021)	Lean tools and firm performance	JIT, Kaizen, and TQM drive efficiency; efficiency mediates business performance	Provides the theoretical framework for lean tool analysis used in this study
Bortolotti et al. (2021)	Organisational culture and lean	Collaborative cultures amplify lean gains; hierarchical structures constrain them	Contextualises the correlation between management support and employee involvement

Author(s) & Year	Focus Area	Core Finding	Relevance to This Study
Sahoo (2021)	Indian manufacturing	Lean reduces cycle time; participation and culture are critical enablers	India-specific lean context directly relevant to this study's setting
Raut et al. (2022)	Lean implementation barriers	Training gaps and weak management support are the top barriers to lean adoption	Directly aligns with this study's challenge frequency findings
Singh et al. (2024)	Food processing sector	Lean reduces waste and improves flow specifically in food manufacturing contexts	Sector-specific evidence that directly supports this study's setting
Zhang et al. (2025)	Smart factories	Lean principles remain relevant and vital in technology-driven production environments	Future-proofs lean's operational role beyond traditional manufacturing

Note. TQM = Total Quality Management; JIT = Just-In-Time.

RESEARCH METHODOLOGY

The research study employed a descriptive quantitative methodology to determine how Lean Manufacturing affects operational efficiency in the manufacturing of confections. The primary data was collected using a structured, self-administrative questionnaire that had eight major themes which were demographic profile of respondents, lean philosophy awareness, implementation of lean tools, productivity/resource usage, minimization of wastes, product quality, employee involvement and implementation difficulties. Questionnaires consisted of Likert-type scale ratings (from 1 to 5 where 1 means Strongly Disagree and 5 means Strongly Agree), Yes/No and multiple-choice questions. In all, sixty questionnaires were administered to employees working in different departments like Production (30%), Human Resources (25%), Quality Control (13.3%), Maintenance (11.7%), Stores (5%) and others (15%). Cronbach's Alpha value of the eighteen-item measure was 0.918 – Excellent reliability value.

Table 2 — Research Design Summary

Parameter	Details
Research Design	Descriptive Quantitative
Data Type	Primary — structured questionnaire
Sampling Method	Simple Random Sampling
Sample Size	N = 60 employees across six departments
Scale Reliability	Cronbach's Alpha = 0.918 (Excellent); 19 items; all 60 cases valid
Analysis Tool	IBM SPSS Statistics
Statistical Methods	Frequency Analysis, Crosstab + Chi-Square, Reliability (Cronbach's Alpha), One-Way ANOVA, Multiple Regression, Pearson Correlation, Descriptive Statistics
Independent Variables	Lean awareness; lean tool implementation (5S, Kaizen, JIT, Kanban, VSM); employee involvement; management support
Dependent Variables	Production productivity; product quality; waste reduction; overall operational efficiency

Note. VSM = Value Stream Mapping. Data collected April 2026.

Respondent Profile and Lean Landscape

The sample accurately portrays the demographics of many medium-sized food manufacturing companies – a population consisting of younger workers who are relatively new to the company. Most of the participants were aged 20 to 24 years old, representing 63.3% of the respondents. Eighty-eight percent (88.3%) of the respondents were younger than 30 years old. Forty percent of the respondents have been working less than one year, while seventy percent of them have stayed less than three years in the company. The percentage of experienced practitioners – those who had at least five years of experience – was only 10%. It is important to note how the awareness of lean is very strong in this context. Eighty-five percent of those surveyed are aware of lean production practices, and 86.7 percent have lean implemented within their organizations. As far as the principal lean technique used, 5S is the obvious leader at 45 percent, followed by Just-In-Time at 25 percent, Kaizen at 15 percent, Value Stream Mapping at 8.3 percent, and Kanban at 6.7 percent. This is significant in terms of the fact that 5S is the most tangible way of incorporating lean into practice.

Table 3 — Demographic Profile of Respondents (N = 60)

Variable	Category	Frequency	Percentage (%)
Age Group	20–24 years	38	63.3%
	25–30 years	15	25.0%
	31–35 years	5	8.3%
	Above 35 years	2	3.3%
Department	Production	18	30.0%
	Human Resources	15	25.0%
	Quality	8	13.3%
	Maintenance	7	11.7%
	Stores	3	5.0%
	Others	9	15.0%
Experience	Below 1 Year	24	40.0%
	1–3 Years	21	35.0%
	3–5 Years	9	15.0%
	Above 5 Years	6	10.0%
Lean Awareness	Aware — Yes	51	85.0%
Lean Implementation	Formally Implemented — Yes	52	86.7%

Source. Primary data collected through structured questionnaire.

Table 4 — Lean Tool Usage (Q9, N = 60)

Lean Tool	Frequency	% Usage	Operational Role
5S (Sort, Set, Shine, Standardise, Sustain)	27	45.0%	Foundation of workspace organisation; most accessible for new employees
Just-In-Time (JIT)	15	25.0%	Aligns inventory with actual production demand; reduces holding costs
Kaizen (Continuous Improvement)	9	15.0%	Drives incremental problem-solving and team-based improvement culture
Value Stream Mapping (VSM)	5	8.3%	Advanced diagnostic tool; opportunity for wider deployment
Kanban	4	6.7%	Visual scheduling tool; currently limited use with expansion potential
Total	60	100.0%	5S dominance consistent with regression findings (Section 5.4)

Note. Respondents selected one primary lean tool in use. 5S usage aligns with its significance in the regression model.

Statistical Findings

1. Crosstab Analysis — Experience and Lean Orientation

The analysis through crosstab showed whether the number of years of experience affects three different attitudes related to lean such as awareness of lean manufacturing (Question Number 5), lean knowledge (Question Number 6) and the importance of lean in enhancing production efficiency (Question Number 7). There was an obvious direction shown in this case. The awareness of lean manufacturing was higher, ranging from 83.3 percent of individuals having less than one year of experience, to 76.2 percent of those having one-to-three years of experience to 100 percent in case of individuals having three years and more. Also, 50 percent of individuals having experience of five years and above reported very good knowledge of lean management. In spite of the above tendencies, there were no statistically significant findings among the three Chi-Square tests conducted for each pair ($p>.05$). This is due to the limitations of sample size rather than the actual lack of correlation, which would be proven with larger sample sizes. It should also be noted that there were two respondents having over five years of work experience who totally disagreed on lean's importance for efficiency, probably due to frustration from lean implementations that failed to prove their worth in the long term.

Table 5 — Crosstab: Years of Experience × Lean Awareness (Q5)

Experience Group	Yes (n)	% Yes	No (n)	% No	Total	χ^2 Result
Below 1 Year	20	83.3%	4	16.7%	24	$\chi^2 = 3.978$
1–3 Years	16	76.2%	5	23.8%	21	df = 3
3–5 Years	9	100.0%	0	0.0%	9	p = .264
Above 5 Years	6	100.0%	0	0.0%	6	(NS)
Total	51	85.0%	9	15.0%	60	

NS = Not Significant at $p < .05$. Trend: awareness increases monotonically with experience; non-significance reflects sample size constraints.

2. Reliability Analysis — Cronbach's Alpha

The Cronbach's Alpha for the scale resulted in 0.918, which confidently falls under the Excellent range of reliability (threshold: $\alpha > 0.90$). There were no missing values among all 60 participants, thus, no need for listwise deletion was observed. The total mean for the scale is 68.58 (Standard Deviation = 12.450). Item means for the five-point scale items range from 3.43 to 3.82, indicating that all item scores are located within the agreement range. Support for Lean management practices (item Q27, Mean = 3.82) gained the highest score. The highest standard deviation (SD = 1.240) was observed in the case of improving the quality of products (item Q23, Mean = 3.43).

Table 6 — Reliability Statistics and Key Item Means (N = 60, 19-Item Scale)

Scale Item	Mean	SD	Interpretation
Q6: Self-Rated Knowledge of Lean Manufacturing (1–4 scale)	2.48	1.097	Moderate — genuine skill gap across the workforce
Q7: Lean Is Important for Production Efficiency	3.60	1.077	Agreement zone
Q11: Workplace Organisation Improved Through 5S	3.73	1.056	Agreement zone
Q14: JIT Helps Reduce Inventory Levels	3.77	1.015	Agreement zone
Q15: Lean Has Improved Production Productivity	3.55	1.126	Agreement zone

Scale Item	Mean	SD	Interpretation
Q23: Lean Has Improved Product Quality	3.43	1.240	Agreement zone — highest variability
Q27: Management Supports Lean Initiatives	3.82	0.930	Highest mean — strongest agreement overall
Overall Scale: Mean = 68.58 | SD = 12.450 | α = 0.918 | Items = 19			

Note. Q6 uses a 1–4 knowledge rating scale. All other items use 5-point Likert scale (1 = Strongly Disagree, 5 = Strongly Agree).

3. One-Way ANOVA — Productivity Perceptions by Experience Group

Four one-way ANOVAs tested if there was any significant difference between the perception of lean's effects on four productivity factors among the four groups according to experience. Four different factors considered were: improvement in productivity (Q15), utilization of manpower (Q16), lowering of idle time of machinery (Q17), and effective utilization of material (Q18). In all four cases, none of the four F-tests yielded any significant output, with all p-values easily exceeding the 0.05 benchmark. Perceptions of productivity improvement through lean remained constant across all experience groups, which itself is a noteworthy observation, implying that the company has succeeded in communicating the productivity benefits of lean equally well irrespective of experience.

Table 7. One-Way ANOVA: Lean Productivity Outcomes by Years of Experience (N = 60)

Dependent Variable	SS Between	df	F	p	Result
Q15: Lean Improved Production Productivity	5.050	3	1.351	.267	Not Significant
Q16: Lean Improves Manpower Utilisation	0.128	3	0.046	.987	Not Significant
Q17: Lean Reduces Machine Idle Time	1.842	3	0.552	.649	Not Significant
Q18: Lean Improves Material Usage Efficiency	1.731	3	0.517	.672	Not Significant

Note. All p > .05. df (within groups) = 56 for all variables. SS = Sum of Squares.

4. Multiple Regression — Predictors of Productivity Improvement

The analysis involved multiple regression with Q15 (lean improved the productivity of production) as the criterion and seven independent variables (Q8–Q14) as predictors. The regression model was found to be statistically significant as a whole ($F = 9.754$, $p < .001$), while explaining a substantial 56.8% variance in productivity perception ($R^2 = 0.568$, Adjusted $R^2 = 0.509$). Out of seven predictors included in the model, two were statistically significant on their own: Q11 (workplace organization was improved by 5S: $\beta = 0.381$, $p = .022$) and Q14 (JIT helped reduce inventories: $\beta = 0.270$, $p = .016$). The message hidden within these figures is obvious and quite implementable. In terms of the numerous lean tools that exist, the ones that have a structural and tangible impact – such as rearranging the work environment and aligning inventory levels with production needs – are the ones that have the greatest productivity impact on employees. While kaizen activities, additional lean tool options, and general awareness about lean tool implementation are crucial factors, their impacts on productivity seem to be delivered via the basic structural components of 5S and JIT.

Table 8 — Multiple Regression Coefficients (Dependent Variable: Q15 — Productivity)

Predictor Variable	B	SE	Beta (β)	t	p
(Constant)	.886	.805	—	1.100	.276
Q8: Lean Practices Implemented	–.513	.329	–.156	–1.562	.124
Q9: Number of Lean Tools Used	–.004	.081	–.005	–.049	.961
Q10: 5S Practices Properly Followed	.063	.157	.056	.400	.691
Q11: Workplace Organisation via 5S ✦	.407	.173	.381	2.358	.022*
Q12: Kaizen Activities Regularly Practiced	–.047	.143	–.038	–.326	.746
Q13: Employee Kaizen Participation	.154	.131	.151	1.177	.245
Q14: JIT Reduces Inventory Levels ✦	.300	.121	.270	2.480	.016*
Model Fit: R = 0.753 | R^2 = 0.568 | Adjusted R^2 = 0.509 | F(7,52) = 9.754 | p < .001					

✦ *Statistically significant predictor. *p < .05. SE = Standard Error. Dependent variable: Q15.*

5. Frequency Analysis — Implementation Challenges

In answering what they perceive as the biggest barrier to successful lean adoption, the overwhelming majority of participants indicated lack of training (35%), while others identified time problems (20%), cost concerns (18.3%), lack of management support (18.3%), and resistance to change (8.3%). What is important about this result is that it provides a direct reflection of the concrete challenges that arise when trying to adopt lean. Moreover, no less than 71.7% of the participants agree that lean has difficulties being implemented in practice. The value of this point is particularly relevant in relation to the results regarding lack of training: without training on the very concept of lean, implementing any other practices would be impossible.

Table 9 — Lean Implementation Challenges: Frequency Analysis (Q28 & Q29, N = 60)

Challenge Cited	Frequency	% of Total	Management Implication
Lack of Training	21	35.0%	Highest priority — structured, role-specific lean training is non-negotiable
Time Constraints	12	20.0%	Lean activities must be scheduled into production plans, not added on top
Cost Issues	11	18.3%	Lean ROI must be made visible and communicated regularly to all levels
Lack of Management Support	11	18.3%	Leadership visibility in lean activities is a critical success factor
Resistance to Change	5	8.3%	Structured change management and open communication reduce resistance
Lean Faces Active Challenges (Q28 — Agree/Strongly Agree)	43	71.7%	Majority self-report implementation challenges — underscores urgency

Source. Q28 and Q29 from Section H of the structured questionnaire.

6. Pearson Correlation — The Relational Architecture of Lean

A Pearson correlation analysis was done to reveal the relational network among the lean constructs and the outcome variables. Management support (Q27) with employee involvement (Q25) yields the highest single correlation value of r = 0.768 — a textbook-level demonstration of how the success of lean initiatives derives from the topmost levels through effective leadership. Just behind are the correlation between 5S activities and workplace organization (r = 0.748), and between product quality and customer satisfaction (r = 0.744). This correlation map shows how lean can be viewed as a system rather than a suite of tools.

Management commitment triggers employee participation, which supports the implementation of 5S and Kaizen processes, leading to improved workplace conditions, fewer defects, and increased productivity and product quality in the process. The two negatively correlated values between Lean Practices Implemented (Q8) and Productivity (r = –0.413) and Workplace Organization (r = –0.368) are seemingly contradictory yet logically understandable because those answering negatively on the binary Q8 question were likely to rate lean outcomes more positively using Likert scales.

Table 10 — Pearson Correlation Matrix: Key Variable Pairs (N = 60)

Variable Pair	r	p (2-tail)	Interpretation
Management Support (Q27) ↔ Employee Involvement (Q25)	0.768**	.000	Strongest association — leadership directly drives engagement
5S Practices (Q10) ↔ Workplace Organisation (Q11)	0.748**	.000	5S and workspace quality are deeply and directly linked
Product Quality (Q23) ↔ Customer Satisfaction (Q24)	0.744**	.000	Quality improvements translate directly to customer outcomes
Productivity (Q15) ↔ Product Quality (Q23)	0.700**	.000	Productivity and quality gains reinforce each other
Workplace Organisation (Q11) ↔ Defects Reduced (Q22)	0.673**	.000	5S-driven organisation directly reduces defects and rework
Kaizen Participation (Q13) ↔ Management Support (Q27)	0.632**	.000	Management commitment energises employee Kaizen participation
Productivity (Q15) ↔ Waste Reduction (Q19)	0.609**	.000	Productivity gains and waste reduction are mutually reinforcing
Lean Practices Implemented (Q8) ↔ Productivity (Q15)	–0.413**	.001	Counter-intuitive negative; likely encoding asymmetry in Q8

*** Significant at p < .01 (2-tailed). N = 60 for all pairs.*

7. Descriptive Statistics — Central Tendency and Distribution

The descriptive analysis for six variables reveals a generally favorable assessment of the impact of lean from the workforce, which manifests itself in a mean score of 3.43 to 3.82 for the five items measured using Likert's scale. The management's support for lean (Question 27) is rated the highest, registering a mean score of 3.82 (Standard Deviation = 0.930), making it the question with the greatest consensus among employees. Meanwhile, the second-lowest rating pertains to product quality improvement (Question 23), which registers a mean score of 3.43 but also the largest Standard Deviation of 1.240, as quality results depend on implementation efforts rather than merely awareness.

Table 11 — Descriptive Statistics: Key Lean Variables (N = 60)

Variable	N	Min	Max	Mean	Std. Dev.	Skewness	Kurtosis
Q6: Lean Knowledge Rating	60	1	4	2.48	1.097	–0.275	–1.315
Q7: Lean Important for Efficiency	60	1	5	3.60	1.077	–0.732	0.352
Q10: 5S Practices Followed	60	1	5	3.70	1.013	–0.974	0.885
Q22: Defects and Rework Reduced	60	1	5	3.73	0.972	–1.037	1.426
Q23: Lean Improved Product Quality	60	1	5	3.43	1.240	–0.732	0.120
Q27: Management Supports Lean	60	1	5	3.82	0.930	–1.061	1.541

Note. Q6 uses a 1–4 knowledge rating scale. All other items: 5-point Likert (1 = Strongly Disagree to 5 = Strongly Agree). Negative skewness confirms agreement-skewed distributions throughout.

DISCUSSION

When viewed in totality, the results obtained through this research study make up a cohesive picture of the concept of lean manufacturing that is based on practical application rather than theoretical discussion, such as the one presented in textbooks. There are three major issues that stand out. The importance of 5S and JIT as productivity enablers comes out strongly as the most practical lesson from the regression analysis. It is evident that out of all the lean tools being used by the manufacturing firms in the region, only these two have a tangible and visible influence on productivity. The implementation of 5S involves restructuring the environment to ensure that each tool is in its proper place, surfaces are always clean, and standards are visibly displayed. In other words, 5S improves the environment to enhance efficiency. Meanwhile, the implementation of JIT involves matching inventory levels with real-time needs and delivering material supplies as and when they are required. This helps reduce wastage of resources and improves productivity levels. The architecture of lean in human terms is the second major finding. The connection between managerial support and employee engagement ($r = 0.768$) is by far the strongest in the entire data set, even more so than the technical connections among various lean techniques and their respective output variables. It is an undeniable fact: lean is a managerial art before anything else. Employees know that when managers are walking around, engaging in Kaizen exercises, auditing the implementation of 5S criteria, and allocating funds for education, then it means that lean is indeed practiced in a sustainable fashion. If managers simply go through the motions and do not get involved in lean processes, then the organization simply engages in check-boxes. Training deficit becomes the third issue to be addressed. In fact, 35% of respondents indicate that training is the biggest hindrance, while 15% of employees have no idea about lean principles. This is not just a minor issue – it is a fundamental problem in the core of the lean program. How can one maintain 5S without understanding its significance? How can the Just-in-Time system survive in the face of old habits and the desire to save time? It is not enough to implement lean principles; it is vital to ensure proper training first and foremost.

Implication

The present research makes contributions on both a theoretical and applied level. On a theoretical level, the present research is able to contribute with empirical evidence based on data from the primary source in the confectionery sector industry that shows that 5S and JIT are the closest lean predictors of productivity in a food production setting, thus extending the current literature which is mainly focused on the automotive industry and heavy industries. The correlation framework demonstrated in this paper is also able to mirror the relationship framework presented in theoretical lean models, thus indicating that the social dimension of lean is highly generalizable across different sectors. The implications for practitioners are clear and ordered. The first step involves laying the groundwork, in other words creating the structure, by establishing a 5S program that is adhered to, monitored by auditing, and JIT that operates as a true pull system in line with the manufacturing process and not just a metric on a dashboard. Second, bridge the gap in terms of training by developing lean training programs for new hires specifically tailored to their roles and responsibilities, while providing additional training to those who have been there longer but who have learned lean in an inconsistent way. Third, be a visible manager. Floor walks, participating in Kaizens, and recognizing achievements in lean process improvement are no longer soft management skills – according to the correlations, these steps carry the most weight when trying to drive employee engagement. Fourth, share the successes achieved through waste reduction. With 45 percent of employees being neutral about waste reduction outcomes, the benefits of lean processes are still unknown to some.

CONCLUSION

The research began with a simple question: What is the effect of Lean Manufacturing on the effectiveness of operations in the context of confectionery production? It was found that Lean works, but it still hasn't reached its maximum performance, based on 60 answers received from employees and the use of seven statisticsThe regression model shows that 5S-based workplace organization ($\beta = 0.381$) and Just-in-Time inventory management ($\beta = 0.270$) significantly predict productivity enhancement, accounting for 56.8% of the total variance. Correlation analysis suggests that the relationship between management support and employee involvement is the most robust in the lean system ($r = 0.768$), thereby demonstrating that the human side of lean is inseparable from its practical side. Descriptive statistics prove a general consensus among workers regarding the importance of lean practices, as the highest score for management support for lean practices (Mean = 3.82) and none of the items falling below the agreement level prove. Lastly, frequency analysis provides a brutal analysis; 35% of the participants consider insufficient training as the main obstacle to adopting lean practices, while 71.7% believe that implementation difficulties remain.

The message is unambiguous. Establish a robust structural base by embracing rigorous 5S and comprehensive JIT practices. Develop people consistently by conducting continuous structured and role-based training for all employees, particularly new hires. Foster effective leadership by encouraging managerial participation on the shop floor. Finally, communicate results by publicizing the success of lean practices within the company. It is important to emphasise that lean manufacturing is not a project with a defined start point and a completion deadline but rather a skill which accumulates in value with the passage of time only if it becomes sufficiently rooted within the organisation to withstand changes in management and staff, as well as the pressure of actual production. Those who have succeeded in doing so are the ones who take equally seriously their investment in training, culture, and management commitment as they do the acquisition of machinery and technology. Future studies will need to test such results using larger samples and multiple sites in order to explore the relationship between lean maturity, demographics, and industry characteristics.

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Conflict of Interest

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