Project Overview: Maintenance Data Analysis for Production Optimization

Business Problem

Our manufacturing operations are facing a critical challenge: low production capacity that fails to meet increasing sales demand. This shortfall is primarily driven by excessive equipment downtime across our three main production lines (SC, EU, and SA). Frequent failures and repairs lead to reduced output, resulting in lost revenue, delayed deliveries, and potential customer dissatisfaction. The root of the issue lies in suboptimal maintenance practices, where unplanned breakdowns disrupt operations and prevent us from achieving full capacity utilization.

By addressing this through data-driven analysis, we aim to minimize downtime, enhance equipment reliability, and scale production to align with market needs. This project focuses on identifying bottlenecks, prioritizing fixes, and implementing improvements to boost overall efficiency, potentially increasing availability by up to 20% on the most affected line.

Key Questions to Answer

To guide our analysis and decision-making, we will address the following questions based on maintenance data:

1. **What are the current availability rates for each production line?**
   This helps benchmark performance and identify the line with the greatest improvement potential.
2. **What are the MTBF (Mean Time Between Failures) and MTTR (Mean Time to Repair) numbers for each production line?**
   These metrics reveal failure frequency and repair efficiency, highlighting whether issues are chronic or sporadic.
3. **What is the most critical equipment requiring immediate action?**
   Using Pareto analysis (80/20 rule), we'll pinpoint machines causing the majority (~80%) of downtime.
4. **What is the action plan for improving the critical equipment to increase availability levels?**
   This includes short-term fixes, preventive measures, and resource allocation focused on dominant root causes (e.g., mechanical vs. electrical).

5. **What is the project plan to be approved?**
   A phased timeline for implementation, monitoring, and scaling improvements across lines.

These questions ensure a structured approach, turning data insights into actionable strategies.

Metrics to Measure

We will track the following key performance indicators (KPIs) to quantify issues and evaluate progress. These metrics are calculated from historical data and will be monitored post-implementation:

- **Availability**: Percentage of time the line is operational (Up Time / Total Time). Target: Increase to 95%+ for underperforming lines.
- **MTBF (Mean Time Between Failures)**: Average time between failures (Up Time / Number of Failures). Higher values indicate better reliability.
- **MTTR (Mean Time to Repair)**: Average time to fix a failure (Down Time / Number of Failures). Lower values mean faster recoveries.
- **Up Time**: Total operational hours per line.
- **Down Time**: Total hours lost to failures.
- **Number of Failures**: Count of breakdown incidents.

Additional breakdowns include:

- Root cause distribution (e.g., Mechanical % vs. Electrical %).
- Machine-specific downtime (sum and count of durations).

Success will be measured by reductions in Down Time and improvements in Availability, with weekly tracking during the project.

Data Information

Data Source and Scope

- **Time Period**: 90 days (covering approximately December 2019 onward, based on sample entries), assuming 24-hour operations per day.
- **Total Operational Time**: 2,160 hours (90 days × 24 hours).
- **Production Lines Covered**: SC, EU, and SA.
- **Data Format**: Tabular records including columns like Date, Line Name, Machine Name, Machine Code, Shift, From/To Times, Duration, Failure Description, Root Cause, Action Taken, Section (e.g., Electrical/Mechanical), and Individuals Involved.