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Research Article

An Empirical Study Of Lean Manufacturing Practices In Smes Of Uttar Pradesh

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ABSTRACT

The paper thoroughly examines the readiness of small and medium enterprises (SMEs) in Uttar Pradesh, India, for the implementation of Lean manufacturing practices. It delves into the level of understanding these enterprises have regarding Lean practices, the specific challenges they face during implementation, and the benefits they gain from these practices. To gather data, a questionnaire was designed and circulated in SMEs of Uttar Pradesh. A sample of 200 SMEs listed in the Development Commissioner, Ministry of Micro, Small, and Medium Enterprises (DCMSME) database in Uttar Pradesh was considered for the study. The study's findings reveal several critical issues, including a predominant emphasis on cost reduction at the expense of customer satisfaction and a lack of clear procedural guidelines for implementing Lean manufacturing. Additionally, the research indicates that medium-scale industries generally benefit more from Lean practices than their small-scale counterparts. Conversely, small-scale industries tend to encounter more significant challenges in implementing these practices, highlighting a disparity in the readiness and capability of different-sized enterprises within the SME sector. This research is particularly significant as it is one of the few assessments of Lean manufacturing practices within SMEs in Uttar Pradesh. By showcasing the tangible productivity improvements that can be achieved through Lean methodologies, the paper underscores the practical implications and potential benefits of adopting Lean practices. It provides valuable insights into how Lean manufacturing can drive efficiency and competitiveness among SMEs, thereby contributing to the broader discourse on enhancing manufacturing practices in developing regions.

Keywords – Lean Tools, Lean Manufacturing Practices, waste Reduction, Small & medium enterprises, Lean Production.

1. Introduction

The concept of lean manufacturing, tracing its origins to Japan and the pioneering use of lean practices in the Toyota production system. The primary focus of lean manufacturing is on optimizing production processes and improving employee job satisfaction. (Singh, Garg, Sharma, & Grewal, 2010) .
In contrast to traditional manufacturing, which emphasizes inventory, lean manufacturing views inventory as wasteful and opposes the traditional inventory-centric approach. It is emphasized in the article that understanding the distinctions between traditional and lean manufacturing is crucial for organizations seeking to implement lean practices. (Andrew, 2006). The increasing volatility of the market and the importance of comprehending market dynamics in designing more effective manufacturing systems. (Gadalla, 2010) Lean manufacturing aligns with the belief that customers are willing to pay for the value of services they receive, but not for mistakes, highlighting the importance of delivering high-quality products and services. (Rawabdeh, 2005)
The Implementation of lean manufacturing in various industries has a direct and straight forward Impact on manufacturing processes. Contemporary perspectives on manufacturing processes Emphasize that the value of a product should be assessed from the customer's viewpoint rather than an Internal manufacturing perspective. Lean manufacturing specifically targets the elimination of waste within an organization, defining

waste as anything that does not contribute value to the final product. The integration of lean tool techniques, particularly when combined with SWOT (Strengths, Weaknesses, Opportunities, Threats) analysis, proves effective in identifying and eliminating wasteful practices within an organization. This approach aligns with the overarching goal of lean manufacturing to streamline processes and enhance efficiency by focusing on value addition from the customer's perspective. The research suggests that this strategic combination can contribute to more effective waste reduction and process optimization. (Upadhye, Deshmukh, & Garg, 2010)

The strategic importance of Lean Manufacturing is widely acknowledged, with the growth and survival of small and medium enterprises (SMEs) now contingent on the successful adoption of these practices. This study aims to assess the preparedness of Indian SMEs for implementing Lean Manufacturing practices by developing a readiness index for various aspects of this manufacturing approach. The focus is on understanding the extent to which SMEs in Uttar Pradesh are equipped and inclined to embrace Lean Manufacturing for their operational enhancement and long-term viability.

In their 2009 study, Ferdousi and Ahmed focused on Lean Manufacturing (LM) and highlighted significant improvements in productivity, product lead time, and product quality. Their research revealed productivity increases of 10% to 60%, reductions in product lead time by 8% to 50%, and enhancements in product quality ranging from 8% to 80%. The main objective of the study was to offer a comprehensive overview of LM practices by categorizing them into three groups based on investment requirements, feasibility, and recommendations by researchers. This categorization provides a valuable framework for understanding and implementing LM practices effectively.

In 2011, M. Eswaramoorthi studied lean practices in the Indian machine tool manufacturing sector. Using a questionnaire-based survey, the research assessed awareness and implementation levels. Results analyzed factors like current lean practices, reasons for low prioritization, types of tools used, waste perception, and challenges faced. The study emphasized the positive impact of lean practices in industries like aerospace, electronics, manufacturing, process industry, steel forging, and automotive manufacturing.

Lean manufacturing, also known as lean production or simply lean, is a methodology aimed at eliminating waste and enhancing efficiency in manufacturing processes. Over the years, various organizations across multiple industries have adopted lean practices to achieve operational excellence. This review analyzes the implementation of lean manufacturing, focusing on the key factors, challenges, and outcomes associated with adopting these principles.

Just-in-Time (JIT) production aims to produce and deliver products or services exactly when they are needed, in the required quantities and quality. By aligning production with customer demand, JIT minimizes inventory levels, reducing carrying costs and waste associated with excess inventory.

Continuous improvement, also known as Kaizen, involves ongoing efforts to identify and eliminate waste, inefficiencies, and defects. It encourages employees at all levels to participate actively in problem-solving and process improvement, fostering a culture of continuous learning and innovation.Successful implementation of lean manufacturing requires careful consideration of several factors. Strong leadership commitment and support are essential, as leaders need to understand lean principles and promote their adoption throughout the organization.

The core objective of a lean manufacturing system is to eradicate all forms of waste within an organization, as highlighted by Dennis (2007). The essence of a lean system is captured through two fundamental pillars: 'jidoka' and 'just-in-time.' Jidoka refers to the concept of building quality into the manufacturing process, while just-in-time emphasizes the efficient use of resources by producing items only as they are needed. The primary aim of a lean manufacturing system, as outlined in the research, is to achieve the production of high-quality products at the lowest possible cost and within the shortest timeframe. This is accomplished through a systematic approach that systematically identifies and eliminates various forms of waste across the production processes. The emphasis on quality, efficiency, and waste reduction underscores the overarching goal of lean manufacturing to enhance the overall value and effectiveness of the production system. (Dennis, 2007).

This involves fostering a culture of continuous improvement, engaging employees, and providing the necessary resources and training. Employee involvement and empowerment are critical, with all levels encouraged to participate in lean initiatives, contribute ideas, and take ownership of process improvements.

Effective communication is also key, requiring clear and transparent messaging to convey the purpose and goals of lean implementation and to address any concerns or resistance. Regular communication channels, such as team meetings and visual management boards, support continuous improvement and keep employees informed about progress. Additionally, training and education are crucial, as they equip employees with the knowledge and skills needed to identify waste, streamline processes, and drive improvements. Training programs should be tailored to the organization’s needs and delivered consistently to ensure a shared understanding of lean principles and methodologies.

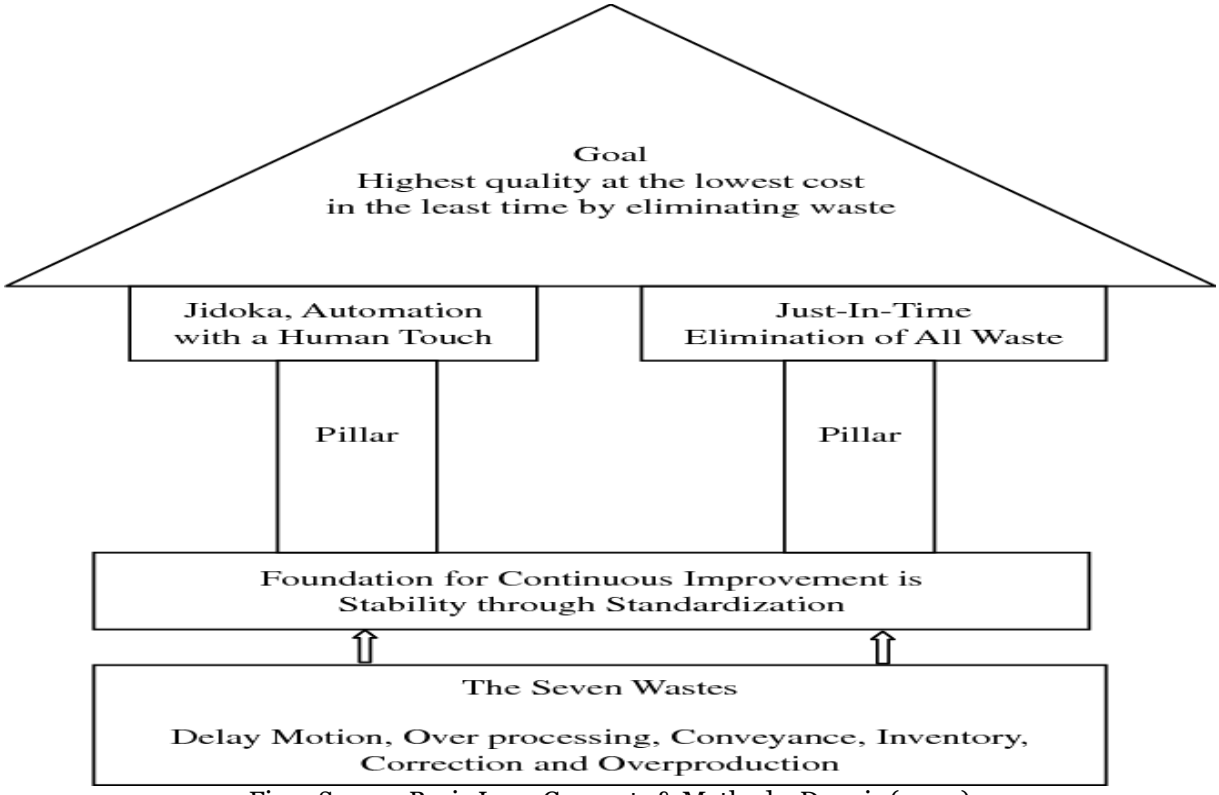

Fig.1, Source-Basic Lean Concepts & Methods, Dennis (2007)

Embracing Lean Manufacturing (LM) is positioned as a solution to address persistent challenges in areas such as employee satisfaction, quality management, competitive advantage, and waste elimination. The adoption of LM is expected to result in improved product quality, enhanced lead times, effective warehouse management, reduced waste, and increased adaptability. Beyond these direct advantages, there are also hidden benefits associated with Lean Manufacturing, particularly significant in the success stories of small and medium enterprises (SMEs).

While the benefits of lean manufacturing practices (LMPs) may not have a direct impact on success, they serve crucial indirect functions that should not be underestimated.

Implementing lean manufacturing in Indian small and medium enterprises (SMEs) faces challenges related to top management difficulties, policies, and attitudes. Overcoming these hurdles is crucial for the successful adoption of lean practices in these organizations.

Implementing lean manufacturing in Indian small and medium enterprises (SMEs) encounters various challenges. These challenges include management's lack of focus, support, and a sense of urgency for lean manufacturing. Additionally, issues like shortsightedness regarding long-term benefits, insufficient consulting, lack of funding, and communication hurdles are identified as major barriers to the successful adoption of lean practices in these organizations.

2. Literature Review-

In the current landscape of intensifying global competition, traditional sources of competitive advantage are deemed insufficient for the survival and growth of small and medium enterprises (SMEs). In response, these businesses are compelled to reassess their strategies to maintain competitiveness. Lean Manufacturing (LM) has emerged as a crucial strategy for meeting these challenges. Originating from Toyota during the post-World War II reconstruction phase, lean manufacturing, also known as lean production, is now recognized as a vital approach for SMEs aiming to enhance efficiency and competitiveness in today's dynamic business environment. (Johan et. al., 2022).

The primary objective of the lean methodology is the elimination of seven types of waste: overproduction, waiting, movement, inventory, motion, making faults, and inefficiencies in processes. Lean manufacturing specifically targets the removal of waste from various processes, notably work-in-progress and finished goods inventories, commonly associated with mass production. Importantly, lean is not about eliminating personnel; rather, its focus lies in enhancing capacity by reducing costs and minimizing the time between customer orders and delivery. (Deshmukh et. al., 2022).

2.1 Lean Tools-

Table 1, Lean tools, Definitions and Authors

Lean tools	Definition	Literature
7 waste	Waste is identified as the fundamental cause of inefficiency in any organization. The seven categories of waste, namely Defects, Overproduction, Transportation, Waiting, Inventory, Motion, and Processing, contribute to ineffective performance.	N. Skhmot, (2017) , S. D. Triagus et. al., 2013)
5S	An organizational and cleaning approach designed to minimize resources and cut down on costs.	Li X (2017), Banawi A(2014), Kobayashi (2005)
Value Stream Map	The process of mapping out the flow of materials and information required to convert raw materials into the final product.	Gilbert (2017), Rother & Shook (2003)
Ishikawa Dia-gram	It is a visual representation that depicts the relationships between a particular outcome and its underlying causes.	American Society for Quality ;shikawa & Loftus (1990)
Cellular Arrangement	In the physical layout of a cell, operations and processes are organized based on the production sequence of a specific product family, considering the optimal utilization of resources.	Khodier (2018), Black (1998)
Water spider	Rapid and efficient movement to gather and deliver materials or supplies to the primary members of a cellular flow.	Banawi (2014), Womack & Jones (1998)
Card material	A card accompanying the material facilitates pulling items from the production line based on the final demand of a product. It provides essential information about the specific product or item in question.	Khodier (2018),Shingo (1996)
SMED	A system designed to minimize the setup time of machines.	Womack & Jones (1998)
Autonomous Inspection	Teams or individuals dedicated to enhancing equipment performance through communication, identifying and addressing potential failures and issues during inspections.	Gilbert (2017), Swanson (2001)
Poka-yoke	A mechanism designed to minimize the production of defective parts, independent of the operator's level of attention or focus.	Li X (2017), Shingo (1988)
Total productive maintenance	Maintenance activities conducted by operators or small groups in a brief period and as a proactive measure to prevent issues.	Marhani(2012),Nakajima (1988)
Heijunka	Managing and regulating the variability in the order of tasks to enhance the efficient use of the employed capacity.	Anasah(2017), Hüttmeir, Treville,Ackere,Monnier & Pren-ninger (2009)

2.2. Lean Manufacturing Practices and Applications:

Manufacturing organizations employ various Lean Manufacturing tools and strategies to achieve their objectives. Recent research has focused extensively on the technologies and applications of Lean manufacturing. This production method considers all resource expenditures to provide economic value to customers while eliminating waste. In the contemporary business landscape, small and medium enterprises (SMEs) aspire for excellence. Management is committed to ensuring flawless products, promoting first-time-right production, and involving employees in organizational excellence. (Adrian Pugna , 2016).adhering to the zero-defects concept, motivating employees, incorporating environmental protection,

Many empirical studies, including Moyano-Fuentes and Sacristán-Daz (2012), consistently affirm the positive impact of implementing lean manufacturing (LM) on a company's operational performance. The main benefits include the reduction of process variability, waste, and rework time, leading to decreased production costs and lead times, along with increased process flexibility and adherence to quality standards.

Small and medium enterprises (SMEs) face intense global competition and heightened customer expectations daily. To address these challenges, many SMEs are turning to lean manufacturing (LM). LM offers a holistic approach to minimizing lead times, eliminating process waste, and attaining superior product and process quality, enabling SMEs to navigate the evolving business landscape effectively.

The eighth waste in lean manufacturing, unlike other wastes, is not specific to the manufacturing process. It arises when management fails to fully utilize employee talent. This waste was added to encourage organizations to focus on staff development within the lean framework. It can result from assigning employees inappropriate tasks or insufficient training, and from poor communication management. Engaging employees, incorporating their ideas, offering training, and involving them in process improvements enhance overall operational effectiveness. Eliminating this waste can lead to improvements in all other areas of waste. Gibbon,P.M.,Kennedy(2012)

Fig.2 , Eight Lean Waste, Source-www.processexcellencenetwork.com

2.3. Benefits of Implementing LMP

Embracing Lean Manufacturing (LM) is positioned as a solution to address persistent challenges in areas such as employee satisfaction, quality management, competitive advantage, and waste elimination. The adoption of LM is expected to result in improved product quality, enhanced lead times, effective warehouse management, reduced waste, and increased adaptability. Beyond these direct advantages, there are also hidden benefits associated with Lean Manufacturing, particularly significant in the success stories of small and medium enterprises (SMEs).

2.4. Challenges in Implementing LMP-

Lean Manufacturing is increasingly recognized as a valuable tool for businesses to enhance organizational performance and achieve their goals. (Joshi & Naik, 2012). Business excellence practices are incorporated into traditional manufacturing methods to bring about significant changes in the organization. (Wong et. al., 2009).

The transformation process initiates when management transitions from orthodox to contemporary thought processes, emphasizing factors such as employee education and training, allocation of funds for improvement activities, and balanced resource deployment.

Despite the challenges associated with lean manufacturing, careful attention to these obstacles is crucial for ensuring its smooth implementation. Implementation of lean manufacturing faces significant challenges in Indian small scale industries. While the benefits of lean manufacturing practices (LMPs) may not have a direct impact on success, they serve crucial indirect functions that should not be underestimated. (Gupta & Jain, 2013).

2.5 Research Gap-

The literature review highlights the varied definitions of lean manufacturing, reflecting the unique perspectives of individual researchers. Despite numerous studies on the topic, there is no comprehensive compilation of these diverse definitions. The implementation of lean manufacturing (LM) in small and medium enterprises (SMEs) is insufficiently covered in existing literature.

This research aims to address this gap by exploring LM practices in SMEs, focusing on benefits such as cost reduction, quality improvement, and optimization, specifically in North India, particularly Uttar Pradesh. The study seeks to investigate the issues identified in the literature review and provide insights into the application of LMP in this context.

2.6. Objectives-

1- To assess the readiness level of Lean Manufacturing Practices in Small and Medium Enterprises (SMEs) in Uttar Pradesh.

2- To identify the benefits associated with the implementation of Lean Manufacturing Practices in Small and Medium Enterprises (SMEs) in Uttar Pradesh.

3- To identify and understand the barriers and challenges associated with the implementation of Lean Manufacturing Practices in Small and Medium Enterprises (SMEs) in Uttar Pradesh.

3. Research Methodology

The research methodology is outlined as the approach taken to achieve the primary objectives of the research. It highlighted the significance of Lean Manufacturing Practices and reviewed existing research in the field. The need for investigating Lean Management Practices in Indian SMEs was identified, with a focus on understanding and identifying the challenges faced in implementing lean manufacturing practices.

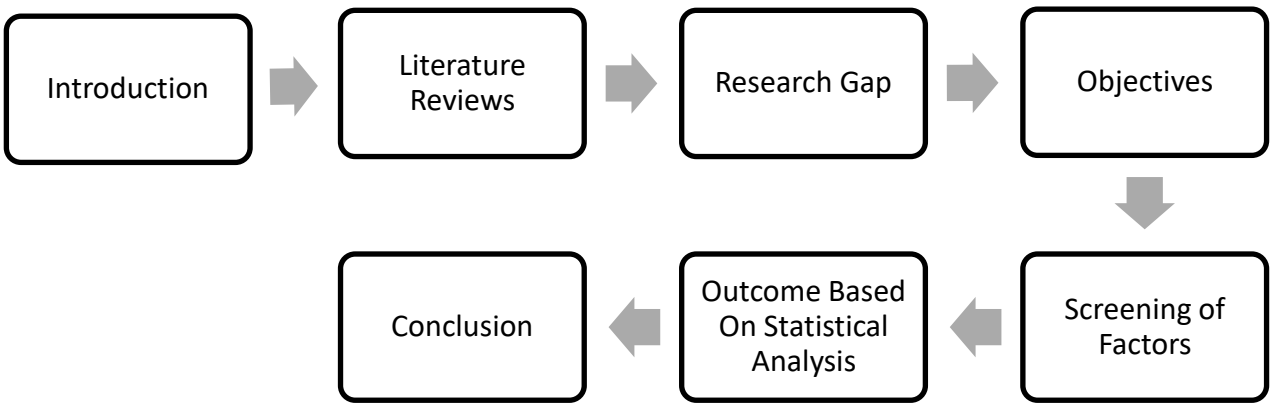

Fig.3, Flow of Research

The aim of this research is to provide a comprehensive overview of small and medium industries of Uttar Pradesh state. The responses are categorized based on demographic variables. Descriptive information, including basic statistics such as percentages and frequencies, is presented in the form of figures and tables. In the present study, a list of 450 SMEs was prepared. The name and addresses are taken from the office of DCMSME (Development Commissioner, Ministry of Micro, Small and Medium Enterprises, Uttar Pradesh). After the analysis of collected responses on the excel sheet, 200 responses are selected for the evaluation.

Table.2, Sector wise Classification of SMEs

Sr. No	Nature of Organization	Frequency	Percentage
1	Automobile Components	46	23
2	Machine Tools	40	20
3	Agricultural products	6	3
4	Electrical	28	14
5	Electronic and Telecommunications	4	2
6	Chemicals and Pharmaceuticals	37	18.5
7	Food Processing	23	11.5
8	Leather and Leather Goods	4	2
9	Others	12	6
	Total	200	100.0

4. Result and Analysis –

A. Test of Hypothesis 1- Null Hypothesis (Ho): There exists no difference in the readiness level of Lean manufacturing practices between small and medium enterprises in Uttar Pradesh.

Table 3, Statements for the readiness of LMP in SMEs of U.P.

No.	Statements
1	We are aware of lean management practices.
2	We are aware of the benefits of the implementation ofLean manufacturing practices.
3	We are aware of the various components of Lean manufacturing practices.
4	We are aware of the implementation methods ofLean manufacturing practices.
5	We are willing to implement lean management practices in our organization / continue if its already implemented.

Table 4. Response Statistical Analysis for Hypothesis-1

Independent Samples Test						
Statement		Levene's Test For Equality of Variances		t-test for Equality of Means		
		F	Sig.	T	Df	Sig. (2-tailed)
1	Equal variances assumed	1.1	0.294	-2.2	498.0	0.027
	Equal variances not assumed			-2.2	416.3	0.028
2	Equal variances assumed	33.5	0	-1.3	498.0	0.197
	Equal variances not assumed			-1.4	480.4	0.177
3	Equal variances assumed	7.6	0.006	-3.0	498.0	0.003
	Equal variances not assumed			-3.2	497.9	0.001
4	Equal variances assumed	5.5	0.019	0.4	498.0	0.719
	Equal variances not assumed			0.4	450.4	0.714
5	Equal variances assumed	2.5	0.113	0.6	498.0	0.518
	Equal variances not assumed			0.7	439.0	0.513

The analysis of the table indicates that, among both small and medium enterprises, only two statements show significance at the 5% level. The remaining statements do not exhibit significance. Therefore, we are unable to reject the null hypothesis. This implies that there is no discernible difference in the readiness levels between small and medium enterprises when it comes to implementing Lean manufacturing practices.

B. Test of Hypothesis-2:

Null Hypothesis (Ho): There exists no benefit accumulated to SMEs implementing Lean Manufacturing Practices in Uttar Pradesh as compared to SMEs without the existence of Lean Manufacturing Practices.

Table 5, Ten Benefits Statements

Benefit No.	Statements
1.	Reduction in cost.
2.	Reduction in wastage.
3.	Improved safety.
4.	Enhanced customer satisfaction.
5.	Controlling over-processing.
6.	Increased machine life.
7.	Better space utilization.
8.	Better inventory management.
9.	Re-use of materials.
10.	Improved supply chain practices.

Table 6, Response Statistical Analysis For Hypothesis-2

	t – test	P value	LMP Implementation	Average	Std. Deviation	Std. Error Mean
Benefits 1	3.526*	P < 0.05	No	1.90	1.259	.151
			Yes	3.89	1.554	.159
Benefits 2	3.329*	P < 0.05	No	1.96	1.292	.154
			Yes	4.30	1.667	.175
Benefits 3	3.262*	P < 0.05	No	1.96	1.316	.157
			Yes	4.08	1.623	.169
Benefits 4	3.730*	P < 0.05	No	1.81	1.337	.160
			Yes	4.33	1.586	.163
Benefits 5	3.816*	P < 0.05	No	1.97	1.293	.154
			Yes	3.91	1.559	.160
Benefits 6	2.672*	P < 0.05	No	2.05	1.281	.153
			Yes	4.11	1.696	.174
Benefits 7	2.923*	P < 0.05	No	1.93	1.236	.148
			Yes	4.05	1.648	.172
Benefits 8	3.524*	P < 0.05	No	2.0	1.323	.159
			Yes	4.14	1.654	.170
Benefits 9	3.622*	P < 0.05	No	1.99	1.360	.164
			Yes	4.15	1.659	.170
Benefits 10	3.746*	P < 0.05	No	1.86	1.374	.164

It is noticed that there is a significant difference between industries, where LMP has been implemented and the industries where LMP has not been implemented. On every benefit statements, P value is less than 0.05 (95% confidence limit). The average of benefit for each statement of the industry, where LMP has been implemented, is more than that average of the industry where LMP has not been implemented. Hence the null Hypothesis is rejected. It means that there is a significant difference between benefit accrued to the SMEs implementing LM practices in SME of Uttar Pradesh Industry as compared to that with nonexistent LM practices.

C. Test of Hypothesis 3:

Null Hypothesis (Ho): There exists no difference in challenges, barriers, and problems in the implementation of Lean Manufacturing Practices between small and medium enterprises in Uttar Pradesh.

Table 7, Ten Challenges Statements

Challenge	Statements
1.	Top management commitment
2.	Lack of financial resources
3.	Lack of adequate training
4.	Lack of supporting infrastructure
5.	High implementation cost
6.	Longer implementation time
7.	Adherence to traditional workingMethods
8.	Lack of supplier support
9.	No technical/managerial supportfrom large industries
10.	Lack of support from Ministry ofMSME and local government bodies

Table 8, Response Statistical analysis for Hypothesis-3

	t – test Value	Type of Industries	Average	Std. Deviation	Std. Error Mean
Problem &Challenge 1	3.072*	Small	3.80	.968	.100
		Medium	3.31	1.064	.126
Problem &Challenge 2	3.966*	Small	3.82	.950	.098
		Medium	3.24	.902	.107
Problem &Challenge 3	4.093*	Small	3.75	1.116	.116
		Medium	3.07	.961	.114
Problem &Challenge 4	4.417*	Small	3.91	1.100	.114
		Medium	3.15	1.078	.128
Problem &Challenge 5	2.257*	Small	3.70	1.035	.107
		Medium	3.31	.919	.109
Problem &Challenge 6	2.120*	Small	3.62	1.233	.128
		Medium	3.23	1.136	.135
Problem &Challenge 7	1.556	Small	3.83	2.148	.222
		Medium	3.39	1.115	.132
Problem &Challenge 8	2.655*	Small	3.71	1.064	.110
		Medium	3.27	1.068	.127
Problem &Challenge 9	2.299*	Small	3.74	1.042	.108
		Medium	3.37	1.031	.122
Problem & Challenge 10	1.848	Small	3.75	1.183	.123
		Medium	3.42	1.037	.123

Result showed that 10 statements of problems and challenges were significantly different between from small scale industry and medium scale industry (* indicates $p < 0.05$). Since most of the statement problems and challengeswere significantly different between the two different scale of industry hence the Null hypothesis is rejected. It means that, there exists significant difference of problems and challenges in the implementation of between small scale industries and medium scale industries.

The specific challenges faced by small-scale industries could include limited financial resources, lack of skilled personnel, and inadequate technological infrastructure, which are less problematic for larger enterprises.

1. **Targeted Support for SMEs**: Policymakers and industry bodies should provide targeted support to small-scale industries to help them overcome the unique challenges they face in adopting LMP. This support could include financial incentives, training programs, and access to affordable technology.

2. **Customized LMP Strategies**: Implementation strategies for LMP should be customized to address the specific needs and constraints of small and medium-scale industries. One-size-fits-all approaches may not be effective given the varying challenges across different scales of enterprises.
3. **Resource Allocation**: Medium-scale industries can serve as models for small-scale industries in terms of best practices and resource allocation for LMP. Knowledge sharing and mentorship programs between medium and small-scale industries could be beneficial.
4. **Continuous Improvement Programs**: SMEs should focus on continuous improvement programs that gradually build their capabilities to adopt and sustain LMP. Incremental changes might be more feasible and less disruptive than large-scale overhauls.
5. **Government and Institutional Role**: Government and educational institutions should play an active role in disseminating knowledge about LMP and providing the necessary infrastructure and support systems to facilitate its adoption.

5. Conclusion-

The objective of this study was to assess the preparedness of Indian Small and Medium Enterprises (SMEs) in employing lean manufacturing practices (LMP). The findings indicate that Small and Medium Enterprises in Uttar Pradesh exhibit a similar level of readiness for implementing LMP. Additionally, the study aimed to identify the impediments and challenges hindering the adoption of LMP within the SME sector in India.
The results from the 't-test' show that medium-scale industries achieve greater benefits from LMP compared to small-scale industries. This disparity suggests that medium-scale enterprises may have more resources or better capabilities to implement lean practices effectively, leading to enhanced outcomes.
Furthermore, the study reveals that for 7 out of 10 statements, the average scores of challenges significantly differ between small and medium-scale industries compared to large-scale industries. This indicates that the obstacles to implementing LMP are more pronounced in small-scale industries than in medium-scale industries.
Overall, the study highlights the need for a nuanced approach to implementing lean manufacturing practices within SMEs of Uttar Pradesh, taking into account the specific challenges and readiness levels of different scales of enterprises. Addressing these issues can enhance the overall efficiency and competitiveness of SMEs in Uttar Pradesh.

6. Recommendations & Future Scope-

The study suggests potential for further development as a Lean manufacturing system within the framework of mixed supply chains. However, the study encountered limitations, particularly in its applicability across various industrial sectors and countries. The results, being context-specific, may not be generalized to different industrial fields. It is acknowledged that different industries might necessitate distinct approaches, particularly in the implementation of the environmental factors framework.
The research emphasizes the utilization of lean manufacturing as a significant factor for improving performance. This particular factor has been relatively overlooked by researchers in India in previous studies. The research elevates the awareness of the importance and strategic significance of lean manufacturing practices. This heightened awareness is anticipated to provide industries with a better understanding of lean practices, ultimately aiding in their effective implementation.
The research highlights the problems and challenges encountered by various industry sectors during the implementation of Lean Manufacturing practices. This information aims to empower industries to undertake suitable actions when implementing Lean Manufacturing practices. Furthermore, this study centered on a singular upstream Employee-Management (EM) relationship, specifically within a distinct region of a particular country. It acknowledges that organizations within the same industry sector but in different countries may exhibit diverse behaviors.

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