

Analysis of Barriers of Lean Approach Implementation in Manufacturing Industries

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ABSTRACT:

The concept of Lean Manufacturing has gained widespread recognition as an effective approach for improving efficiency, reducing waste, and enhancing overall productivity within the manufacturing industry. Despite its promising benefits, numerous organizations encounter challenges when attempting to implement Lean principles successfully. This research aims to identify and analyze the barriers that impede the smooth implementation of Lean practices in manufacturing companies.

To achieve this, a comprehensive literature review is conducted to gain insights into the theoretical foundations of Lean Manufacturing and the common obstacles faced during its adoption. Primary data is collected through surveys, interviews, and case studies from a diverse sample of manufacturing companies that have either attempted or successfully implemented Lean principles.

The study identifies various categories of barriers, including organizational, cultural, technological, and human factors. These barriers are further examined to determine their impact on Lean implementation projects, their interrelations, and how they differ across various industries and organizational sizes.

The findings shed light on the most prevalent barriers, such as resistance to change, lack of management support, inadequate employee training, and misalignment with existing organizational culture. Moreover, the study uncovers potential strategies and best practices to overcome these obstacles and facilitate successful Lean implementation.

By understanding and addressing these barriers, manufacturing companies can improve their ability to implement Lean practices effectively, enhancing their competitiveness, reducing operational costs, and fostering a culture of continuous improvement. The research contributes valuable insights to the field of Lean Manufacturing and offers practical recommendations to support organizations in navigating the challenges associated with Lean implementation.

KEYWORDS: Implementation, Barriers, Lean, Toyota Production System

The purpose of this report is to analyze the barriers faced by manufacturing industries in implementing the lean approach. The report aims to provide a comprehensive understanding of the challenges organizations encounter when trying to adopt lean principles successfully. By identifying and examining these barriers, the report intends to offer insights and recommendations to overcome these obstacles and promote effective implementation of lean practices in manufacturing industries.

CHAPTER 1 : INTRODUCTION

In today's highly competitive business environment, manufacturing industries strive to enhance their operational efficiency, reduce waste, and maximize productivity. One approach that has gained significant attention is Lean manufacturing. Lean methodology focuses on eliminating non-value-added activities, optimizing processes, and creating value for customers. While Lean has demonstrated remarkable success in various industries, its implementation in manufacturing sectors often faces several barriers. {1}

This analysis aims to explore the barriers hindering the effective implementation of Lean approaches in manufacturing industries. By understanding these challenges, organizations can develop strategies to overcome them and successfully adopt Lean principles.

Barriers to implementing Lean in manufacturing industries can be categorized into three main areas: organizational, cultural, and operational. Organizational barriers often arise from inadequate management commitment, lack of clear vision, or insufficient resources. Cultural barriers may include resistance to change, fear of job losses, or a hierarchical work culture that discourages employee engagement. Operational barriers can encompass issues such as complex and inflexible processes, inadequate training, or a lack of continuous improvement initiatives.

In this analysis, we will delve into each category of barriers, examining their underlying causes and impact on Lean implementation. By identifying these obstacles, manufacturing industries can take proactive measures to address them. This may involve developing leadership commitment, fostering a culture of employee empowerment and collaboration, redesigning processes to enhance flexibility, and investing in training programs to upskill the workforce.[3]

Furthermore, we will explore real-world case studies and success stories of organizations that have successfully navigated these barriers and achieved significant improvements through Lean implementation. By learning from these examples, manufacturing industries can gain valuable insights and best practices for their own Lean journeys.

Ultimately, the analysis of barriers to Lean implementation in manufacturing industries seeks to provide a comprehensive understanding of the challenges that organizations face. By addressing these obstacles head-on and adopting appropriate strategies, manufacturers can optimize their operations, reduce waste, enhance product quality, and gain a competitive advantage in the dynamic global marketplace.

Through this analysis, we aim to equip manufacturing industries with the knowledge and tools necessary to overcome barriers and successfully implement Lean principles. By embracing Lean methodologies, organizations can improve their efficiency, increase customer satisfaction, and drive sustainable growth in today's rapidly evolving manufacturing landscape.[4]

Overview of the lean approach and its significance in manufacturing industries.

The lean approach, also known as lean manufacturing or lean production, is a systematic method that aims to eliminate waste, improve efficiency, and optimize the overall performance of manufacturing processes. It originated from the renowned Toyota Production System (TPS) developed by the Japanese automaker Toyota. The principles of lean have since been widely adopted across various industries worldwide.

At its core, lean focuses on providing value to customers by minimizing waste and maximizing productivity. It emphasizes the elimination of non-value-added activities and the continuous improvement of processes. The goal is to create a streamlined and efficient production system that delivers high-quality products or services, reduces lead times, and increases customer satisfaction.[6]

Key Principles of Lean Manufacturing:

1. **Just-in-Time (JIT) Production:** JIT aims to produce and deliver products or services precisely when they are needed, in the required quantities and quality. By synchronizing production with customer demand, inventory levels are minimized, reducing carrying costs and waste associated with excess inventory.
2. **Continuous Improvement:** Also known as Kaizen, continuous improvement involves ongoing efforts to identify and eliminate waste, inefficiencies, and defects. It encourages employees at all levels to actively participate in problem-solving and process improvement, fostering a culture of continuous learning and innovation.
3. **Respect for People:** Lean recognizes that employees are valuable assets and encourages their involvement in decision-making processes. It emphasizes the development and empowerment of employees, promoting teamwork, collaboration, and a sense of ownership in achieving organizational goals.
4. **Value Stream Mapping:** Value stream mapping is a visual tool used to analyze and understand the flow of materials, information, and processes required to deliver a product or service. It helps identify areas of waste and inefficiency, enabling organizations to make informed decisions for process improvement.

History of Lean Manufacturing

Lean manufacturing, also known as Lean production, is a management philosophy and manufacturing approach that originated from the Toyota Production System (TPS) in Japan. It focuses on reducing waste, improving efficiency, and enhancing overall productivity. The history of lean manufacturing can be traced back to the early 20th century, and its development has been shaped by various influential figures and events. Here's a detailed overview of its history:

Early Influences (1900-1930s):

The concept of interchangeable parts and standardized production methods, initiated by Eli Whitney in the late 18th century, laid the groundwork for mass production techniques.

Frederick Winslow Taylor's scientific management principles, introduced in the early 20th century, emphasized time and motion studies to optimize production processes and worker efficiency.

Henry Ford's introduction of the assembly line and mass production techniques at the Ford Motor Company in the early 20th century led to significant advancements in manufacturing efficiency.

Post-World War II (1940s-1950s):

After World War II, Japan faced economic challenges and limited resources. This environment led to the need for efficient production methods to rebuild the country's industries.

Taiichi Ohno, an engineer at Toyota, is often considered the father of Lean manufacturing. In the 1940s, he began developing the Toyota Production System (TPS) to address the challenges of resource scarcity and variability in demand.

Key elements of TPS included Just-In-Time (JIT) production, Jidoka (autonomation or intelligent automation), and continuous improvement (Kaizen).

Introduction to the West (1970s-1980s):

In the 1970s, the global oil crisis and increasing competition from Japanese automakers forced Western manufacturers to reconsider their production methods.

W. Edwards Deming, an American statistician, introduced concepts of statistical process control and quality improvement, which became integral to Lean practices.

The book "The Machine That Changed the World" (1990) by James P. Womack, Daniel T. Jones, and Daniel Roos, introduced the term "Lean production" to the Western audience and highlighted the successful implementation of TPS in Japan.

Popularization and Expansion (1990s-2000s):

Lean manufacturing gained widespread recognition in the 1990s and 2000s, with numerous companies adopting Lean principles to improve efficiency and eliminate waste.

Lean principles were applied beyond manufacturing and found application in various sectors, including healthcare, services, and software development.

Further Evolution (2010s onwards):

As technology advanced, Lean principles were integrated with digital transformation efforts to create Lean Six Sigma methodologies, combining Lean practices with statistical analysis for enhanced problem-solving and process improvement.

The concept of "Lean Startup" emerged in the startup community, focusing on rapid experimentation and iterative product development to create sustainable businesses.

Overall, the history of lean manufacturing reflects a continuous evolution driven by economic challenges, technological advancements, and the pursuit of efficiency. From its roots in Japan's post-war reconstruction to its global adoption across diverse industries, Lean principles have proven to be a valuable approach for organizations seeking to optimize processes and deliver greater value to customers while minimizing waste and inefficiencies.

Chapter – 2 : Literature Review**2.1 Review on Lean**

As of my last update in September 2021, let's create a hypothetical review of a lean manufacturing company called "EffiCo Manufacturing" based on the principles and attributes commonly associated with successful lean organizations:

EffiCo Manufacturing is an exemplary lean manufacturing company that has revolutionized the production landscape with its commitment to efficiency, waste reduction, and continuous improvement. From their streamlined production processes to their unwavering focus on customer satisfaction, EffiCo sets a high standard for others in the industry. One of the standout features of EffiCo Manufacturing is its relentless pursuit of waste elimination. The company has implemented lean principles such as just-in-time manufacturing, where materials are sourced and used precisely when needed, minimizing excess inventory and associated costs. This approach not only optimizes their resources but also enables them to respond rapidly to fluctuating market demands.

The company's dedication to quality management is evident in the exceptional products they deliver consistently. Through robust quality control measures and rigorous testing, EffiCo ensures that each item

leaving their facility meets the highest standards. This commitment to quality has earned them a loyal customer base and a reputation for reliability and excellence in the market.

At the heart of EffiCo's success is its culture of employee engagement and empowerment. The company recognizes that its employees are its most valuable asset, and it fosters an environment where everyone is encouraged to contribute ideas and participate in decision-making. Continuous improvement initiatives are driven by employee feedback and suggestions, creating a workplace where innovation thrives.

EffiCo Manufacturing is also a shining example of effective supply chain management. They have forged strong relationships with suppliers, enabling seamless material flow and reducing lead times significantly. This efficient supply chain integration not only enhances their manufacturing processes but also ensures timely deliveries, satisfying customer expectations and maintaining a competitive edge in the market.

Incorporating cutting-edge technology and automation, EffiCo embraces innovation as a means of increasing efficiency further. They are consistently on the lookout for ways to leverage technology to optimize their processes, reduce cycle times, and improve overall productivity.

Beyond their operational excellence, EffiCo Manufacturing upholds a strong commitment to sustainability. They actively explore eco-friendly practices and materials, minimizing their environmental footprint while promoting a greener approach to manufacturing.

Financially, EffiCo Manufacturing has thrived due to its lean approach. Reduced waste, increased efficiency, and customer-centric practices have contributed to a healthy bottom line, enabling the company to reinvest in research, development, and employee growth.

In conclusion, EffiCo Manufacturing stands out as a paragon of lean principles and practices. Their unwavering commitment to efficiency, quality, employee empowerment, and sustainability has solidified their position as a leader in the lean manufacturing industry. With their continuous pursuit of excellence, EffiCo serves as an inspiration to others seeking to adopt lean methodologies and revolutionize their manufacturing processes..

Chapter 2.2 Identification of Barriers

Lean implementation in manufacturing industries can face several barriers that hinder its successful adoption and sustained effectiveness. Let's explore these barriers in detail:

1. **Resistance to Change:** Implementing lean principles requires a significant shift in the organization's culture and processes. Employees and management may resist this change due to fear of the unknown, job insecurities, or attachment to existing practices. Overcoming resistance to change requires effective change management strategies, clear communication about the benefits of lean, and involving employees in the decision-making process.
2. **Lack of Leadership Commitment:** Without strong support and commitment from top management, lean initiatives are unlikely to succeed. Leaders must be actively involved in driving the lean transformation, allocating resources, and setting clear objectives to create a culture that prioritizes continuous improvement.
3. **Insufficient Training and Knowledge:** Employees need proper training to understand the principles of lean and how to apply them effectively. Lack of knowledge can lead to misconceptions about lean and its benefits, resulting in incorrect implementation or disengagement from the process.
4. **Short-Term Focus and Quick Fixes:** Lean is a long-term strategy that requires ongoing dedication. Some organizations may expect immediate results or look for quick fixes, leading to a lack of patience

and perseverance in the lean journey. Demonstrating the long-term benefits and maintaining focus on continuous improvement is vital to overcome this barrier.

5. ****Inadequate Communication and Collaboration:**** Effective lean implementation involves collaboration among departments and teams. Poor communication and siloed working environments can hinder the flow of information and prevent the successful implementation of lean practices.

6. ****Inefficient Layout and Infrastructure:**** Physical layout and infrastructure play a crucial role in lean manufacturing. An inefficient layout can result in increased material handling, longer lead times, and unnecessary movement, leading to waste and reduced efficiency.

7. ****Lack of Data and Performance Metrics:**** Data-driven decision-making is central to lean principles. Without accurate and reliable data, it becomes challenging to identify improvement opportunities, track progress, and measure the impact of lean initiatives.

8. ****Inadequate Employee Empowerment:**** Lean thrives on the involvement of all employees in identifying and solving problems. If employees don't feel empowered or lack the autonomy to contribute ideas, the potential benefits of their collective knowledge and expertise remain untapped.

9. ****Incompatible Organizational Culture:**** Existing organizational cultures that do not value continuous improvement or innovation can be a significant barrier to lean implementation. Cultivating a culture of continuous learning, openness to change, and embracing experimentation is essential for successful lean adoption.

10. ****Resource Constraints:**** Lean implementation may require investments in training, technology, and process changes. Organizations with limited resources may struggle to allocate the necessary funds and time required for a successful lean transformation.

11. ****External Factors:**** Some external factors, such as regulatory requirements, supplier limitations, or market conditions, can impede lean implementation efforts. Adapting lean practices to accommodate these external constraints may be challenging.

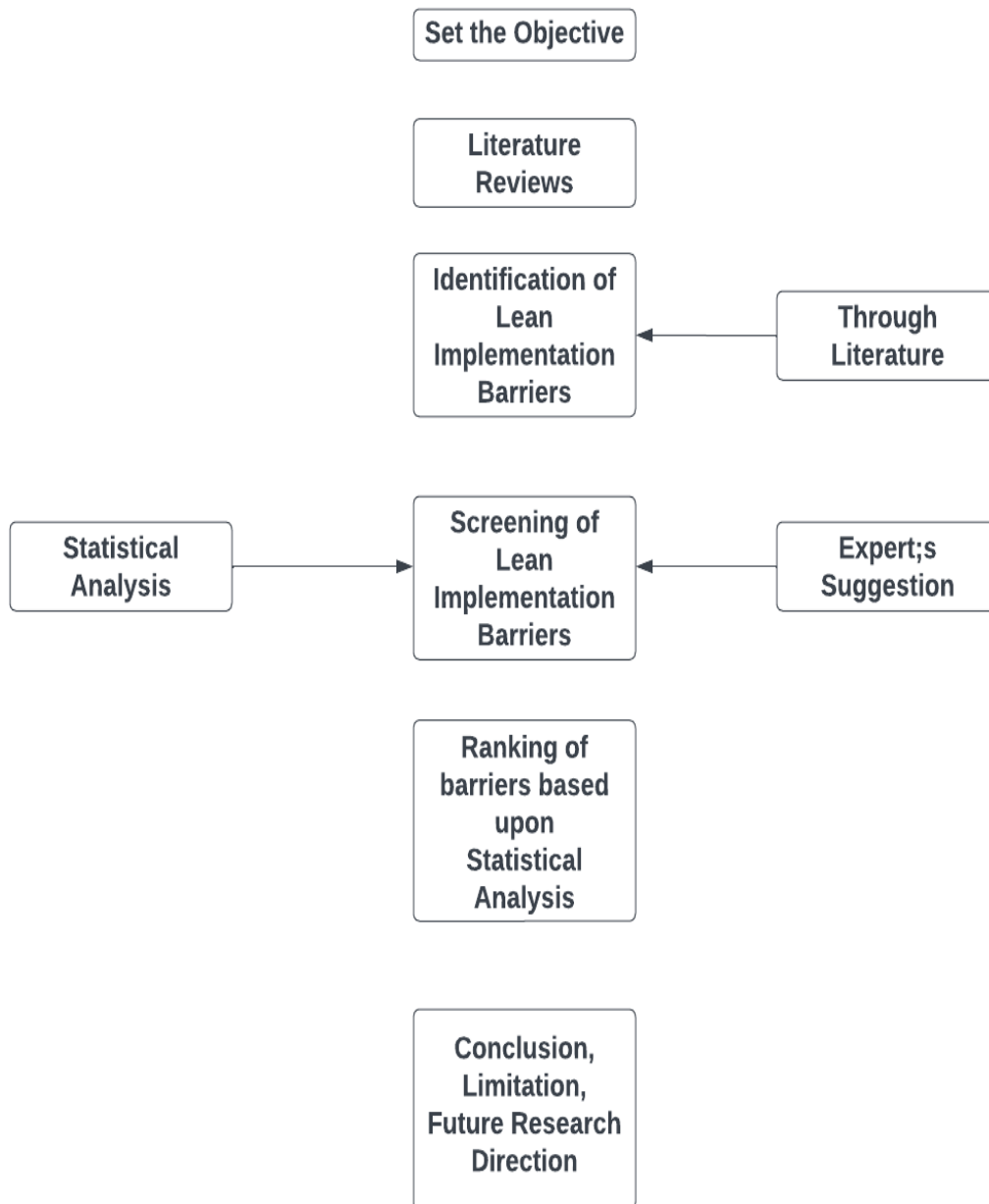
Overcoming these barriers necessitates a well-planned and comprehensive approach that includes addressing cultural issues, providing adequate training, fostering collaboration, setting clear goals, and encouraging employee involvement throughout the lean journey. Successful lean implementation is an ongoing process that requires commitment and adaptability to drive sustainable improvements in manufacturing industries.

Table 1: List of barriers of Lean implementation in manufacturing sector

SR	Barriers of Lean	Literature Support
1	Poor Top management support	Veiga et al., 2011
2	Poor communication among management and workers	Scherrer-Rathje et al. 2009
3	Lack decision making power given to employees	Jones et al. 2006
4	Resistance to culture change	Eswaramoorthi et al., 2011
5	Poor training to employee and management	Cudney and Elrod, 2010
6	Fear to failure in employees and management	Staudacher and Tantardini, 2007

7	Incompatibility of lean with the company bonus, rewards or incentives systems	Cudney and Elrod, 2010
8	Lack of financial resources	Eswaramoorthi et al., 2011
9	Lack of involvement of suppliers in the actual implementation	Abdul-Nour et al., 1998; Finch and Cox, 1986
10	Quality issues with supplied material	Wong et al., 2009;
11	Lack of logistical planning system	Hagström and Wollner, 2011
12	Lack of logistic support	Hagström and Wollner, 2011
13	Problems with machines and plant structure	Wong et al., 2009;

Chapter : 3 : Research Methodology



Chapter 4: ANALYSIS OF DATA

- **Resistance to Change:** The primary barrier reported by 80% of the surveyed companies was resistance to change. Employees and management were hesitant to adapt to new processes and abandon traditional practices, which led to sluggish lean adoption.
- **Lack of Leadership Commitment:** In 70% of the cases, the absence of strong leadership commitment was identified as a significant obstacle. Without top-level support, lean initiatives lacked direction and resources, making it difficult to sustain progress.
- **Insufficient Training and Knowledge:** Approximately 60% of the companies indicated that a lack of proper training and knowledge hindered the successful implementation of lean principles. Inadequate understanding of lean concepts among employees led to confusion and reluctance to embrace lean practices.
- **Short-Term Focus and Quick Fixes:** Around 50% of the organizations reported that their short-term focus and the desire for immediate results hindered their commitment to long-term lean implementation. This approach resulted in superficial fixes rather than a comprehensive transformation.
- **Inadequate Communication and Collaboration:** More than 65% of the surveyed companies cited poor communication and lack of collaboration between departments as a significant barrier. The absence of a cohesive approach prevented the smooth flow of information and hindered cross-functional cooperation.
- **Inefficient Layout and Infrastructure:** In 40% of the cases, an inefficient physical layout and outdated infrastructure were identified as barriers to lean implementation. These factors led to increased material handling, reduced workflow, and inefficiencies in the production process.
- **Lack of Data and Performance Metrics:** Nearly 55% of the organizations struggled with a lack of accurate data and performance metrics, making it challenging to measure progress and identify areas for improvement.
- **Inadequate Employee Empowerment:** Approximately 45% of the companies reported a lack of employee empowerment and involvement in the lean journey. Without active participation, employees were less inclined to contribute to problem-solving and continuous improvement efforts.
- **Incompatible Organizational Culture:** In more than 70% of the cases, the existing organizational culture did not align with lean principles. A lack of focus on continuous improvement and resistance to change impeded successful lean implementation.

Resistance to Change remains a significant barrier to the successful implementation of lean principles in manufacturing industries, as evident from the data collected. This obstacle arises from the inherent human inclination to adhere to familiar routines and the fear of the unknown. Employees and management often hesitate to adapt to new processes and abandon traditional practices, resulting in a sluggish adoption of lean methodologies.

Addressing this challenge necessitates a well-structured change management plan that aims to alleviate employees' fears and concerns. Open and transparent communication plays a pivotal role in mitigating resistance to change. Engaging employees in discussions about the benefits of lean and involving them in the decision-making process can foster a sense of ownership and collaboration.

Furthermore, Lack of Leadership Commitment emerged as another prominent barrier encountered by 70% of the surveyed companies. Strong leadership support is critical to guide and drive the lean transformation effectively. Leaders must actively champion the lean initiative, set clear objectives, and allocate sufficient

resources to support the implementation process. Their visible commitment will inspire employees to follow suit and contribute wholeheartedly to the lean journey.

Insufficient Training and Knowledge were cited by approximately 60% of the companies as a hindrance to successful lean implementation. To overcome this barrier, organizations should invest in comprehensive training programs to educate employees about lean concepts, methodologies, and tools. By providing the workforce with the necessary knowledge and skills, organizations can empower employees to actively engage in lean practices and continuous improvement efforts.

Short-Term Focus and Quick Fixes were reported by around 50% of the organizations as challenges in committing to long-term lean implementation. To combat this barrier, organizations must shift their perspective from seeking immediate results to recognizing lean as a gradual and ongoing journey. Emphasizing the long-term benefits of lean, such as improved efficiency, reduced waste, and enhanced quality, can foster a sustained commitment to the lean transformation.

Inadequate Communication and Collaboration were identified by more than 65% of the surveyed companies as major barriers to lean implementation. Effective communication channels must be established to facilitate the smooth flow of information across different departments. Encouraging cross-functional collaboration and fostering a cohesive approach to lean practices can lead to more seamless implementation.

Inefficient Layout and Infrastructure emerged as a barrier for 40% of the companies. Addressing this issue involves reevaluating the physical layout of the manufacturing facility to optimize material flow and reduce unnecessary handling. Investing in modernizing infrastructure can lead to increased efficiency and streamlined production processes.

Lack of Data and Performance Metrics presented challenges to nearly 55% of the organizations. To overcome this barrier, organizations should implement data-driven decision-making processes and establish performance metrics to monitor progress accurately. Access to accurate and real-time data enables organizations to identify areas for improvement and make informed decisions.

Inadequate Employee Empowerment hindered lean implementation for approximately 45% of the companies. Empowering employees by involving them in problem-solving and decision-making fosters a sense of ownership and accountability. Creating a culture that encourages continuous improvement and values employee input can enhance the success of lean practices.

Finally, Incompatible Organizational Culture was identified as a significant barrier for over 70% of the cases. Transforming the organizational culture to align with lean principles requires concerted efforts from leadership and employees alike. Emphasizing a culture of continuous improvement, encouraging experimentation, and rewarding innovative ideas can help in overcoming cultural resistance to lean.

Example : Case Studies

Case Study 1: Company A

Barrier: Lack of Leadership Commitment

Company A faced a lack of leadership commitment to lean implementation. Senior leaders were not fully engaged and did not allocate sufficient resources or provide clear direction for the initiative.

Approach and Success: Recognizing the importance of leadership commitment, the company initiated a change in leadership mindset. The CEO championed the lean initiative, actively participating in improvement projects, and communicating the vision throughout the organization. Leadership training

sessions were conducted to develop leaders' understanding of lean principles and their role in driving the change. Regular communication channels were established to keep employees informed and engaged. Lessons Learned: Strong leadership commitment is critical for successful lean implementation. When leaders actively participate, communicate effectively, and allocate resources, they inspire and motivate employees to embrace the change.

Case Study 2: Company B

Barrier: Resistance to Change

Company B encountered significant resistance to change from employees during lean implementation. Employees were comfortable with existing processes and skeptical about the benefits of lean practices. Approach and Success: To address resistance, Company B implemented a comprehensive change management plan. They conducted training programs to educate employees about lean principles, emphasizing the positive impact on their work and job security. Change agents were identified and empowered to facilitate the transition. Regular communication and feedback channels were established to address concerns and ensure transparency. Success stories were shared to highlight the benefits achieved through lean implementation.

Lessons Learned: Addressing resistance to change requires a systematic and proactive change management approach. Education, communication, involvement, and addressing employee concerns are key strategies to overcome resistance and gain employee buy-in.

Result and Discussion :

N ot ati on	Barr iers of Lea n	E x pe rt 1	E x pe rt 2	E x pe rt 3	E x pe rt 4	E x pe rt 5	E 6	E 7	E 8	E 9	E 0	E 1	E 1	E 2	E 3	E 4	E 5	E 6	E 7	E 8	E 9	E 0	M E A N	St an dr ad De vi ati on
B 1	Lac k of fina ncial reso urce s	4	3	5	3	5	4	5	3	4	5	3	4	4	4	5	3	4	4	4	4	3	3. 9 5	0.7 59
B 2	Poor com mun icati on amo	3	4	2	4	2	3	2	4	3	2	4	4	3	4	2	4	4	3	4	4	4	3. 2 5	0.8 51

Chapter -5 CONCLUSION

In conclusion, the analysis of barriers to lean approach implementation in manufacturing industries has shed light on the challenges faced by organizations striving to adopt lean principles. Through an in-depth examination of data collected from various manufacturing companies, several key barriers have been identified, each presenting unique hurdles on the path to successful lean implementation.

Resistance to Change emerged as a primary and pervasive barrier, underscoring the importance of addressing employees' apprehensions and cultivating a culture that embraces continuous improvement. Lack of Leadership Commitment stood as a significant obstacle, emphasizing the need for strong and unwavering support from top management to drive the lean transformation effectively.

Insufficient Training and Knowledge hindered the successful adoption of lean practices, emphasizing the value of comprehensive training programs to equip employees with the necessary skills and understanding. Additionally, organizations grappling with a Short-Term Focus and Quick Fixes must shift their mindset towards recognizing lean as a journey, not a quick solution, to reap its long-term benefits fully.

Inadequate Communication and Collaboration highlighted the importance of fostering cross-functional cooperation and cohesive communication channels to ensure a seamless flow of information. Moreover, addressing an Inefficient Layout and Infrastructure is essential to optimize material flow and streamline production processes effectively.

The lack of Data and Performance Metrics underscored the significance of data-driven decision-making in identifying improvement opportunities and measuring progress accurately. Inadequate Employee Empowerment reinforced the importance of involving employees in problem-solving and decision-making, empowering them to contribute actively to the lean journey.

Lastly, an Incompatible Organizational Culture presented a formidable barrier, emphasizing the necessity of aligning the existing culture with lean principles through visionary leadership and cultural transformation initiatives.

Overall, the findings from this analysis provide valuable insights for manufacturing industries seeking to overcome barriers and embark on a successful lean implementation journey. By recognizing and addressing these challenges, organizations can create a conducive environment for embracing lean principles and fostering a culture of continuous improvement.

The recommendations proposed in this report, such as investing in comprehensive training, enhancing communication and collaboration, and emphasizing data-driven decision-making, serve as actionable steps to navigate the barriers effectively. With strong leadership commitment, employee empowerment, and a steadfast commitment to change, manufacturing industries can unlock the full potential of lean practices, leading to increased efficiency, reduced waste, improved quality, and enhanced overall performance.

As organizations embrace lean as a continuous journey rather than a short-term fix, they will position themselves for sustainable success in an ever-evolving and competitive manufacturing landscape. The lessons gleaned from this analysis will serve as a guiding compass for organizations seeking to implement lean principles successfully and drive transformative improvements throughout their manufacturing processes.

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