A Study on Overall Equipment Effectiveness (OEE) At Metal Industries For Agricultural Implements, Shoranur

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Abstract- *This project aims to Overall Equipment Effectiveness (OEE) at metal industries. In the metal industry, which is pivotal for producing agricultural implements, maintaining high equipment performance is critical for operational efficiency and cost-effectiveness. This study aims to assess the current equipment performance, identify potential areas for improvement, and develop strategies to enhance Overall Equipment Effectiveness (OEE). Frequent machinery breakdowns, production delays, and escalating maintenance costs are common challenges faced by the industry, adversely affecting productivity. By analyzing existing equipment performance metricssuch as availability, performance, and quality ,this research seeks to pinpoint inefficiencies and propose solutions to optimize machine speeds, reduce cycle times, and enhance overall performance. Improving OEE not only boosts the efficiency and output of manufacturing processes but also supports the broader goal of advancing the agricultural sector by providing reliable and high-quality implements. This study underscores the importance of continuous improvement in equipment management to sustain competitive advantage and operational excellence in the metal industry.*

Keywords- Overall Equipment Effectiveness (OEE), Agricultural implements, Equipment performance, Operational efficiency, Machine optimization.

I. INTRODUCTION

Overall Equipment Effectiveness (OEE) is a comprehensive metric used to assess the efficiency and effectiveness of manufacturing equipment. It combines three critical performance factors: availability, performance, and quality. Availability measures the proportion of scheduled time that the equipment is ready to operate, performance evaluates the speed at which the equipment operates as a percentage of its designed speed, and quality assesses the ratio of good output to total output. By providing a holistic view of equipment productivity, OEE helps identify areas of loss and guides improvement efforts to enhance operational efficiency. In industries such as metal manufacturing for agricultural implements, improving OEE can lead to significant gains in production capacity, cost savings, and product quality.

The Metal Industries Ltd. Is a one among the first few pioneer industries in pre independent India and the first one in south India. The factory is located at Shoranur, a major industrial destination of Malabar region of Kerala in 24 acres of land. The ownership of the unit is as a public sector undertaking owned and promoted by the Government of Kerala.

The Metal Industries Ltd, Shoranur was established in 1928 as a public limited company and was taken over by the Government of Kerala in 1980. It is a pioneer industry engaged in the manufacture of “TUSKER” bran agricultural implements, artisan’s tools and hand tools. The Metal Industries have a wide range of produces to showcase to their respective customers and make them to the perfect produce for their purpose with a high quality in the product. The industry has great past and looking for a better future in the agricultural sector. Its products are made of high carbon steel. These are intimate and indispensable part Sort agriculture. This is the only government company producing agricultural, estate and artisan’s implements, tools and hand tools in India.

“METIND” is known for Quality, Durability and Reliability of its products and is still remains on the zenith. A special type of alloy steel used as raw material for manufacturing, which undergoes a series of scientific forging and treatment processes to refine the grain structure and thus makes our implements resistance to wear, tear and corrosion. This unique feature of the products has sky rocketed the fame of our company in capturing the local market within the country and now capable to tap the global market in agriculture implements sector.

II. REVIEW OF LITERATURE

Mario Enrique heranandaz kornez , Jesus royo (2020) : This study examines the evolution of overall equipment effectiveness (OEE), modifications made to the original model, and future development areas. A systematic literature review was conducted, analyzing 862 articles and 186 articles. The research found increased academic interest in OEE over the past five years, with keywords evolving from maintenance and production to lean manufacturing and optimization. A list of authors developing OEE models was created, and OEE is emerging in areas like logistics and services. This research serves as a basis for future relevant studies and is the first of its kind.

Osama Taisir R.Almeanazel (2010): This paper discusses the benefits of Total Productive Maintenance in a steel company in Jordan, focusing on calculating overall equipment effectiveness and addressing the big six losses: quality, availability, and speed. A multidiscipline team was formed to eliminate department boundaries and improve maintenance processes. The company achieved 99% in quality and 76% in availability, with a 72% performance. Techniques like single-minute exchange die, computer maintenance management systems, and production planning were suggested to improve maintenance procedures and productivity. The study highlights the importance of effective maintenance strategies in any industry.

Y SiSwati, T Hidayat (2023): PT. XYZ's production process faces productivity issues due to inefficient Total Productive Maintenance (TPM) processes. OEE measures availability, performance rate, and quality rate, which are indicators of the effectiveness of TPM in improving production efficiency and operational productivity. TPM aims to minimize defects and breakdowns. This study aimed to understand OEE performance data, analyze OEE performance, and identify areas for improvement. The results showed an OEE Moulding PMS Line of 76.39%, a Performance Rate of 56%, a Quality Rate of 99.95%, and an OEE of 42.21%. Six Big Losses were identified, with a dominance of 23.0%. Improvements could be made by considering factors such as human/operator, Methods, Material, Materials, and work environment.

Soltanali, Hamzeh, Rohani, Abbas, and Tabasizadeh, Mohammad (2018): This study investigates the performance measurement through OEE theory in the Iranian automotive industry. Data from the Computerized Maintenance Management System (CMMS) was collected from two assembly lines, Peugeot and Sports Utility Vehicle (SUV). The results showed significant differences in availability rate, performance, and quality for the Peugeot and SUV lines. The OEE index for these lines increased by 0.27 and 0.21 over a year. To improve OEE, systematic manufacturing planning and the implementation of Total Productive Maintenance (TPM) are suggested. This study highlights the importance of OEE in the automotive industry.

Masha Fekri sari, Soroush Avakh Dagestan (2019): The overall equipment effectiveness (OEE) is a powerful metric in production as well as one of the methods in evaluating function for measuring productivity in the production process. In the existing method, measuring OEE is based on three main elements consisting availability, performance and quality. The purpose of this paper is to evaluate the recognized metrics of production: OEE and overall line effectiveness (OLE) by using smart systems techniques.

III. OBJECTIVES OF THE STUDY

- Assessment of current equipment performance.
- Identification of improvement opportunities.
- Development of Overall Equipment Effectiveness (OEE) Strategies.

IV. RESEARCH METHODOLOGY

The descriptive research design involves observing and collecting data on a given topic without attempting to infer cause-and-effect relationships. The goal of descriptive research is to provide a comprehensive and accurate picture of the population or phenomenon being studied and to describe the relationships, patterns, and trends that exist within the data.

The research design objectives for Overall Equipment Effectiveness (OEE) at metal industries for agricultural implements assessment of current equipment performance, improvement opportunities and OEE strategies for the machine improvements. OEE is a key metric used in manufacturing to measure production efficiency. It essentially calculates the percentage of planned production of good quality units . An OEE score of 100% represents perfect productions,with no down time , no defects , and running at the maximum speed.

V. DATA ANALYSIS

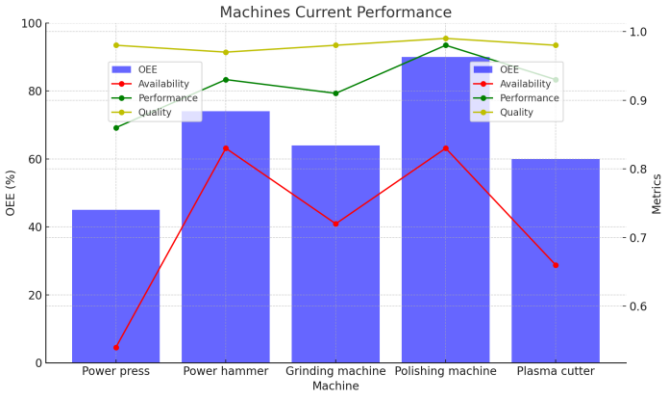
MACHINES CURRENT PERFORMANCE

achine	reak	otal time	educe speed/ breakdowns	vail ability	erformance	uality	E E

ower press	0 minutes	80 minutes	80 minutes	.54	.86	.98	5 %
ower hammer	0 minutes	80 minutes	0 minutes	.83	.93	.97	4 %
rinding machine	0 minutes	80 minutes	0 minutes	.72	.91	.98	4 %
olishing machine	0 minutes	80 minutes	0 minutes	.83	.98	.99	0 %
lasma cutter	0 minutes	80 minutes	20 minutes	.66	.93	.98	0 %

CALCULATIONS

- **Availability = Actual running time/ Total available time**
- **Performance = Actual production time/ Planned production**
- **Quality = Good production Quantity/ Total production Quality**
- **Overall Equipment Effectiveness (OEE) = Availability × performance × Quality**



- The Lines by represent the Availability, Performance, and Quality metrics for each machine.
- OEE (blue bars): Shows the overall efficiency of each machine.
- Availability (red line): Indicates the proportion of time the machines are available for production.
- Performance (green line): Measures the speed at which the machines operate relative to their designed speed.
- Quality (yellow line): Represents the ratio of good output to total output.

INTERPRETATION

- The graph shows the performance of five machines using Overall Equipment Effectiveness (OEE) and three other metrics: Availability, Performance, and Quality.
- Power Hammer and Polishing Machine have the highest OEE (around 80%).
- Power Press has the lowest OEE (about 55%).
- Availability and Quality are generally high across all machines, around 0.9 and 1.0 respectively.
- Performance varies significantly, with Power Hammer and Polishing Machine performing best.
- Overall, Power Hammer and Polishing Machine are the top performers, while Power Press needs improvement.

KEY OBSERVATIONS

Overall Equipment Effectiveness (OEE):

- Power Hammer andPolishing Machine have the highest OEE (around 80%).
- Lower Press has the lowest OEE (approximately 45%).
- Grinding Machine and Plasma Cutter have moderate OEE (around 60%).

Availability:

- Consistently high across all machines, close to 0.9.

Performance:

- Varies significantly among machines.
- Highest for Power Hammer and Polishing Machine.
- Lowest for Power Press and Plasma Cutter.

Quality:

- Generally very high for all machines, close to 1.0.
- Slight variations but remains the highest among the metrics.

VI. CONCLUSION

The study on Overall Equipment Effectiveness (OEE) in the metal industries producing agricultural implements underscores its vital role in optimizing operational efficiency. OEE provides comprehensive insights into equipment utilization by assessing availability, performance, and quality. Addressing frequent machinery breakdowns and leveraging advanced technologies can significantly enhance production efficiency, product quality, and competitiveness. Enhancing OEE is crucial for meeting the evolving demands of modern agriculture, contributing to increased productivity and sustainability. By regularly assessing equipment performance and implementing improvement strategies, manufacturers can achieve operational excellence and drive sustainable growth in the agricultural machinery sector. This optimization not only benefits manufacturers but also supports the broader agricultural industry in achieving higher levels of efficiency and innovation. It serves as a comprehensive measure of how well equipment is utilized to produce quality products efficiently. By assessing availability, performance, and quality, OEE provides valuable insights into equipment utilization and efficiency. Leveraging OEE data enables organizations to identify opportunities for improvement, streamline processes, and drive sustainable growth. As manufacturing landscapes evolve, embracing OEE methodologies becomes increasingly essential for maintaining competitiveness and achieving operational excellence in today's dynamic business environment. Enhancing the production efficiency of agricultural implements is critical for meeting the evolving needs of modern agriculture and ensuring the sustainability and profitability of farming operations. Optimizing overall equipment performance in the metal industries specializing in agricultural implements is essential for meeting the demands of modern agriculture and ensuring the sustainability and profitability of farming operations. By investigating OEE metrics, manufacturers can pinpoint inefficiencies in equipment utilization, maintenance, and performance, leading to enhanced availability, throughput, and quality of agricultural implements. This optimization is essential for meeting the increasing global demand for agricultural machinery and ensuring the competitiveness of manufacturers in the market. To improve Overall Equipment Effectiveness (OEE) in the manufacturing setting, several strategies can be implemented. First, increasing availability is crucial. This can be achieved through preventive maintenance programs that minimize unplanned downtime and ensure the longevity of equipment. Additionally, adopting quick changeover techniques, such as Single-Minute Exchange of Dies (SMED), can reduce setup times and transition delays, while maintaining a well-organized spare parts inventory ensures that critical components are readily available for swift repairs. Enhancing performance is another key strategy. Comprehensive training for operators can ensure they operate machinery at optimal speeds safely, and process optimization can help eliminate bottlenecks and inefficiencies that hinder production rates. Investing in automation and upgrading equipment can also lead to consistent and higher throughput rates. Improving quality involves implementing stringent quality control measures throughout the production process to detect and address defects early. Conducting root cause analysis on recurring quality issues and providing employees with training in best practices for quality assurance can further help maintain high standards. Holistically, utilizing real-time OEE monitoring systems can provide continuous insights into equipment performance, aiding in the identification of improvement areas. Encouraging a culture of continuous improvement allows employees to suggest and implement incremental changes, while forming cross-functional teams ensures diverse expertise from maintenance, production, and quality assurance departments are leveraged for OEE initiatives. These integrated strategies can significantly enhance the availability, performance, and quality of equipment, leading to substantial improvements in OEE and overall operational efficiency.

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