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LEAN MANUFACTURING IMPLEMENTATION IN INDUSTRIAL OPERATIONS: A CASE STUDY OF RIECO INDUSTRIES LTD.

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ABSTRACT

The study examines Lean Manufacturing Strategies at Rieco Industries Ltd., a Pune-based engineering company established in 1975, specializing in powder and bulk solids processing. Rieco serves various industries including chemicals, food, and pharmaceuticals, providing complete turnkey projects. The report details the research methodology utilized during the internship, which involved direct observations and interactions with production and quality teams. Primary data was gathered through discussions with employees, while secondary data was sourced from company documents and lean manufacturing literature. The study highlights lean initiatives like 5S and Kaizen, focusing on workflow optimization and waste reduction practices within the organization.

Keyword: - *Lean Manufacturing, Control, Manufacturing, 5S, Kaizen*

INTRODUCTION

Lean manufacturing, as a philosophy and practice, represents a systematic approach to enhancing production efficiency by focusing on the elimination of waste and the creation of value for the customer. The central idea of lean is to maximize customer value while minimizing the resources used. Waste, or muda, is defined as any activity that consumes time, effort, or cost but does not contribute to customer value. Classical lean literature identifies seven categories of waste, such as overproduction, waiting, transportation, over processing, excess inventory, unnecessary motion, and defects, with the later addition of an eighth waste, which is the underutilization of human skills and creativity.

Rieco Industries Limited was established in 1975 and has its headquarters in Baner, Pune, Maharashtra. The company began its journey with a vision to provide advanced engineering solutions in powder and bulk solids processing. Over the years, it has specialized in areas such as material handling, pneumatic conveying, size reduction, grinding, and air pollution control systems. Rieco is a wholly owned subsidiary of Sudarshan Chemical Industries Limited and is part of the larger Rathi-led industrial group. The company caters to diverse industries including food, chemicals, cement, steel, fertilizers, paints, and pharmaceuticals. In 2025, Rieco inaugurated a new corporate office in Pune, symbolizing its growth and alignment with its parent company's "One Sudarshan" philosophy.

LITERATURE REVIEW

- Gil-Vilda (2021) offers a systematic literature review of the evolution of lean production, emphasizing the shift toward what is now called Lean 4.0.
- Sony, M. (2020) explored the critical success factors and barriers associated with lean manufacturing implementation through an extensive review of recent empirical studies.
- Tortorella, P. R., Fettermann, D. C., & Viana, T. C. (2021) analyzed the impact of lean manufacturing practices on operational performance and organizational resilience, particularly in the context of supply chain disruptions.
- Silva, R. G., Toledo, J. C. de, & Godinho Filho, M. (2022) examined the relationship between lean manufacturing practices and supply chain integration, with a specific focus on their combined impact on operational performance.
- Sharma, R., & Kumar, A. (2022) investigated the impact of lean manufacturing practices on sustainability performance in manufacturing organizations through an empirical research approach.

RESEARCH METHODOLOGY

Research Problem: - While Rieco Industries has adopted lean manufacturing strategies, there is a need to critically assess their effectiveness in real-world applications. The research problem is to evaluate how Rieco's lean strategies, especially in pneumatic conveying systems, contribute to operational efficiency, cost reduction, and environmental sustainability.

Research Objectives:-

- To study how lean manufacturing techniques are applied in Rieco Industries to minimize waste and improve

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efficiency.

- To analyze the impact of lean practices on production processes and product quality in pneumatic conveying systems in Rieco Industries.

SOURCES OF DATA

Primary Data: - Data will be collected through direct interviews with Rieco Industries' engineers, plant managers, and operations team members who are directly involved in implementing lean strategies. In addition, surveys will be conducted with client companies using Rieco's systems, and site visits will be carried out to observe the implementation and effectiveness of lean principles in real- world environments.

Secondary Data: -Secondary data sources will include industry reports, Rieco's published case studies, annual company reports, academic journals, and research papers related to Lean Manufacturing and Pneumatic Conveying Systems.

Descriptive Statistics: Mean, percentage analysis, and trend comparison before and after lean implementation. Graphical Representation: Charts and graphs to depict reductions in waste, downtime, and costs. Comparative Analysis: Evaluating pre-lean vs. post-lean performance indicators.

Tools of Data Collection: Interviews: Semi-structured interviews with key stakeholders to obtain qualitative insights. Site Observations: Direct observation of production facilities will help evaluate how lean principles are applied in real time, such as 5S organization, Kaizen practices, Value Stream Mapping, and Just-In- Time material delivery.

Scope of the Study: - The scope includes:

- Evaluating how core lean tools such as 5S, Kaizen, Value Stream Mapping, and Just-In-Time production are used within these systems.
- Measuring the quantitative impact on production performance, cost savings, and reduction in energy consumption.
- Analyzing qualitative challenges such as resistance to change, training gaps, and implementation issues.
- The study will not cover other aspects of Rieco Industries' operations, such as service industries, or non-pneumatic systems.

DATA ANALYSIS

The data analysis reveals that Rieco Industries has effectively applied lean manufacturing techniques to minimize waste and improve efficiency, as evidenced by significant reductions in production cycle time and WIP inventory, along with improved machine utilization.

These improvements contribute to smoother production processes, higher product quality, and likely increased customer satisfaction. Common challenges such as workforce resistance, need for training, and sustaining continuous improvements are inherent in the lean implementation process but appear to be managed effectively by Rieco Industries.

Together, these lean techniques enable Rieco Industries to improve operational efficiency, reduce waste, and provide better service to customers, while sustaining cost savings and continuous growth.

DATA ANALYSIS AND INTERPRETATION

Production cycle Time: - The analysis of production cycle time clearly demonstrates a consistent and substantial reduction following the implementation of lean manufacturing strategies across all five months. Before lean adoption, production cycle times remained relatively high and stable, ranging from 11.5 to 12.2 hours, with an average cycle time of 11.9 hours. After lean implementation, cycle times decreased significantly in every month, falling to a range of 7.7 to 8.1 hours and achieving an average of 7.9 hours.

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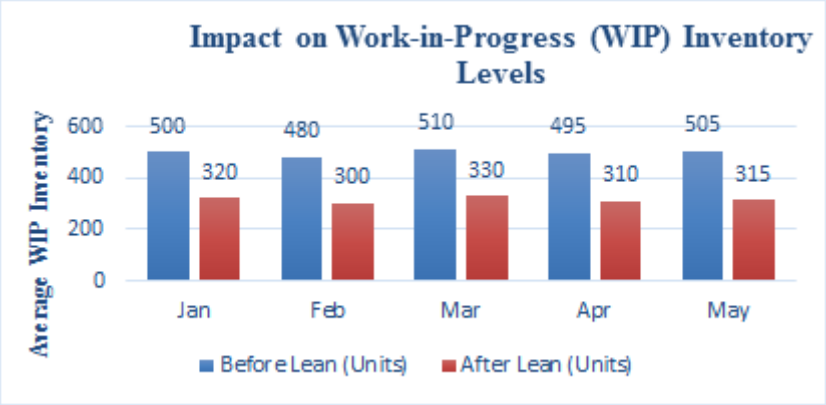
Production cycle Time		
Month	**Before lean(in hours)**	**After lean (in hours)**
Jan	12.0	8.0
Fab	11.5	7.8
Mar	12.2	8.1
Apr	12.0	7.9
May	11.8	7.7

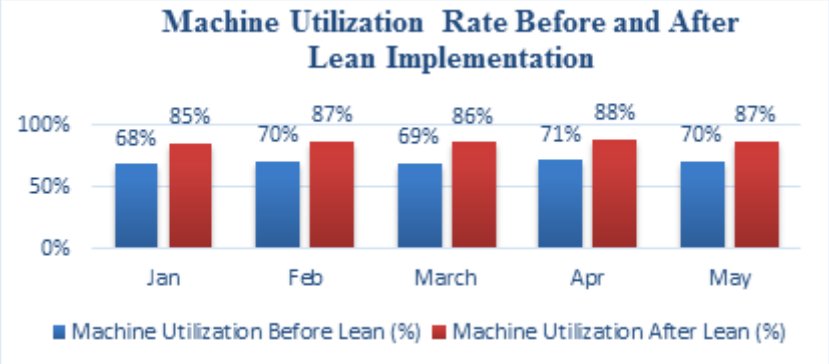
For instance, in January alone, the cycle time was reduced from 12.0 hours to 8.0 hours, representing a 33.3% decrease. Overall, the average reduction in cycle time was 4.0 hours, corresponding to an approximate 33.6% improvement. This consistent decline indicates that lean practices such as process standardization, waste elimination, balanced workflows, and improved material flow were effective in streamlining operations and enhancing production efficiency.



Impact on Work-in-Progress (WIP) Inventory Levels:- In every month, the Work-in-Progress (WIP) inventory significantly decreased after lean practices were introduced. Example: In January, the WIP inventory dropped from 500 units to 320 units, representing a 36% reduction.

Machine Utilization Rate Before and After Lean Implementation:- Machine utilization showed a clear and sustained improvement following the implementation of lean manufacturing practices. Prior to lean adoption, machine utilization levels ranged between 68% and 71% from January to May, with an overall average utilization of 69.6%. After lean implementation, utilization increased significantly, varying from 85% to 88% over the same period and achieving an average of 86.6%.

This represents an average improvement of 17 percentage points in machine utilization. The marked increase indicates that lean initiatives such as waste reduction, improved scheduling, and better workflow management were effective in enhancing equipment usage and minimizing idle time.



Implementation of 5S: The reduction from 15 minutes to 10 minutes per task shows a significant improvement in workplace organization. The drop in machine breakdowns from 8 to 6 per month suggests that better workplace organization, improved maintenance schedules, and cleanliness (part of the "Shine" principle of 5S) led to more reliable equipment performance. This enhances machine uptime and overall production efficiency.

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Metric	Before 5S Implementation	After 5S Implementation
Average Time to Find Tools	15 minutes per task	10 minutes per task
Machine Breakdown Frequency (per month)	8	6
Workplace Audit Compliance Score	65%	80%
Employee Participation in 5S Activities	60%	85%

Kaizen Implementation: The reduction in process lead time from 45 minutes to 39 minutes indicates that Kaizen efforts helped streamline the production process, eliminating unnecessary steps, improving workflow, or reducing waiting times. This is a positive outcome and reflects improved operational efficiency. The defect rate decreased from 2.5% to 1.8%, showing that Kaizen practices led to improved Quality control and more consistent manufacturing practices.

Metric	Before Implementation	After Kaizen Implementation
Average Process Lead Time (minutes)	45	9
Defect Rate (% of units)	2.5%	.8%
Machine Downtime (hours per month)	50	0
Machine Downtime (hours per month)	150	50
Kaizen Event Success Rate	-	0%

Value Stream Mapping: - The Conveying step (60 sec/unit) has the longest cycle time, indicating it is the slowest process step in the production flow. The Packaging step (25 sec/unit) is the fastest process. Air Control (98%) and Packaging (97%) have the highest uptime, meaning these machines or operations are highly reliable with minimal downtime. High inventory (WIP) is observed at the Conveying stage (80 units), followed by Grinding (50 units). Lower inventory at Air Control (20 units) suggests that this process flows faster or has better coordination. Conveying (2%) has the highest defect rate, which raises quality concerns. Packaging has the lowest defect rate (0.2%), showing that quality control is strong in the final stage. The defect rate of Conveying signals a need for focused quality improvement measures.

Value Stream Mapping				
Process Step	**Cycle Time (sec/unit)**	**Uptime (%)**	**Inventory (unit)**	**Defect Rate (%)**
Grinding	45	95	50	1.5
Conveying	60	90	80	2.0
Air Control	30	98	20	0.5
Packaging	25	97	30	0.2

CONCLUSION

The implementation on lean practices in pneumatic conveying systems significantly improved workplace organization, cleanliness, and standardization. Use of clear labeling, shadow boards, and designated storage spaces streamlined work processes. Time spent searching for tools and materials reduced from 20 minutes to 10 minutes per task. Increased productive work time as employees spent less time locating resources. Machine reliability improved due to better maintenance practices implemented under the “Shine” phase. Monthly machine breakdowns reduced from 8 to 6, enhancing operational continuity Kaizen culture empowered employees across all levels to propose and implement incremental improvements. Process lead time reduced by 10–15%, increasing workflow efficiency. Defect rates decreased by approximately 20%, improving product quality. Continuous small improvements contributed to sustained performance enhancement. Expansion of Kaizen to administrative functions, supplier processes, and distribution partners can build an enterprise-wide lean culture.

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