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A STUDY ON REDUCTION OF LABOUR COST BY ELIMINATING NVA ACTIVITIES WITH REFERENCE TO PRAVEEN ENGINEERING PRODUCTS INDIA PRIVATE LIMITED, HOSUR

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ABSTRACT

Manufacturing organizations continuously strive to achieve operational excellence by optimizing resource utilization and minimizing costsNon-Value Added (NVA) activities such as waiting time, unnecessary movement, idle time, rework, and poor workflow are among the primary contributors to inflated labour costs. This study focuses on the reduction of labour cost through systematic identification and elimination of NVA activities with reference to Praveen Engineering Products India Pvt. Ltd., Hosur. The study adopts a descriptive research design using primary data collected through a structured questionnaire based on a 5-point Likert scale from 100 respondents using convenience sampling. Statistical tools including percentage analysis, mean score analysis, Chi-square test, Pearson correlation, ANOVA, and time-motion study analysis are employed. Findings reveal that rework (mean = 3.60), inefficient workflow (mean = 3.61), and NVA impact on labour cost (mean = 3.89) are the most critical areas for improvement. The study concludes that adoption of lean practices, improved plant layout, training, and process standardization can significantly reduce NVA activities and enhance overall organizational efficiency.

KEYWORDS: Labour Cost Reduction, Non-Value Added Activities, Lean Manufacturing, Operational Efficiency, Work Study, Praveen Engineering Products.

I. INTRODUCTION

In the current globalized and highly competitive industrial environment, manufacturing organizations are continuously striving to achieve operational excellence by optimizing resource utilization and minimizing costs. The pressure to deliver high-quality products at competitive prices, coupled with the need to meet stringent delivery deadlines, has forced companies to adopt innovative strategies for improving efficiency. Among the various elements of production cost, labour cost represents a significant component, particularly in sectors where human intervention is indispensable.

Labour cost is a multifaceted concept that extends beyond direct wages and salaries. It includes indirect expenses such as overtime payments, idle time, inefficiencies in work processes, supervision costs, employee benefits, and the cost associated with errors and rework. In many organizations, a lack of proper monitoring and control mechanisms results in inefficient utilization of labour, leading to increased operational costs. One of the primary reasons for this inefficiency is the presence of Non-Value Added (NVA) activities within the production system.

The concept of value addition is central to modern manufacturing practices. Value is defined from the customer's perspective, and an activity is considered value-added only if it directly contributes to transforming raw materials into finished products in a way that meets customer requirements. Any activity that does not contribute to this transformation is classified as Non-Value Added. These activities consume time, effort, and resources but do not enhance the value of the product.

NVA activities are often deeply embedded in routine operations and may not be easily identifiable without a systematic analysis. These activities can manifest in various forms, such as waiting for materials, unnecessary movement of workers, excessive transportation of materials, overprocessing, rework due to defects, and idle time. Each of these activities contributes to increased labour cost without adding any value to the product.

In recent years, Lean Manufacturing has gained prominence as an effective approach to eliminating NVA activities. It is based on the principles of continuous improvement, efficient resource utilization, and elimination of non-value-added activities. Lean manufacturing identifies several types of waste — transportation, inventory, motion, waiting, overproduction, overprocessing, and defects each representing a form of inefficiency that leads to increased labour effort and cost.

The present study is conducted with reference to Praveen Engineering Products India Pvt. Ltd., located in Hosur. The company operates in the engineering manufacturing sector and is

engaged in the production of sheet metal components and assemblies. The production system involves multiple processes, including laser cutting, machining, fabrication, welding, assembly, and finishing operations. This study aims to provide a comprehensive analysis of labour cost reduction through elimination of NVA activities in this real-time industrial setting.

II. REVIEW OF LITERATURE

A comprehensive review of existing literature was conducted to understand the theoretical and empirical foundations of NVA activity elimination and labour cost reduction.

Dara et al. (2024) examined the application of lean tools to reduce NVA activities in the precast industry, emphasizing that lean management's primary goal is to eliminate waste that reduces efficiency and productivity. Adeyemi, Ogbeyemi & Zhang (2021) addressed negative labour cost variance (NLCV) by combining motion measurement, lean analysis, and historical data review to identify and eliminate sources of cost overruns in industrial settings.

Shou et al. (2020) developed a methodology to classify value-adding (VA) and non-value-adding (NVA) tasks for lean applications in turnaround maintenance projects, while Fadlil & Rosyidi (2020) applied VA/NVA analysis with ECRS methodology and line balancing to improve work methods and achieve production targets. Reddy (2024) demonstrated significant reduction in production time in aerospace manufacturing through deliberate identification and elimination of NVA activities.

Kumar, Dhingra & Singh (2018) demonstrated a notable annual expense decrease of INR 7.50 lacs using Lean-Kaizen with Value Stream Mapping (VSM). Rose et al. (2020) improved productivity by 35% and extended production lead time by 400% through VSM-based NVA elimination. Nallusamy (2016) and Nallusamy & Saravanan (2016) applied VSM, work standardization, and line balancing to enhance efficiency in CNC and small-scale industries.

Ruangchoengchum et al. (2020) proposed a cost-reduction plan for rubber sheet production using activity value analysis and activity-based costing. Zahrotun & Taufiq (2018) demonstrated a reduction of NVA activity from 3.10% to 1.01% using VALSAT tools and process activity mapping, reducing lead time by 80 minutes. Kovacs (2020) proposed a novel combination of lean techniques and facility layout design for significant efficiency improvement and cost reduction.

Storfjell et al. (2009) identified NVA time costs in acute care nursing units, highlighting the million-dollar opportunity from reducing wasted nursing time. Teichgräber & De Bucourt

(2012) applied VSM to eliminate NVA waste in the procurement of endovascular stents in healthcare. Kelesbayev et al. (2020) demonstrated how Kaizen costing can reduce or eliminate production losses as NVA activities in a transformer manufacturing company.

III. RESEARCH GAP

Despite the extensive literature on lean manufacturing and NVA elimination, several critical gaps exist. Most prior research is conducted at a generalized level, focusing on large multinational organizations, leaving medium-scale manufacturing firms in regional contexts underrepresented. There is limited focus on directly linking NVA activities to specific labour cost components such as idle time, rework costs, and movement-related delays. Additionally, existing studies predominantly adopt a top-down managerial perspective, neglecting employee-level perceptions from shop-floor workers who are best positioned to identify inefficiencies. The present study addresses these gaps by focusing on a medium-scale engineering firm in Hosur, employing primary survey data from production-level employees, and using quantitative statistical tools to establish the relationship between NVA activities and labour cost.

IV. OBJECTIVES OF THE STUDY

The primary objective is to analyze how labour cost can be reduced through the elimination of Nonvalue-added activities in the production process.

The secondary objectives are:

- To identify and categorize different types of NVA activities present in the production system
- To examine the root causes of inefficiencies in labour utilization
- To analyze the relationship between NVA activities and productivity levels
- To evaluate employee perceptions regarding operational inefficiencies using a structured measurement scale
- To suggest practical and implementable measures for improving efficiency

V. RESEARCH METHODOLOGY

Research Design

Descriptive research desigh.

Data Collection

- **Primary**: collected through structured Questionnaire (google form),
- **Secondary**: Journals, company record.

Sample Size

100 Respondents (staff, operators, supervisors, technicians).

Sampling Method

Convenience sampling.

Tools for Analysis

- Percentage analysis
- Chi-square
- ANOVA
- Charts and graphs

This study adopts a descriptive research design to systematically examine NVA activities in the production environment of Praveen Engineering Products India Pvt. Ltd. Primary data was collected using a structured 5-point Likert scale questionnaire (Strongly Agree = 5 to Strongly Disagree = 1) covering dimensions including waiting time, unnecessary movement, rework, idle time, workflow efficiency, layout issues, and labour cost impact.

A convenience sampling method was employed to select 100 respondents directly involved in production activities, including machine operators, supervisors, and shop-floor workers. Data analysis was carried out using percentage analysis, mean score analysis, Chi-square test, Pearson correlation, ANOVA, ranking analysis, and time-motion study analysis. A sample of 100 respondents was used for Chi-square and ANOVA tests to ensure statistical validity.

VI. INDUSTRY AND COMPANY PROFILE

The engineering industry is widely regarded as the backbone of industrial development. In India, the sector is one of the largest contributors to manufacturing output and exports, encompassing heavy engineering, automotive components, electrical equipment, and industrial fabrication. Hosur, Tamil Nadu has emerged as a major industrial hub owing to its strategic proximity to Bengaluru, availability of skilled labour, and well-developed industrial infrastructure.

Praveen Engineering Products India Pvt. Ltd. is a medium-scale engineering manufacturing enterprise located in Hosur. The company specializes in the production and supply of

precision sheet metal components and assemblies across three key product categories: commercial vehicle components (Fuel Tank Bracket, Battery Carrier, RTM Bumper, FUPD Beam, Cab Mounting Bracket), defence vehicle components (Tools Box & Bracket, Spare Wheel Carrier, Winch Assembly, Channel Cab), and construction vehicle components (Hand Railing, Mesh & Ladder, Cat Walk Assembly, Bucket, Diesel & Oil Tank).

The production process encompasses procurement of raw materials, CNC machining and fabrication, welding, assembly, quality inspection, and dispatch. The company operates with a functional organizational structure comprising production, quality, finance, marketing, and human resource departments. Its vision is to be a leading manufacturer delivering superior quality through innovative practices and customer satisfaction.

VII. DATA ANALYSIS AND INTERPRETATION

A. Demographic Analysis

The demographic profile of 75 respondents shows a male-dominant workforce (69% male, 31% female), consistent with the typical structure of manufacturing industries. The majority (33%) fall in the 26-30 age group, indicating a young and dynamic workforce with high potential for adopting improvement techniques. In terms of qualifications, 47% are undergraduates, 27% diploma holders, and 26% postgraduates. The highest respondent participation is from the production department (40%), followed by quality (20%), maintenance (16%), stores (13%), and others (11%). Work experience analysis reveals that 39.2% have 1-3 years of experience and 32% have less than one year, suggesting a predominantly entry-to-mid-level workforce.

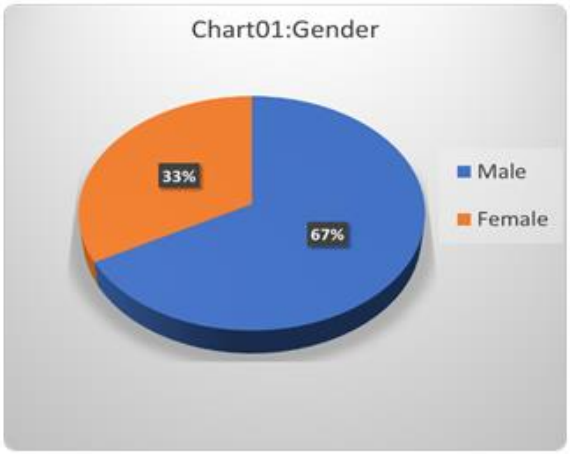


FIG 1: Gender Distribution

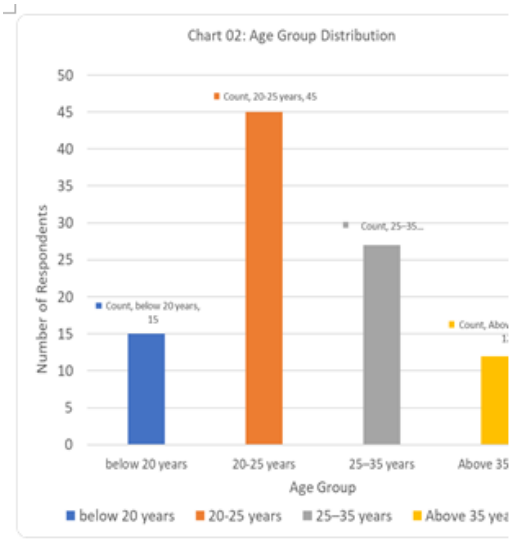


FIG 2: Age Group Distribution.

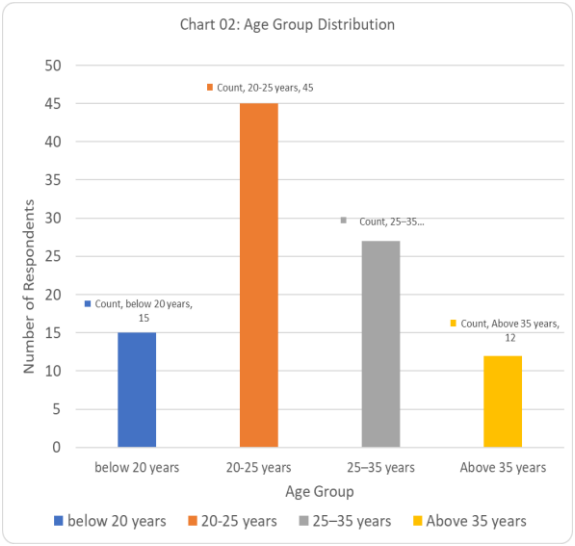


FIG 3: Type of NVA Activities Noticed

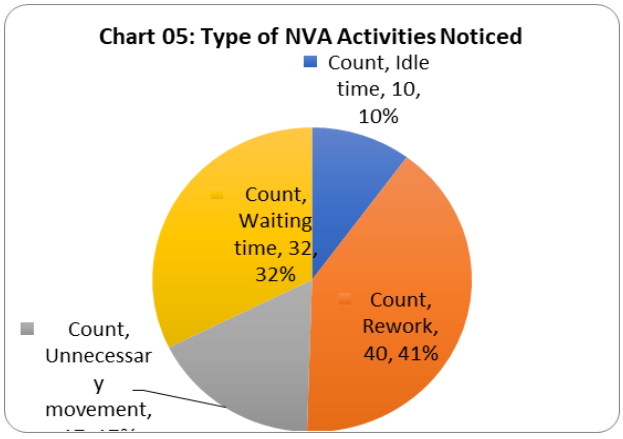


FIG 4: Major Causes of NVA Activities.

B. NVA Activities Analysis

Rework is identified as the most prevalent NVA activity (40.4%), followed by waiting time (32.3%). These two activities represent over 72% of all identified NVA occurrences, indicating critical areas for immediate intervention.

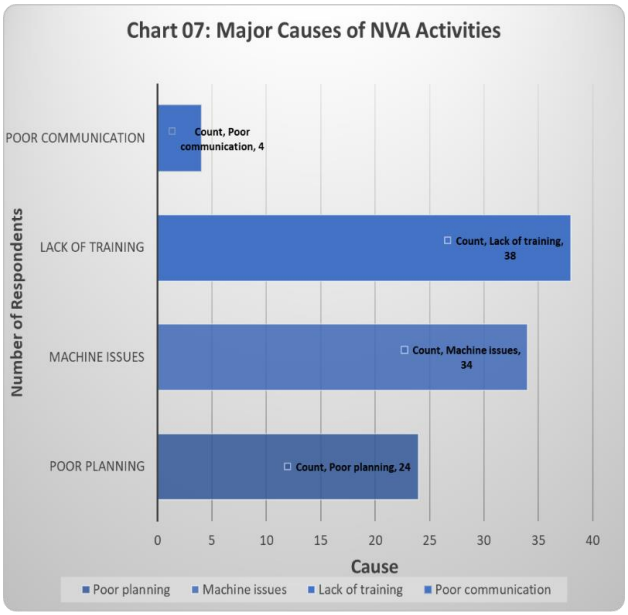
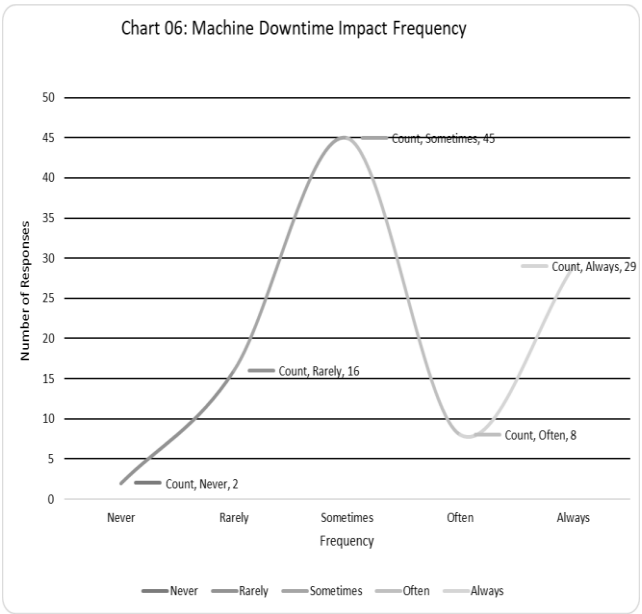


FIG 5: Machine Downtime Impact Frequency.

C. Machine Downtime and Delay Analysis

Lack of training is identified as the primary cause (38%), followed by machine issues (34%) and poor planning (24%), underscoring the need for employee skill development and equipment reliability improvements.



74% of respondents report that machine downtime sometimes or always affects operations, indicating a systemic maintenance issue that contributes to idle labour time and workflow disruption.

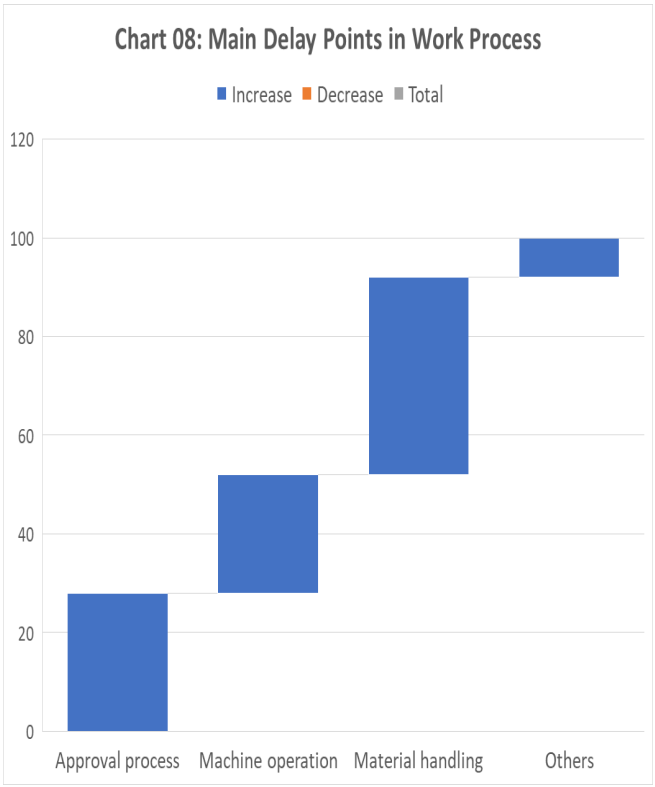


FIG 6: Main Delay Points in Work Process.

D. Time Motion Study Analysis

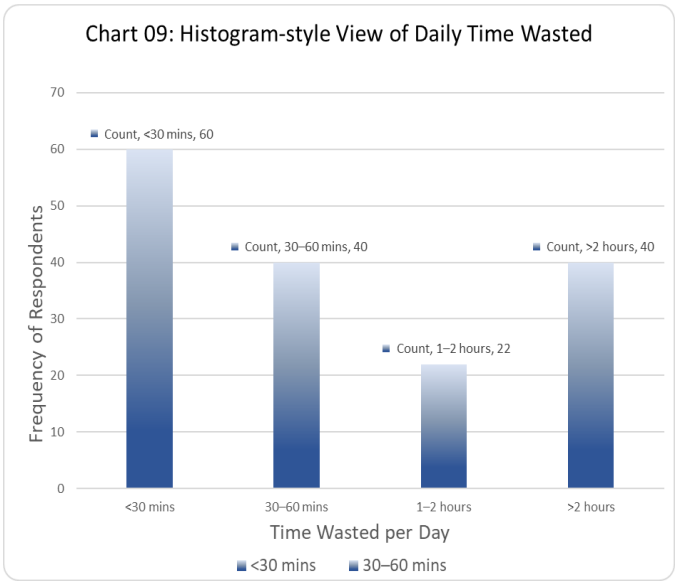


FIG 7: Time Motion Study — Average NVA Time =Lost Per Day

The time motion study reveals that rework (42 minutes/day) and waiting for materials (38 minutes/day) account for the highest non-productive labour time, together consuming approximately 80 minutes of labour per worker per day. Across the workforce, this translates to substantial annual labour cost leakage.

E. Labour Inefficiency — Weighted Evaluation

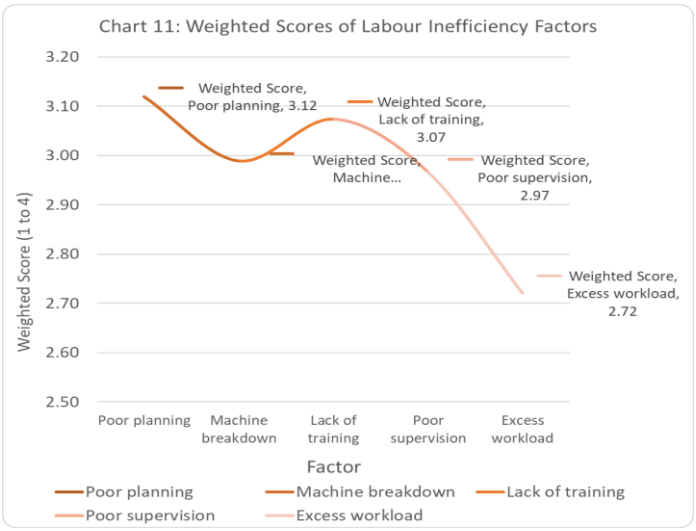


FIG 8: Labour Inefficiency Factors — Weighted Evaluation

Poor planning records the highest weighted score (3.12) and agreement rate (79.3%), making it the most significant contributor to labour inefficiency. This is followed by lack of training and machine breakdown, confirming that managerial and operational factors dominate the inefficiency landscape.

F. Overall Performance Impact of NVA Activities

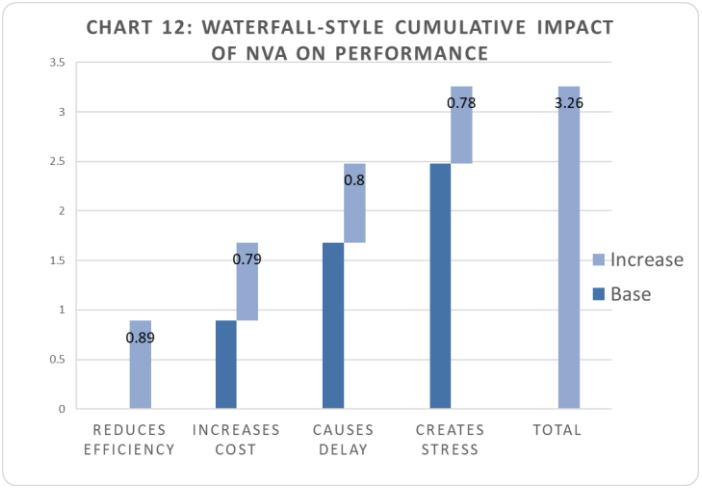


FIG 9: Overall Performance Impact

NVA activities are found to reduce efficiency (89% agreement) and increase costs (79% agreement) most significantly. An overall weighted score of 3.26 confirms strong consensus that NVA activities adversely affect all dimensions of organizational performance.

VIII. STATISTICAL ANALYSIS

A. Chi-Square Test

H_0: There is no significant association between Department and Type of NVA Activity Identified. H_1: There is a significant association between Department and Type of NVA Activity Identified.

Since $\chi^2 = 18.462$ ($df = 12$, $p = 0.102 > 0.05$), the null hypothesis is accepted. There is no statistically significant association between department and type of NVA activity identified, suggesting that NVA activities are uniformly distributed across all departments.

B. Pearson Correlation Analysis

The correlation analysis between employee experience and understanding of work processes yields $r = 0.284$ ($p = 0.004 < 0.05$), indicating a statistically significant moderate positive relationship. Employees with greater experience demonstrate better understanding of work processes, reinforcing the importance of retention and knowledge transfer in reducing NVA activities.

C. ANOVA

H_0: There is no significant difference between age groups regarding opinion on NVA elimination and labour cost reduction.

Since $F = 2.417$ ($p = 0.071 > 0.05$), the null hypothesis is accepted. No statistically significant difference exists between age groups in their opinion on NVA elimination and labour cost reduction, indicating that awareness of the problem is consistent across all age categories.

D. Ranking Analysis

Training is ranked as the most effective method (Rank I) for reducing NVA activities, followed by better planning, layout improvement, and automation — confirming that human capital development is the most critical lever for improvement.

IX. FINDINGS

- NVA activities are widely present in the production process, with rework (40.4%) and waiting time (32.3%) identified as the most prevalent types.

- Time motion study reveals that rework consumes 42 minutes/day and waiting for materials consumes 38 minutes/day of unproductive labour time.
- Lack of training (38%) and machine issues (34%) are the primary root causes of NVA activities.
- Material handling (40%) and approval processes (28%) are the main sources of production delays.
- NVA activities increase labour cost (mean = 3.89) and proper planning can reduce NVA (mean = 3.89) — both recording the highest agreement scores.
- Poor planning records the highest weighted score (3.12, 79.3% agreement) among labour inefficiency factors.
- NVA activities reduce efficiency (89.0% agreement), increase costs (79.0%), cause delays (80.0%), and create workplace stress (78.0%).
- Chi-square analysis confirms NVA activities are uniformly distributed across all departments ($p = 0.102$).
- Pearson correlation confirms that experienced employees have better work process understanding ($r = 0.284$, $p = 0.004$).
- ANOVA confirms no significant age-group difference in perception of NVA-labour cost relationship ($p = 0.071$).
- Training is ranked as the most preferred method to reduce NVA activities, followed by better planning.
- Lack of awareness (41%) and resistance to change (36%) are identified as the major barriers to eliminating NVA activities.

X. SUGGESTIONS

- Implement lean manufacturing techniques including 5S, Kaizen, and Value Stream Mapping to systematically identify and eliminate waste.
- Redesign plant layout to minimize unnecessary movement of workers and materials, thereby reducing transportation waste and handling time.
- Introduce structured training and skill development programs to address the most significant root cause of NVA activities — lack of employee training.
- Establish preventive maintenance schedules to minimize machine breakdown frequency and reduce associated idle labour time.

- Develop Standard Operating Procedures (SOPs) for all production activities to ensure consistency and reduce rework due to process variability.
- Streamline material handling systems through automation or reorganization of stores and material flow to address the primary delay point.
- Implement proper production planning and scheduling with daily monitoring to reduce waiting time and improve workflow coordination.
- Develop employee awareness programs highlighting the impact of NVA activities on labour cost to overcome the primary barrier of lack of awareness.
- Introduce change management strategies to address resistance to process improvements, involving shop-floor employees in problem identification.
- Leverage digital tools and ERP systems for better production planning, tracking, and real-time monitoring of process performance.

XI. CONCLUSION

This study conclusively demonstrates that Non-Value Added activities significantly impact labour cost and overall operational performance at Praveen Engineering Products India Pvt. Ltd. Through systematic analysis combining Likert scale surveys, time-motion studies, and inferential statistics, the research establishes that rework, waiting time, unnecessary movement, idle labour, and inefficient workflow collectively constitute a major source of labour cost leakage in the production environment.

The statistical analysis confirms that NVA activities are uniformly present across departments, that employee experience positively correlates with work process understanding, and that age groups are equally aware of the NVA-labour cost relationship. The time-motion study quantifies the daily productivity loss, with rework and material waiting alone consuming over 80 minutes of unproductive labour per worker per day.

The study underscores that a combination of training, better planning, layout improvement, and automation — led by strong management commitment and employee participation is the most effective pathway to NVA elimination. By adopting lean principles and fostering a culture of continuous improvement, organizations like Praveen Engineering Products can achieve significant reductions in labour cost, enhanced productivity, improved quality, and greater competitiveness in the engineering manufacturing sector.

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