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Impact of Organizational Structure on Lean Implementation in Small and Medium Manufacturing Enterprises: A Mixed-Methods Approach

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Abstract

This study examines the influence of organizational structures—functional, divisional, matrix, and flat—on the implementation and outcomes of lean manufacturing within small and medium-sized manufacturing enterprises (SMEs). Using a mixed-methods approach, data were collected from five SMEs over a five-year period, involving 17 lean projects, more than 100 employees, and multiple case studies supported by interviews, focus groups, and surveys. Performance indicators such as revenue growth, return on investment (ROI), cycle time reduction, and employee perceptions were compared across structures. Findings reveal that organizational structure significantly shapes lean implementation outcomes. Matrix organizations achieved the highest mean revenue increase (53.5%) and cycle time reduction (66%), highlighting their adaptability. Flat organizations reported the strongest ROI (243.3%) and the greatest reduction in customer complaints (63.3%), reflecting the benefits of reduced hierarchy and quicker decision-making. Functional organizations demonstrated strengths in process reliability, achieving the highest on-time delivery (96%) and the lowest scrap rate (1.55%), while divisional organizations consistently underperformed, with the lowest mean scores across revenue (20.4%), customer complaint reduction (23.8%), and communication effectiveness (3.03/5). Qualitative analysis underscored common challenges, including resistance to change and decision-making delays, mitigated through leadership support, training, and cross-functional collaboration. Sentiment analysis showed that while divisional structures remained largely neutral, flat and matrix organizations experienced significant positive shifts in employee acceptance after 10 weeks. This research highlights that no single structure guarantees success; instead, aligning lean initiatives with organizational dynamics is critical. The findings provide managers with evidence-based insights to tailor lean strategies, enhance employee engagement, and maximize operational efficiency in SMEs.

Keywords
Lean Manufacturing, Organizational Structure, Small and Medium Enterprises (SMEs), Mixed-Methods Research, Case Studies, Focus Groups, Operational Efficiency.

1. Introduction
Lean manufacturing has transformed the manufacturing sector around the world by increasing efficiency and capacity utilization. It is a step-by-step approach that aims at reduction of all kinds of waste without sacrificing productivity. Large businesses have been more successful in implementing lean concepts like Just-In-Time (JIT), 5S, and continuous improvement (Kaizen), based on the principles outlined in the Toyota Production System. These efforts have been able to improve product quality, save costs, and simplify operations (Womack *et al.,* 1990; Liker, 2004). However, because of their small scale, limited resources, and organizational structures, small and medium-sized firms (SMEs) have hurdles when applying lean methods (Achanga *et al.*, 2006; Panizzolo *et al.*, 2012).

Organizational structure is typically underestimated in how it may affect the initiation or maintenance of lean initiatives. Organizational structures like flat, matrix, divisional, and functional models are often found in small and medium-sized enterprises (SMEs). Every one of these structures has distinct characteristics that impact employee engagement, operational processes, decision-making, and communication (Burns and Stalker, 1961; Mintzberg, 1979). Understanding how these structures impact the lean journey is crucial for customizing lean methodologies to the specific needs of SMEs (Browning and Heath, 2009; Anand and Kodali, 2009).

Many people in the manufacturing industry understand the value of lean manufacturing, however, the interaction between organizational structure and the success of lean initiatives in SMEs is largely unexplored. Prior studies focused mainly on big corporations or companies, overlooking the unique challenges present in smaller organizations (Shah and Ward, 2003; Hines *et al.,* 2004). This study aims to narrow this knowledge gap by understanding the effects organizational structures play on the adoption, use, and outcomes of lean manufacturing initiatives in SMEs.

The primary aim of this study is to see if there is any relationship between the effectiveness of lean implementation and organizational structure in small and medium-sized manufacturing enterprises. This study looked at five SMEs with different organizational structures to find common obstacles, workable solutions, and how employee interaction within these structures affect lean results. Using a mixed-methods methodology that combines quantitative performance measurements with qualitative case studies, the research offers a glimpse into the lean transformation process in SMEs.

This study is important because it may provide managers and practitioners of small and medium-sized enterprises with useful information and suggestions. SMEs will be able to better navigate structural barriers, streamline their processes, and achieve lasting gains by knowing how to best approach lean within their organizational structure. This study adds to the body of knowledge in manufacturing/industrial engineering and offers advice for continuous improvement effectiveness in SMEs.

2. Literature Review
2.1 Lean Manufacturing Principles and Benefits
According to American Society of Quality (ASQ, 2024), “Lean is defined as a set of management practices to improve efficiency and effectiveness by eliminating waste. The core principle of lean is to reduce and eliminate non-value adding activities and waste.” The seven types of waste (muda) which are attacked by lean manufacturing are: Defects, Overproduction, Waiting, Non-utilized talent, Transportation, Inventory, Motion and Extra-processing. The five principles used to tackle these wastes are: Value, Value Stream Mapping, Flow, Pull and Perfection. There are various tools used in the lean journey such as Kaizen, Kanban, Cellular manufacturing, 5S and Poke Yoke.

Lean manufacturing has several established advantages. Organizations that implement lean methodologies generally witness notable enhancements in productivity, inventory control, and total financial gain. Lean manufacturing, for example, has been demonstrated to shorten lead times, boost flexibility, and raise customer satisfaction (Shah and Ward, 2003). Large businesses are not the only ones that may profit greatly from lean implementation; small and medium-sized businesses (SMEs) can also reap significant advantages, however their route to lean transformation may vary because of limitations and resources (Achanga *et al.*, 2006).

Worley and Doolen (Worley and Doolen, 2015) examine how different organizational structures impact the success of lean implementation and their effect on the development of employee problem-solving skills. Key findings from their work suggest that the absence of dedicated personnel for lean initiatives hampers widespread adoption and that lean practices significantly enhance employee problem-solving skills. Yadav *et. al* (2017) studied the use of different lean tools such as 5S and JIT across an organization and the challenges encountered from both technical and employee perception perspective.

Multiple researchers have been studied the impact of organizational culture on successful implementation and long-term viability of Lean methods in SMEs. According to Bortolotti *et al.* (2015), lean finds great success when soft lean methods such as employee knowledge are incorporated into the day to day working of the organization. Secchia and Camuffo (2019) show that organizational ambidexterity—the ability to strike a balance between flexibility and stability—is important for overcoming obstacles in lean deployment. Inuwa and Abdul Rahim (2020) talk about the importance of cultural readiness and conclude that lean readiness and success can be achieved by aligning the culture of the organization with the needs for productivity gains.

Hardcopf et al.'s (2021) research demonstrates how certain cultural characteristics such as punctuality, teamwork etc. has a major influence on the success of lean systems. This is supported by Knapp (2015) and Alkhoraif and McLaughlin (2018), who emphasize that the effective use of Lean Six Sigma depends on a culture that promotes flexibility and continuous improvement. Matthews (2017) explores the tight interlink of process improvement and learning within an organization for SMEs, concluding that there is a need to develop a culture that supports both learning and growth at the same time.

All these studies demonstrate that to successfully implement and sustain lean initiatives we need a supportive and aligned company culture which values employee engagement. They emphasize the importance of a well-thought-out plan for cultural alignment that actively promotes lean approaches from both top down and bottoms up management in addition to supporting them.

2.2 Existing Studies on Lean Implementation in SMEs

Over the last few decades lean manufacturing has become widely accepted in major corporations, however, its use in SMEs is very informal and lacks adequate research into the organizational dynamics. Achanga et al. (2006) identified some factors that help in lean adoption inside SMEs such as management commitment, adequate training, and a supportive business culture. Panizzolo et al. (2012) gave an example from Indian SMEs demonstrating that lean techniques can performance gains even when the resources are scarce.

Multiple studies also highlight the difficulties faced by SMEs while implementing lean. These obstacles include a lack of knowledge of lean approaches, resistance to change, and finite financial and human resources (Knol *et al.,* 2018). Despite these obstacles, successful case studies show that it is possible for SMEs to succeed in using lean concepts and achieve desired increases in competitiveness and efficiency with a right strategy (Kumar *et al.*, 2020).

2.3 Different Types of Organizational Structures

The adoption and sustainability of lean manufacturing processes are highly influenced by the organizational structure. Typical organizational configurations consist of:

1. Functional Structure: Departments within an organization are separated according to their respective functions (e.g., marketing, production). Although specialization is permitted by this structure, silos and communication hurdles may result (Mintzberg, 1979).
2. Divisional Structure: Product lines or geographical areas are used to split organizations into units with some degree of autonomy. Although this structure increases accountability and flexibility, it may result in resource duplication (Burns and Stalker, 1961).
3. Matrix Structure: Merges divisional and functional organizations, with staff members answering both project managers and functional managers. Although this structure encourages adaptability and dynamic resource distribution, it may also lead to power conflicts and complexity (Galbraith, 1971).
4. Flat structures: encourage quicker decision-making and more employee empowerment since they have a broad span of influence and a low hierarchy. But scalability and job ambiguity might be problems with this system (Carzo and Yanouzas, 1969).

Understanding these trends is essential to designing lean implementation tactics that suit the unique structural dynamics of a business.

2.4 Research Gap

The advantages of lean manufacturing and the difficulties it presents for SMEs are widely known; yet there is a lack of information in the literature about the relationship between organizational structure and the effectiveness of lean implementation in SMEs. Most of the previous research has focused on large firms or has not adequately considered the ways in which different organizational structures impact the lean transformation process of smaller businesses. Moreover, literature lacks a comprehensive examination of this connection that considers both qualitative and quantitative data.

3. Research Methodology

3.1 Mixed-Methods Approach

This study employs a mixed-methods approach to investigate the impact of organizational structure on lean implementation in small and medium-sized manufacturing enterprises (SMEs). The mixed-methods approach combines both qualitative and quantitative data, providing a wide-ranging understanding of the phenomena under investigation. This approach is particularly appropriate for exploring complex interactions between organizational structure and lean practices (Creswell and Plano, 2011).

3.2 Sample Selection Process for SMEs

The sample for this study consists of five SMEs selected based on the following criteria:

1. **Size**: Firms with 10 to 250 employees.
2. **Industry**: Manufacturing sector. The companies ranged from product manufacturing, custom job shop, contract manufacturing, and food manufacturing
3. **Geographical Location**: Southern Minnesota, USA.
4. **Lean Implementation Status**: Firms at various stages of lean implementation (initial, intermediate, advanced).
5. **Organizational Structure**: Firms exhibiting different organizational structures (functional, divisional, matrix, flat).
6. **Organization Type**: Family Owned, Employee Owned, Corporate

The authors spent the last 5 years in these organizations conducting workforce education and multiple continuous improvement projects. The projects ranged from simple 5S of a machining area, implementation of cobotic welding to large scale kanban system for inventory management. The data was collected over a period of 5 years after interacting with more than 100 employees and conducting 17 different lean projects. The employees included President, CEO, General Manager, Plant manager, Engineering manager, Director of Engineering, Director of Operations, Assembly leads, Line supervisors, Welders, Laser cutting machine operators, and Forklift operators.

3.3 Data Collection Methods

3.3.1 Qualitative Data Collection

1. **Case Studies**: In-depth analysis of each SME to understand the context, challenges, and outcomes of lean implementation. Case studies provide rich, contextualized insights into how organizational structures influence lean practices (Yin, 2018).
2. **Semi-Structured Interviews**: Interviews with key stakeholders (e.g., managers, employees) to gather detailed information on their experiences and perceptions of lean implementation. These interviews were guided by a predefined set of questions but allow flexibility to explore emerging themes (Kvale, 1996).
3. **Focus Groups**: Group discussions with employees from different departments to capture a range of perspectives and facilitate interaction among participants. Focus groups help in identifying common issues and collective insights related to lean practices (Krueger and Casey, 2014).
4. **Document Reviews**: Examination of internal documents (e.g., process maps, performance reports, lean project plans) to gather additional data on lean initiatives and organizational structure (Bowen, 2009).

We collected data among the different dimensions within an organization such as challenges faced, strategies employed, outcomes achieved and employee perceptions over time. This data provides us with a snapshot of how the lean initiatives are progressing and being accepted by the organization as time goes on.

3.3.2 Data Collection Process

Data was collected from a series of structured interviews and surveys conducted with employees across the different organizations, each with a unique organizational structure: Divisional, Flat, Functional, and Matrix. Participants were asked detailed questions about their experiences before, during, and after the implementation of lean initiatives. This included their initial reactions, the challenges they faced, the strategies adopted to overcome these challenges, the outcomes of the initiatives, and their perceptions at multiple stages of the project lifecycle.

3.3.3 Data Compilation and Analysis

All the responses from these various sources were entered in an Excel spreadsheet, which broke down the information according to the organizational structure and the lean project executed in that particular situation. Each row in the spreadsheet corresponded to responses related to a particular lean project within that organizational structure. The data file was then processed using statistical and thematic analysis techniques to identify patterns and insights related to the effectiveness of lean methodologies within different organizational frameworks.

3.3.4 Quantitative Data Collection

1. **Surveys**: Questionnaires were distributed to employees to collect quantitative data on various aspects of lean implementation, organizational structure, and employee perceptions. Survey questions were designed using Likert scales to measure attitudes and satisfaction (DeVellis, 2016).
2. **Performance Metrics**: Data such as cycle time reduction, inventory turnover ratio, and Scrap rate before and after lean implementation was collected for each project (Neely *et al.,* 2005).
3. **Financial Data**: Data of financial metrics including cost savings, revenue growth, and return on investment (ROI) from lean initiatives was also collected (Kaplan and Norton, 1992).

3.4 Data Analysis Techniques

3.4.1 Qualitative Data Analysis

1. **Thematic Analysis**: Interview and focus group transcripts were coded to identify recurring themes and patterns. This involved reading through the data multiple times, coding significant phrases, and grouping these codes into broader themes (Braun and Clarke, 2006).
2. **Content Analysis**: Systematic analysis of documents to identify specific themes, concepts, or terms related to lean implementation and organizational structure was done. This helps in comparing the qualitative findings with documented evidence (Krippendorff, 2004).

3.4.2 Quantitative Data Analysis

1. **Statistical Analysis**: Descriptive statistics (mean, median, standard deviation) to summarize survey responses and performance metrics was calculated. Inferential statistics (t-tests, ANOVA) to compare differences between groups were also run (e.g., different organizational structures) (Field, 2013).
2. **Correlation**: Pearson or Spearman correlation analysis to explore relationships between variables such as organizational structure and lean outcomes (Cohen, 1988).

By combining these qualitative and quantitative methods, the study aims to provide a nuanced and comprehensive understanding of how organizational structure affects lean implementation in SMEs. The mixed methods approach not only allows for a detailed exploration of individual cases but also facilitates generalizable insights through statistical analysis.

Formulas

- ROI = Net Income / Cost of Investment * 100
- Increase in Revenue = (New Revenue – Old Revenue)/Old Revenue * 100
- Inventory Turnover Ratio = Cost of Goods Sold / Average Inventory
- Scrap Rate = number of Scrap Units / Total number of Units

4. Results from Qualitative Data Analysis

4.1 Coding

Each of the categories and subcategories in the qualitative analysis were coded for ease of communication and transcription as shown in Table 1.

Table 1. Category, Coded phrase, and description of qualitative factors in the study

Category	Code	Description
Challenges	Resistance to Change	Employees resist new methods and changes.
	Ambiguity of Roles	Unclear responsibilities and roles.
	Decision Making Delays	Slow decision-making process due to the need for consensus.
	Resource Constraints	Lack of necessary resources.
	Competing Priorities	Conflicting priorities within the organization.
	Lack of Know-how	Employees lack the necessary knowledge or skills.
Strategies	Employee Training	Providing training to employees.
	Leadership Support	Support from leadership.
	Clear Communication	Ensuring clear and effective communication.
	Additional Resources	Providing extra resources as needed.
	Management Involvement	Active involvement of upper management.
	Cross-functional Teams	Formation of teams with members from different departments.
	Transparency	Transparent approach to project execution.
Outcomes	Waste Reduction	Reduction in waste.
	Improved Efficiency	Increase in efficiency.
	Better Space Utilization	Optimal use of space.
	Improved Productivity	Increase in productivity.
	New Technology Integration	Successful integration of new technology.
	Lower Lead Times	Reduction in lead times.
	Standardized Work	Implementation of standardized work processes.
	Improved Production	Increase in production.
Perceptions (Before Start)	Positive Teamwork	Positive attitude towards teamwork.
	Concerns About Role Clarity	Concerns regarding clarity of roles.
	Skepticism	Skepticism about the success of initiatives.
	Doubt	Doubts about the willingness of certain individuals.
	Overwhelmed	Feeling overwhelmed with additional tasks.
	Pessimism	Pessimistic view about the effectiveness.
Perceptions (1 Week After)	Workload Concerns	Concerns about the amount of work done.
	Relief	Relief after project completion.
	Positive Change	Positive outlook towards the changes implemented.
	Frustration	Frustration over ignored suggestions.
	Common Sense	Belief that changes were common sense.
Perceptions (10 Weeks After)	Satisfaction	Satisfaction with the project's results.
	Tweaking	Desire to make further improvements.
	Adaptation	Adjustment and adaptation to the changes.
	Validation	Validation of previous beliefs or suggestions.
	Team Collaboration	Improved collaboration and teamwork.
Other Perceptions	Communication	Need for better communication about solutions.
	Decision-Making	Issues with too many decision-makers.
	Team Composition	Need for a balanced team composition.
	Clear Communication	Importance of clear communication.
	Slow Decision-Making	Slow decision-making process.

4.2 Trend Analysis

- **Challenges Faced**: Resistance to change, decision-making delays, resource constraints.
- **Strategies Employed**: Clear communication, employee training, extra resources.
- **Outcomes Achieved**: Improved customer satisfaction, waste reduction, and better space utilization.

4.2 Sentiment Analysis

Across all four organizational structures, challenges, strategies, and outcomes, were charted along with the reported metrics of sentiments before the project was implemented, one week after the project was implemented, and ten weeks after the project was implemented as shown in Table 2 and Figure 1.

Table 2. Organizational structure, Challenges, Strategies, Outcomes, and Reported Sentiments

Organizational Structure	Challenges	Strategies	Outcomes	Sentiments Before	Sentiments 1 Week After	Sentiments 10 Weeks After
Flat	Resistance to change, decision-making delays, resistance in veteran employees	Employee training, clear communication, extra resources	Waste reduction, better space utilization, improved productivity	Positive: 1 (Openness to teamwork), Neutral: 1, Negative: 1 (Doubts about effectiveness)	Neutral: 3 (Initial skepticism, waiting for results)	Positive: 3 (Acknowledgment of benefits, satisfaction)
Divisional	Competing priorities, lack of vision alignment, time constraints, not set up for lean	Cross-functional teams, data-driven analysis, incremental benefits, training in multiple languages	Standardized work, new product design, reduced worker fatigue, improvement in assembly times	Neutral: 2 (Uncertainty, awaiting outcomes), Negative: 2 (Resistance, skepticism)	Neutral: 2 (Continued adjustment, watching for outcomes) Negative: 2 (Resistance, skepticism)	Neutral: 4 (Stable acceptance, ongoing evaluation)
Functional	Silo mentality, departments operate independently	Cross-functional teams, clear communication	Reduced costs, improved customer satisfaction, employee engagement	Neutral: 3 (General acceptance, no strong sentiments)	Positive: 1 Neutral: 2 (Ongoing neutrality, no significant changes in sentiment)	Positive: 3 (Change of perception)
Matrix	Conflicts due to dual reporting, departments feel burdened	Clear communication channels, regular coordination meetings, resource management system	Reduced rework, improved flow and space utilization	Neutral: 3 (Adaptation to structure, no strong feelings either way)	Positive: 1 Neutral: 2 (Adaptation continuing, steady perception)	Positive: 2 (Improved perception) Neutral: 1 (Adaptation continuing, steady perception)

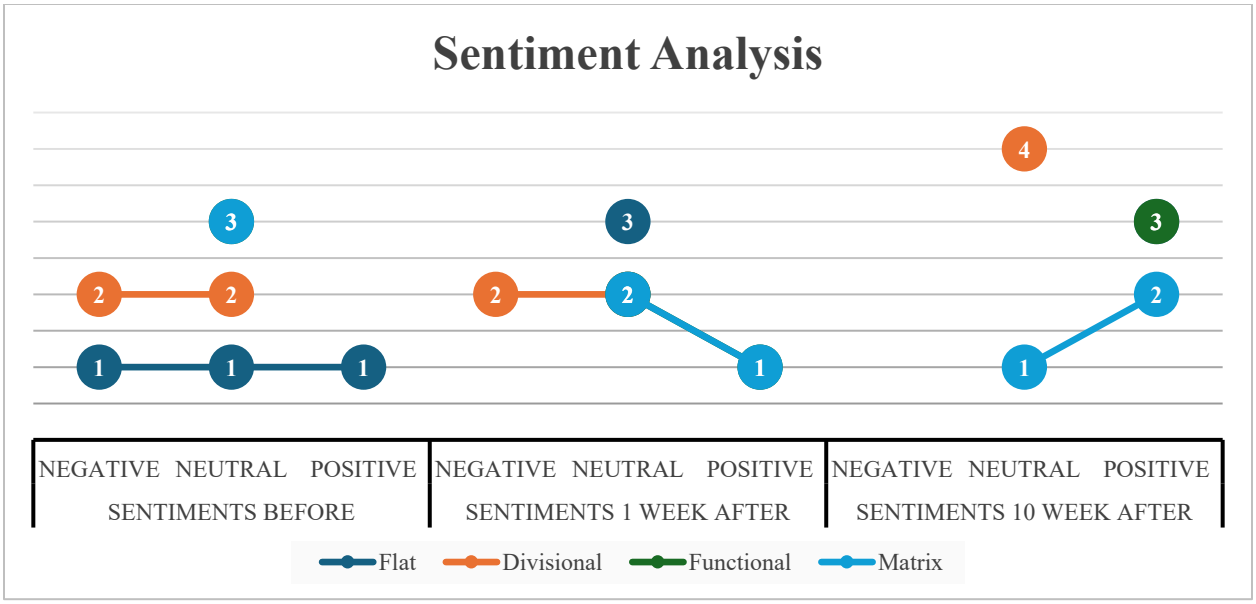

Figure 1. Summary of Sentiment Analysis one week prior, one week after, and ten week after the project implementation

Observations

- Flat organizations show a more diverse range of sentiments over time and a notable positive shift 10 weeks after project completion.
- Divisional structures faced more complex challenges regarding competing priorities and vision alignment, and their sentiments remained largely neutral over time.
- Functional and Matrix structures reported neutral sentiments early and faced specific challenges related to departmental cooperation and structural complexities. These changed as the time went on.
- These findings suggest that organizational structure influences how challenges are perceived, the types of strategies employed, and the outcomes of lean initiatives. The sentiment trends also indicate varying degrees of acceptance and satisfaction with the changes brought about by these initiatives.

4.3 Interaction Analysis

Another component of Qualitative Analysis was to perform Interaction Analysis with the leadership of the organizations from mid-level to senior levels. Steps for the Interaction Analysis performed are listed as well as the outcomes are presented on Table 3.

1. Extract Interactions: Identify how different roles (e.g., managers, supervisors, line workers) are mentioned in the challenges and strategies across different organizational structures.
2. Analyze Communication Patterns: Investigate the "Strategies Employed" for indications of communication methods and involvement across levels.
3. Role-Based Challenges and Responses: Connect specific challenges to the strategies employed by different roles in the organizational structure.
4. Effectiveness of Interactions: Assess the effectiveness of these interactions by linking them to the reported outcomes and sentiments (Table 4).

Table 3. Summary of Interaction Analysis with the Leadership

Organizational Structure	Roles Mentioned in Challenges	Roles Mentioned in Strategies	Details of Interaction
Divisional	General Manager: Competing priorities, alignment issues	Employee training in multiple languages, leadership support	**Challenges:** General Manager faces issues with alignment and competing priorities. **Strategies:** Addressed through comprehensive employee training and leadership initiatives.
Flat	Director of Engineering: Resistance to change, role ambiguity	Employee training, leadership support	**Challenges:** Director of Engineering encounters resistance and role ambiguity. **Strategies:** Focused on training and leadership support to improve clarity and reduce resistance.
Functional	None	None	No specific role-based challenges or strategies highlighted. This suggests a unified approach or less detailed data.
Matrix	Director of Product Design: Resource management, project alignment	None	**Challenges:** Resource management and alignment issues noted by Director of Product Design. **Strategies:** Lack of specific strategies to address these role-specific challenges.

4.4 Summary Analysis

- Divisional Structures tend to face challenges with competing priorities and alignment, but with strong leadership and clear goals, they can achieve high success rates. The key is managing the balance between different departmental needs effectively.
- Flat Structures offer a conducive environment for lean initiatives due to fewer hierarchical barriers, leading to quicker decision-making and higher employee involvement. Success often depends on maintaining clear communication and providing role clarity.
- Functional Structures are often slow to adapt due to the siloed nature of operations. Success is contingent upon demonstrating tangible benefits to overcome initial resistance and skepticism.
- Matrix Structures face inherent challenges due to their complex reporting lines and potential for role conflicts. Success and adaptability in such environments require robust managerial support and clear communication channels to ensure alignment and commitment across intersecting reporting lines.

Table 4. Linking of the outcomes from Interaction Analysis to the Sentiment Analysis

Organizational Structure	Influence on Employee Perceptions	Success of Lean Initiatives	Overall Adaptability
Divisional	Initial resistance, with gradual acceptance through practical applications. Significant progress seen once the benefits are realized.	Low to moderate success, dependent on alignment and managerial support.	Low to Moderate adaptability; dependent on clear leadership and consistent alignment between departments.
Flat	High openness to change with concerns about role clarity initially, moving towards strong acceptance as clarity improves.	High success, particularly when employees see direct benefits and are	High adaptability; employees quickly adjust once they understand their roles and the benefits.

		involved in the process.	
Functional	Skepticism about the necessity of changes, requiring evidence of benefits before fully embracing the initiatives.	Moderate success, heavily reliant on demonstrating clear improvements to gain full employee buy-in.	Moderate adaptability; slow to start but improves significantly once benefits are proven.
Matrix	Initial resistance due to complexities in reporting and role conflicts, with gradual adaptation supported by management.	Moderate success, often challenged by structural complexities but can be mitigated with strong managerial support.	Moderate adaptability; requires ongoing support and clear communication to overcome inherent structural challenges.

5. Quantitative Data Analysis

5.1. Descriptive Statistics

The Group Descriptives table (Table 5) presents the means, standard deviations, and standard errors for ten performance domains across four types of organizational structures: Flat, Divisional, Matrix, and Functional. For "Increase in Revenue (%)", Matrix organizations had the highest mean (53.50), while Divisional organizations had the lowest (20.43). In the "ROI (%)" domain, Flat organizations reported the highest mean (243.33), and Matrix organizations the lowest (51.00). For "Cycle Time Reduction (%)", Matrix organizations also had the highest mean (66.00), while Divisional organizations had the lowest (29.75). "On-time Delivery (%)" was highest for Functional organizations (96.00) and lowest for Divisional (78.50). In terms of "Customer Complaint Reduction (%)", Flat organizations had the highest mean (63.33), whereas Divisional had the lowest (23.75). For "Scrap Rate (%)", Functional organizations had the lowest mean (1.55), while Divisional had the highest (5.22). "Efficiency Perception" was highest for Functional organizations (4.64) and lowest for Divisional (3.51). For "Satisfaction with Structure", Matrix organizations had the highest mean (4.62) and Divisional the lowest (3.41). "Role Clarity" was highest in Matrix organizations (4.70) and lowest in Divisional (3.27). Finally, "Communication Effectiveness" was highest in Matrix organizations (4.68) and lowest in Divisional (3.03).

Table 5. Group Descriptives

	Organizational Structure	**N**	**Mean**	**SD**	**SE**
Increase in Revenue (%)	Flat	3	50.50	17.9775	10.37931
	Divisional	4	20.43	11.2031	5.60154
	Matrix	2	53.50	48.7904	34.50000
	Functional	2	31.00	9.8995	7.00000
ROI (%)	Flat	3	243.33	115.0710	66.43627
	Divisional	4	198.85	193.4448	96.72240
	Matrix	2	51.00	2.8284	2.00000
	Functional	2	90.50	10.6066	7.50000
Cycle Time Reduction (%)	Flat	3	50.00	43.3474	25.02665
	Divisional	4	29.75	15.6711	7.83555

	Organizational Structure	N	Mean	SD	SE
	Matrix	2	66.00	5.6569	4.00000
	Functional	2	60.00	5.6569	4.00000
On-time Delivery (%)	Flat	3	86.00	7.0000	4.04145
	Divisional	4	78.50	14.1067	7.05337
	Matrix	2	93.00	2.8284	2.00000
	Functional	2	96.00	1.4142	1.00000
Customer Complaint Reduction (%)	Flat	3	63.33	26.7644	15.45244
	Divisional	4	23.75	13.8894	6.94472
	Matrix	2	51.50	2.1213	1.50000
	Functional	2	55.00	29.6985	21.00000
Scrap Rate (%)	Flat	3	2.23	0.9451	0.54564
	Divisional	4	5.22	2.7410	1.37050
	Matrix	2	3.40	3.1113	2.20000
	Functional	2	1.55	0.3536	0.25000
Efficiency Perception (1-5)	Flat	3	4.37	0.3614	0.20867
	Divisional	4	3.51	0.7516	0.37579
	Matrix	2	4.37	0.0566	0.04000
	Functional	2	4.64	0.1556	0.11000
Satisfaction with Structure (1-5)	Flat	3	4.33	0.4444	0.25658
	Divisional	4	3.41	0.5864	0.29321
	Matrix	2	4.62	0.0778	0.05500
	Functional	2	4.50	0.1626	0.11500
Role Clarity (1-5)	Flat	3	4.32	0.2641	0.15246
	Divisional	4	3.27	0.8884	0.44419
	Matrix	2	4.70	0.0141	0.01000
	Functional	2	4.55	0.1980	0.14000
Communication Effectiveness (1-5)	Flat	3	4.46	0.0751	0.04333
	Divisional	4	3.03	0.7664	0.38322
	Matrix	2	4.68	0.1838	0.13000
	Functional	2	4.41	0.2475	0.17500

5.2. Assumption Checks and Normality Test

The Shapiro-Wilk test (Table 6) for normality was conducted for all ten domains to ensure the data met the normality assumption required for ANOVA. The p-values for all domains were above 0.05, indicating that the assumption of normality was not violated. Levene's Test for Homogeneity of Variances revealed p-values <0.05 for three out of ten domains, suggesting that the assumption of equal variances was violated. Consequently, a one-way ANOVA assuming unequal variances (Welch's Method) was performed.

Table 6. Assumption Checks: Normality Test (Shapiro-Wilk)

	W	p
Increase in Revenue (%)	0.953	0.686
ROI (%)	0.925	0.360
Cycle Time Reduction (%)	0.908	0.233
On-time Delivery (%)	0.938	0.500
Customer Complaint Reduction (%)	0.939	0.512
Scrap Rate (%)	0.933	0.438
Efficiency Perception (1-5)	0.901	0.188
Satisfaction with Structure (1-5)	0.966	0.841
Role Clarity (1-5)	0.945	0.587
Communication Effectiveness (1-5)	0.954	0.694

Note. A low p-value suggests a violation of the assumption of normality

5.3. One-Way ANOVA Results

The one-way ANOVA (Welch's Method) (Table 7) compared the means of the ten domains across four types of organizational structures. For "Increase in Revenue (%)", the F-statistic was 1.61 ($p = 0.367$). In "ROI (%)", the F-statistic was 8.31 ($p = 0.060$). For "Cycle Time Reduction (%)", the F-statistic was 4.19 ($p = 0.112$). "On-time Delivery (%)" yielded an F-statistic of 2.93 ($p = 0.186$). "Customer Complaint Reduction (%)" showed an F-statistic of 3.61 ($p = 0.170$). The F-statistic for "Scrap Rate (%)" was 1.92 ($p = 0.304$). "Efficiency Perception (1-5)" had an F-statistic of 2.54 ($p = 0.227$). For "Satisfaction with Structure (1-5)", the F-statistic was 4.16 ($p = 0.124$). "Role Clarity (1-5)" had an F-statistic of 3.96 ($p = 0.156$). Lastly, "Communication Effectiveness (1-5)" showed an F-statistic of 3.62 ($p = 0.191$).

Table 7. One-Way ANOVA (Welch's) Output

	F	df1	df2	p
Increase in Revenue (%)	1.61	3	2.68	0.367
ROI (%)	8.31	3	2.93	0.060
Cycle Time Reduction (%)	4.19	3	3.61	0.112
On-time Delivery (%)	2.93	3	3.33	0.186
Customer Complaint Reduction (%)	3.61	3	2.79	0.170
Scrap Rate (%)	1.92	3	2.97	0.304
Efficiency Perception (1-5)	2.54	3	3.11	0.227
Satisfaction with Structure (1-5)	4.16	3	3.29	0.124
Role Clarity (1-5)	3.96	3	2.75	0.156
Communication Effectiveness (1-5)	3.62	3	2.43	0.191

5.4. Box Plot Summaries

Increase in Revenue (%): The boxplot (Figure 2) indicated no significant differences among the organizational structures, with Matrix organizations showing the highest mean (53.50) and the highest variability (SD = 48.79).

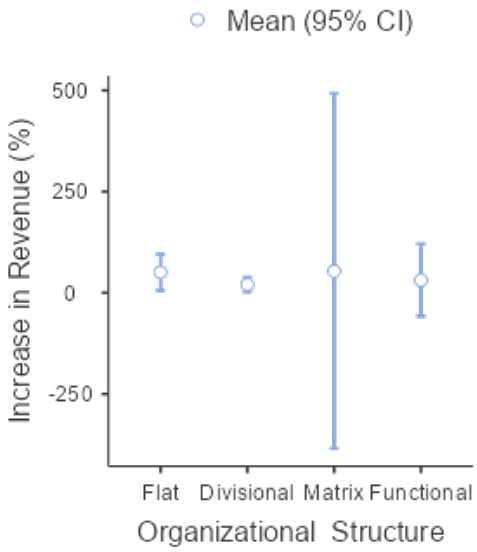

Figure 2. Comparison between Organizational Structure & Increase in Revenue (%)

ROI (%): The boxplot (Figure 3) revealed that Flat organizations had the highest mean ROI (243.33), with substantial variability (SD = 115.07), indicating significant differences in ROI performance across structures.

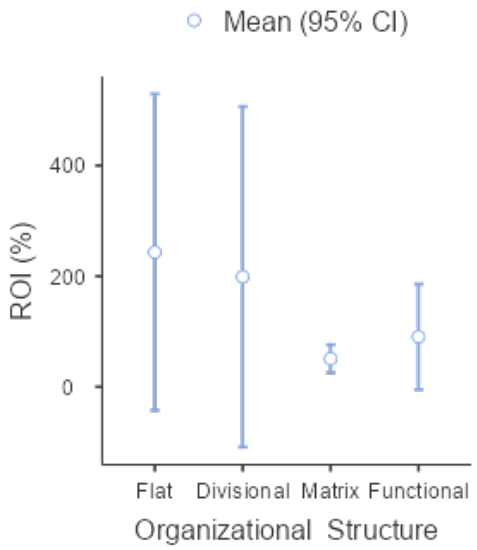

Figure 3. Comparison between Organizational Structure & ROI (%)

Cycle Time Reduction (%): The plot (Figure 4) showed Matrix organizations with the highest mean reduction (66.00) and Divisional organizations with the lowest (29.75), suggesting Matrix structures may be more effective in reducing cycle time.

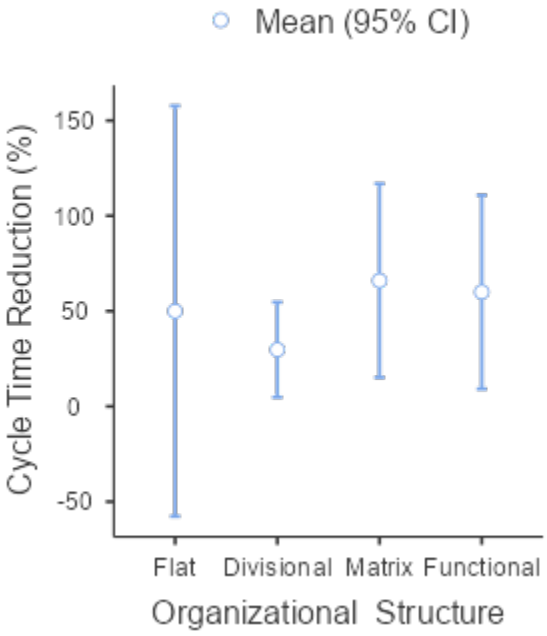

Figure 4. Comparison between Organizational Structure & Cycle Time Reduction (%)

On-time Delivery (%): Functional organizations had the highest mean on-time delivery (96.00) with relatively low variability (SD = 1.41), indicating consistent performance, whereas Divisional organizations had the lowest mean (78.50) (Figure 5).

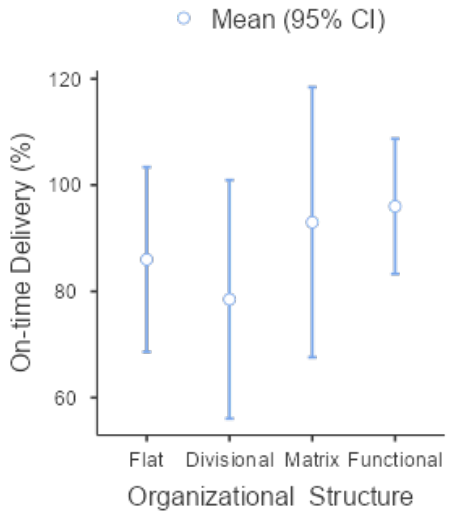

Figure 5. Comparison between Organizational Structure & On-time Delivery (%)

Customer Complaint Reduction (%): Flat organizations had the highest mean reduction in customer complaints (63.33), indicating better performance in this domain, while Divisional organizations had the lowest (23.75) (Figure 6).

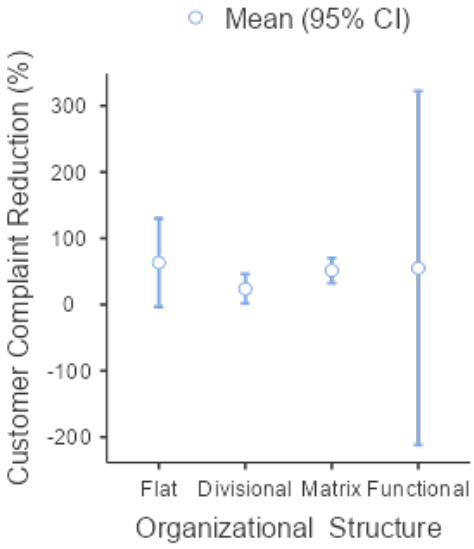

Figure 6. Comparison between Organizational Structure & Customer Complaint Reduction (%)

Scrap Rate (%): Functional organizations (Figure 7) showed the lowest mean scrap rate (1.55), indicating better performance in minimizing waste, whereas Divisional organizations had the highest mean (5.22).

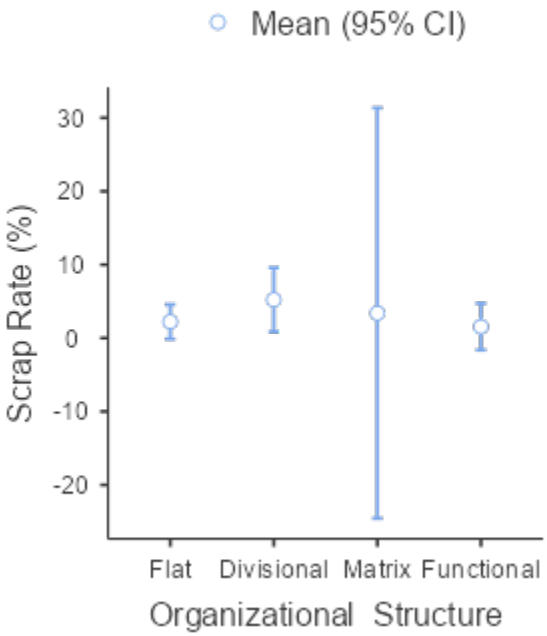

Figure 7. Comparison between Organizational Structure & Scrap Rate (%)

Efficiency Perception (1-5): Functional organizations had the highest perceived efficiency (4.64), with low variability (SD = 0.16), while Divisional organizations had the lowest mean (3.51) (Figure 8).

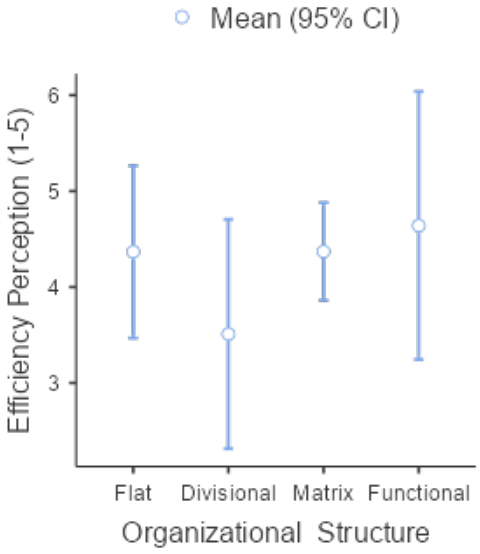

Figure 8. Comparison between Organizational Structure & Efficiency Perception (1-5)

Satisfaction with Structure (1-5): Matrix organizations reported (Figure 9) the highest satisfaction with structure (4.62), indicating a higher level of contentment with their organizational framework, with Divisional organizations reporting the lowest mean satisfaction (3.41).

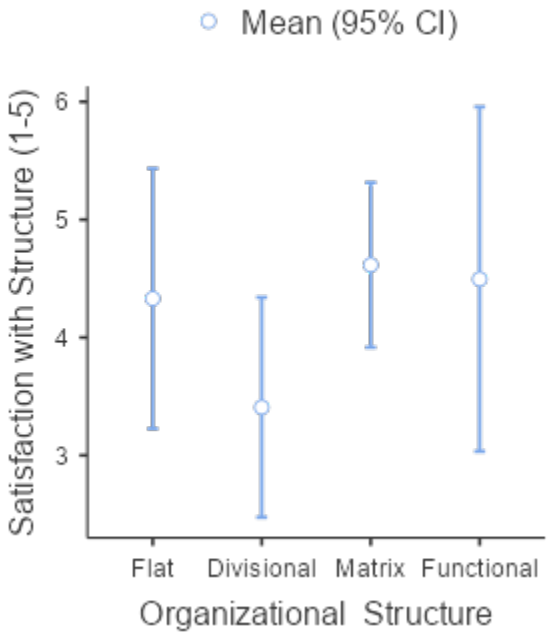

Figure 9. Comparison between Organizational Structure & Satisfaction with Structure (1-5)

Role Clarity (1-5): Matrix organizations had the highest mean role clarity (4.70), suggesting clearer role definitions within this structure, whereas Divisional organizations had the lowest (3.27) (Figure 10).

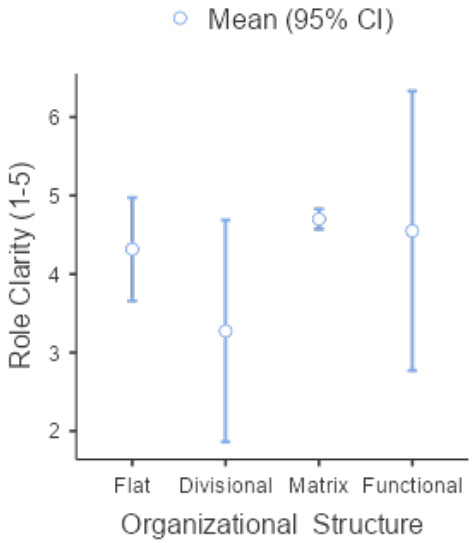

Figure 10. Comparison between Organizational Structure & Role Clarity (1-5)

Communication Effectiveness (1-5): Matrix organizations reported the highest communication effectiveness (4.68), while Divisional organizations had the lowest (3.03), suggesting better internal communication within Matrix structures (Figure 11)..

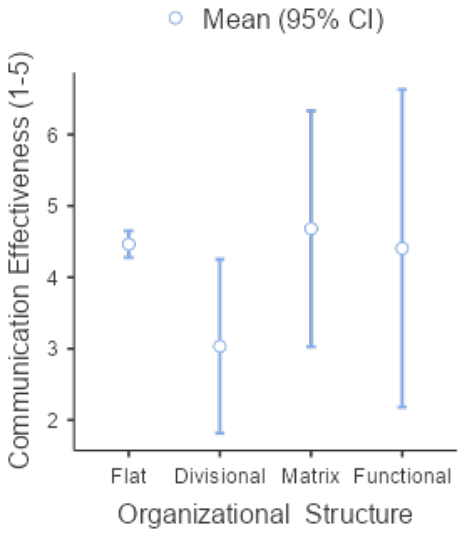

Figure 11. Comparison between Organizational Structure & Communication Effectiveness (1-5)

Note: Jamovi Statistical Software was utilized to conduct the statistical analysis on this article (R Core Team, 2021; The Jamovi Project, 2022).

6. Discussion

This study offers important new information about how organizational structures affect small and medium-sized businesses' (SMEs) adoption of lean manufacturing. The research fills a significant knowledge gap about how various organizational frameworks affect the effectiveness of lean efforts in smaller company settings using an extensive mixed-methods methodology. The results show complex relationships among organizational dynamics, employee engagement, and operational performance, providing significant insights for small and medium-sized enterprises (SMEs) starting their lean transformation journeys.

The qualitative analysis revealed numerous important themes in the lean implementation inside SMEs using case studies, interviews, and focus groups. Some of the difficulties noted were the staff members' lack of experience, decision-making delays, reluctance to change, and role uncertainty. Effective approaches which can help overcome these challenges include staff training initiatives, leadership backing, open lines of communication, resource distribution, and the formation of interdisciplinary teams. The survey revealed that the employees who were initially skeptical about the lean initiative became more receptive when they saw the benefits.

Divisional Structures face serious challenges with competing priorities and alignment of projects, but with strong leadership and clear goals, they can achieve high success rates. The key is managing the balance between different departmental needs effectively. Flat Structures are best suited for lean initiatives due to fewer hierarchical barriers, leading to quicker decision-making and higher employee involvement. Functional Structures are often slow to adapt due to the siloed nature of operations. Success depends upon demonstrating tangible benefits to overcome initial resistance and skepticism. Matrix Structures face challenges due to their complex reporting lines and potential for role conflicts. Success and adaptability in such environments require managerial support and clear communication channels to ensure alignment and commitment across the reporting lines.

The association between organizational structures and the results of lean adoption was statistically supported by the quantitative study. The greatest mean revenue gain (53.50%) and cycle time reduction (66.00%) were recorded by matrix organizations. The greatest mean ROI (243.33%) and customer complaint decrease (63.33%) were seen in flat

businesses. Functional organizations had the lowest mean scrap rate (1.55%) and the highest percentage of on-time deliveries (96.00%). When it comes to employee impressions, matrix organizations have a constant high score of 4.62, 4.70, and 4.68 on a 5-point rating, respectively, for organizational structure satisfaction, role clarity, and effective communication.

To assess the data, the study used a variety of statistical techniques, such as Levene's Test for Homogeneity of Variances, Shapiro-Wilk test for normalcy, and descriptive statistics. Welch's One-way ANOVA was employed to compare means among various organizational configurations. Although there were no statistically significant changes ($p > 0.05$) observed in any of the indicators, the data offered insightful information about performance patterns in various organizational configurations. For example, the ROI analysis produced $F(3, 2.93) = 8.31$, $p = 0.060$, whereas the examination of Increase in Revenue revealed $F(3, 2.68) = 1.61$, $p = 0.367$. These findings imply practical variations in lean implementation outcomes across different organizational structures, even if they are not statistically significant. The study's conclusions highlight important points for SMEs who are thinking about using lean manufacturing techniques or who are already doing so. The study emphasizes that there is no “one size fits all” and they should account for organizational dynamics and structures. SMEs should look at their organizational structure and employee perceptions about the workplace, peers and management during lean project implementation.

It is recommended that managers of SMEs use their organizational structures to their advantage to support lean methods. This could involve changing how resources are allocated, how decisions are made, and how to communicate to employees so that they truly understand the value of lean. The study also highlights the necessity of ongoing enhancement and modification in the application of lean methodology. Organizations must be able to adapt and be sensitive to employee attitudes and results as they change over time. Although we see that the different organizational structures performed well in different performance indicators, we recommend a more balanced strategy considering several variables. SMEs shouldn't concentrate only on one area of excellence; instead, they should work to improve on a variety of criteria.

7. Conclusion

In conclusion, this study offers an in-depth understanding of the relationship between organizational structures and the implementation of lean manufacturing in small and medium-sized enterprises. SMEs can improve their lean transformation journeys by recognizing that the organizational structures can play an important role in this path. The study's conclusions emphasize that it is crucial to maintain flexibility in implementation tactics, promote a culture of support, and match management ideas with the ideas of the employees. The significance of small and medium-sized enterprises (SMEs) in the global economy cannot be overstated, and it is important that we understand how to make use of lean principles in their distinct organizational environments. This study makes an important contribution to our understanding by providing useful insights that help improve competitiveness and operational effectiveness in the constantly evolving environment of modern manufacturing.

8. Limitations and Future Research Directions

It's critical to recognize the limits of this study even if it offers insightful information. Although the sample size is enough for insightful analysis, it might be increased in subsequent studies to improve generalization. Furthermore, because the study concentrated on SMEs in a specific region, future research may examine similar connections in various cultural and economic situations. Future research might also explore the possibility of hybrid structural models that maximize lean implementation in SMEs, as well as the long-term sustainability of lean principles across various organizational structures.

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