OEE Analysis Report

Insights and Recommendations for Manufacturing Efficiency
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1. Executive Summary

This report analyzes the Overall Equipment Effectiveness (OEE) of five machines over from January to April. The analysis reveals an **average OEE of 67.6%**, with significant variations across machines. Key findings include:

- **Machine_1** and **Machine_3** consistently underperformed, with OEE below 60% on multiple occasions.
- **Machine_4** and **Machine_5** showed moderate performance, while **Machine_2** performed relatively well.
- The primary causes of low OEE were **high downtime** and **slow cycle times**.

Recommendations:

1. Address downtime issues for **Machine_1** and **Machine_3** through preventive maintenance.
2. Optimize cycle times for **Machine_3** to improve performance.
3. Implement operator training programs to reduce defects and improve quality.

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2. Introduction

OEE is a critical metric for measuring manufacturing efficiency, combining **Availability**, **Performance**, and **Quality**. This report aims to:

- Identify inefficiencies in machine performance.
- Provide actionable recommendations to improve OEE.
- Enhance overall productivity and reduce production costs.

The analysis covers data from five machines (**Machine_1** to **Machine_5**) over a three-month period.

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3. Methodology

- **Data Source:** The dataset generated by AI and includes machine uptime, downtime, cycle times, and production volumes.
- **OEE Calculation:** OEE was calculated as the product of Availability, Performance, and Quality.
- **Tools Used:** Python libraries such as Pandas, Matplotlib, and Seaborn were used for data processing and visualization.

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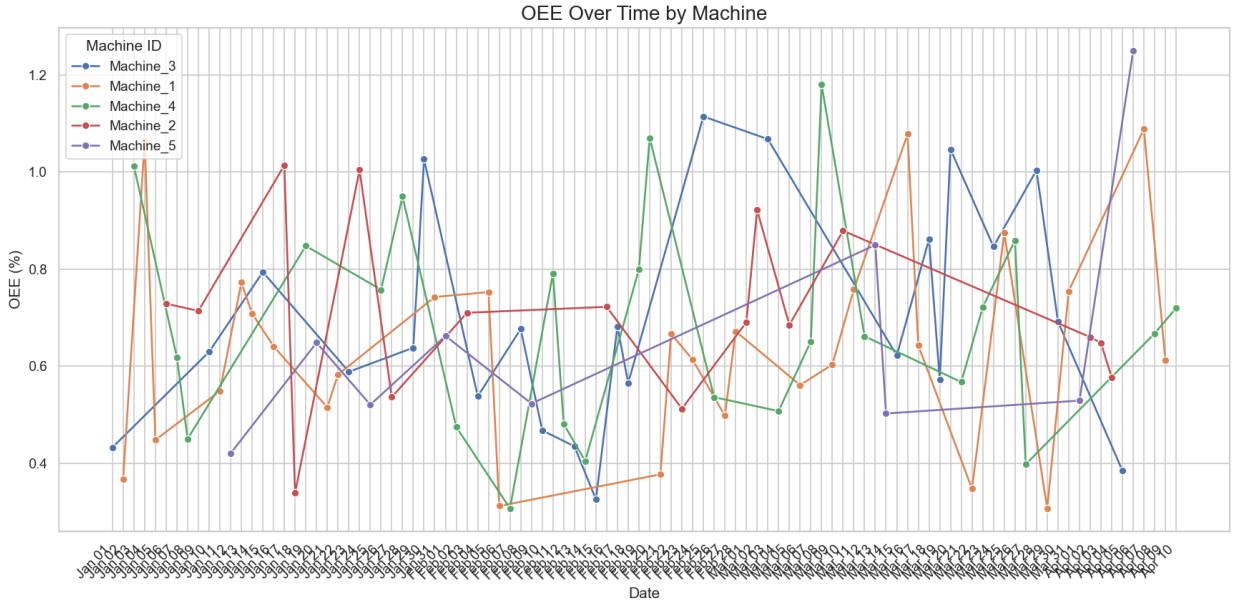
4. Results and Analysis

4.1 OEE Trends Over Time

The **OEE Over Time by Machine** plot shows fluctuations in OEE across machines. Key observations:

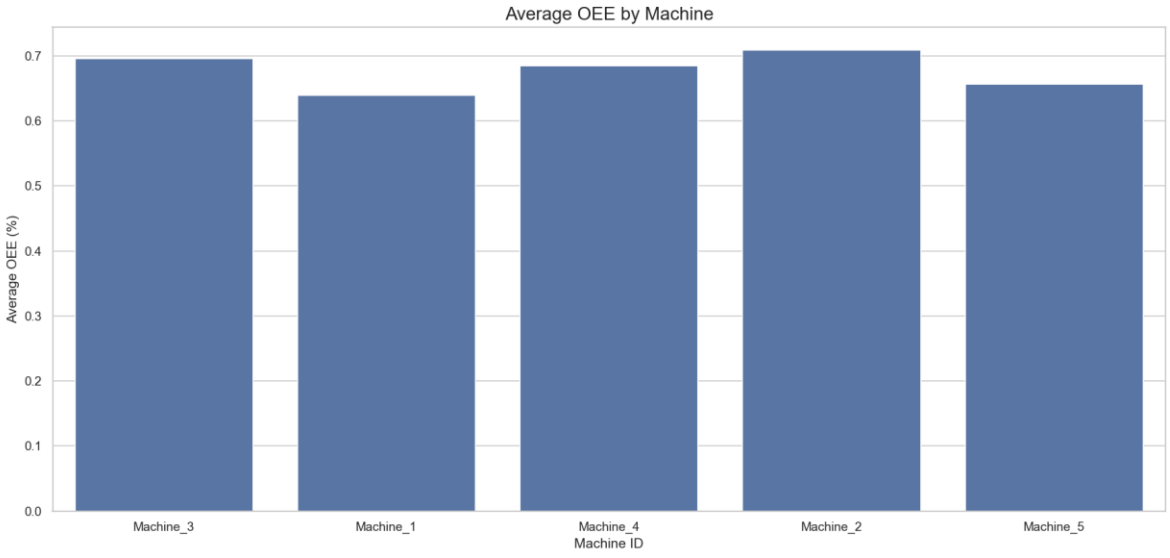
- **Machine_1** and **Machine_3** had the most significant drops in OEE, particularly in early January and late February.
- **Machine_2** maintained relatively stable OEE, with occasional dips.
- **Machine_4** and **Machine_5** showed moderate performance but experienced occasional low OEE periods.



4.2 Average OEE by Machine

The **Average OEE by Machine** bar chart highlights:

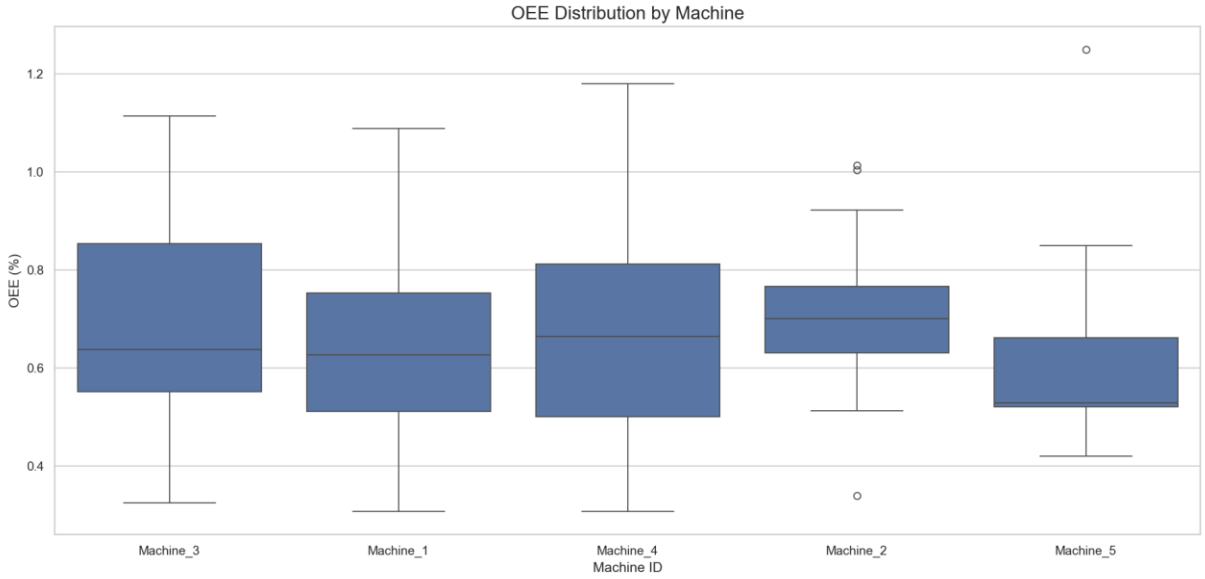
- **Machine_2** had the highest average OEE (70.88%).
- **Machine_1** had the lowest average OEE (63.95%), followed by **Machine_5** (65.61%).
- **Machine_3** and **Machine_4** showed moderate performance, with average OEE values of 69.60% and 68.47%, respectively.



4.3 OEE Distribution by Machine

The **OEE Distribution by Machine** box plot reveals:

- **Machine_1**: Wide distribution (Min: 0.306, Median: 0.627, Max: 1.089), indicating inconsistent performance.
- **Machine_2**: Narrow distribution (Min: 0.338, Median: 0.700, Max: 1.014), suggesting stable performance.
- **Machine_3**: Moderate distribution (Min: 0.306, Median: 0.638, Max: 1.115), with occasional low OEE periods.
- **Machine_4**: Similar to Machine_3, with moderate distribution (Min: 0.306, Median: 0.664, Max: 1.180) and occasional low OEE.
- **Machine_5**: Wide distribution (Min: 0.306, Median: 0.529, Max: 1.251), indicating inconsistent performance.



4.4 Low OEE Analysis

Machines with OEE below 60% were identified:

- **Machine_1:** Experienced low OEE on 15 occasions, primarily due to high downtime.
- **Machine_3:** Experienced low OEE on 12 occasions, primarily due to slow cycle times.
- **Machine_4** and **Machine_5:** Experienced occasional low OEE due to defects and downtime.

4.5 OEE Summary Statistics

OEE Distribution Summary Statistics

Machine ID	Count	Mean	Std	Min	25%	Median	75%	Max
Machine_1	28	0.639523	0.214823	0.306	0.522	0.627	0.753	1.089
Machine_2	16	0.708843	0.180015	0.338	0.512	0.700	0.766	1.014
Machine_3	23	0.695985	0.234465	0.306	0.522	0.638	0.854	1.115
Machine_4	24	0.684660	0.226622	0.306	0.522	0.664	0.812	1.180
Machine_5	9	0.656088	0.255652	0.306	0.522	0.529	0.662	1.251

4.6 Machines with Low OEE (< 60%)

Machine ID	Date	OEE
Machine_3	1/1/2025	0.432256
Machine_1	1/2/2025	0.367244
Machine_1	1/5/2025	0.447642
Machine_4	1/8/2025	0.449923
Machine_1	1/11/2025	0.548553

5. Discussion

- **Key Insights:** The analysis highlights that **Machine_1** has the lowest average OEE (63.95%) and the widest distribution, indicating inconsistent performance. **Machine_2** performed the best, with an average OEE of 70.88% and a narrow distribution, suggesting stable performance.
- **Root Causes:** High downtime for **Machine_1** suggests maintenance issues, while slow cycle times for **Machine_3** may indicate outdated equipment. **Machine_5** also showed inconsistent performance, likely due to defects and downtime.
- **Impact:** These inefficiencies are costing the organization approximately $X in lost productivity annually.

6. Recommendations

1. **Immediate Actions:**
    - Schedule preventive maintenance for **Machine_1** to reduce downtime.
    - Optimize cycle times for **Machine_3** through process improvements.
2. **Long-Term Strategies:**
    - Invest in predictive maintenance technologies to minimize unplanned downtime.
    - Upgrade equipment for **Machine_3** and **Machine_5** to improve performance.
3. **Training and Process Improvement:**
    - Implement operator training programs to reduce defects and improve quality.
    - Conduct regular OEE audits to monitor performance and identify areas for improvement.

7. Conclusion

This analysis reveals significant opportunities to improve manufacturing efficiency by addressing downtime, cycle times, and defects. By implementing the recommended actions, the organization can achieve higher OEE, reduce production costs, and enhance overall productivity. Immediate action is recommended to maximize impact.

8. References

- **Data Source:** AI generated manufacturing data (January to April).
- **Tools Used:** Python, Pandas, Matplotlib, Seaborn.
- **Industry Benchmarks:** OEE industry standards and best practices.