Manufacturing Line Productivity Report

Introduction:

The organization specializes in producing its proprietary line of soft drinks, offering a variety of flavors such as Orange, Lemon Lime, Cola, Diet Cola, and Root Beer. To maintain production efficiency, four operators are assigned to different shifts.

Purpose and Objectives:

The organization is currently addressing several production challenges. To tackle these issues, the purpose has been set to improve manufacturing efficiency while minimizing downtime and product rejection. The objectives focus on identifying inefficiencies in production by analyzing factors that contribute to increased downtime and prolonged cycle times.

Terminology:

1. **Rejection in Manufacturing**: Refers to the disposal of products that do not meet quality standards, specifications, or tolerances during production.
2. **Downtime in Manufacturing**: The period when equipment or production lines are not operational, leading to delays and decreased output.
3. **Operational Time**: The duration required by an operator to produce a single batch of a product.
4. **Cycle Time**: The time needed to complete a process, calculated as:
   Cycle Time = Operation Time − DowntimeCycle Time = Operation Time − Downtime
5. **MTTR (Mean Time to Repair)**: The average time taken by an operator to resolve an issue, calculated as:
   MTTR = Total Downtimem / Total Number of Downtime Occurrences
6. **MTBF (Mean Time Between Failures)**: A reliability metric indicating the average time a system operates before failing, calculated as:
   MTBF=Total Operational Time / Number of Failures
7. **Downtime Percentage**: Calculated as:
   Downtime = (Downtime / Operational Time) ×100%
8. **Operational Efficiency**: Calculated as:
   Operational Efficiency = Average Cycle Time / Targeted Cycle Time

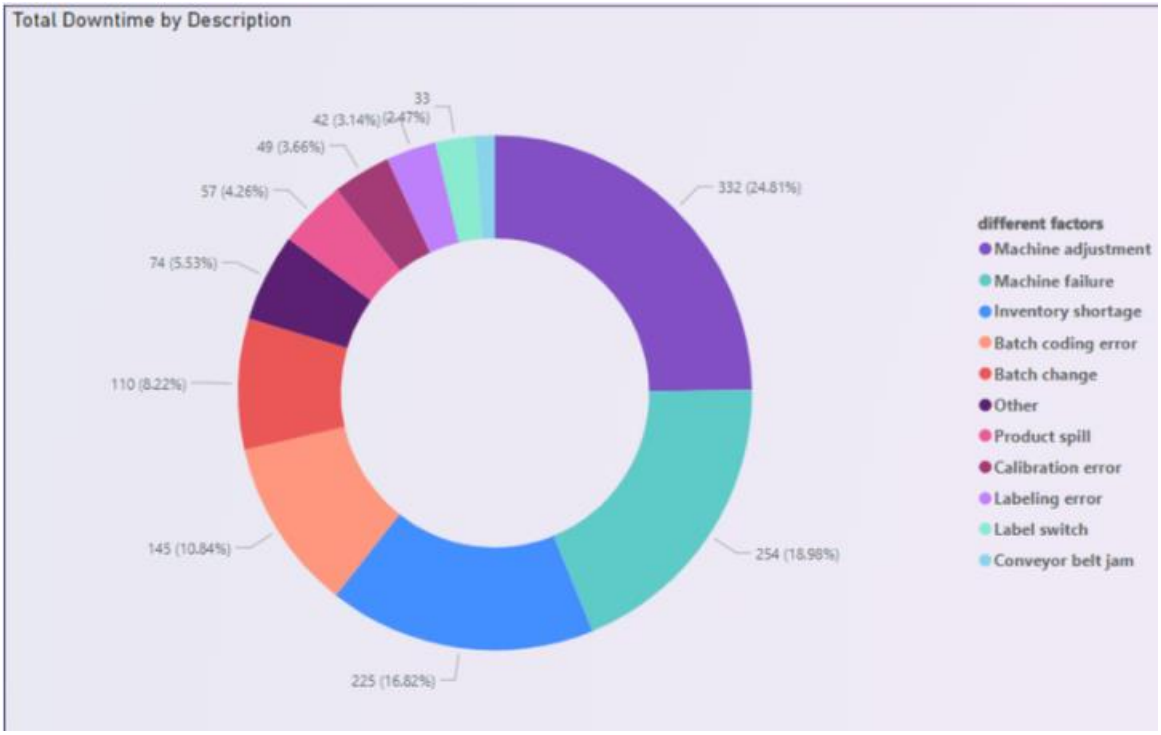
Key Performance Indicators (KPIs):

- **Target Rejection Rate**: Set at 1, with current rejections at 1.13.
- **Mean Time Between Failures (MTBF)**: Targeted at 54, currently at 40.00.
- **Operational Efficiency**: Targeted at 100%, currently achieving 90.48%.
- **Mean Time to Repair (MTTR)**: Target set at 16, with current performance at 22.30.

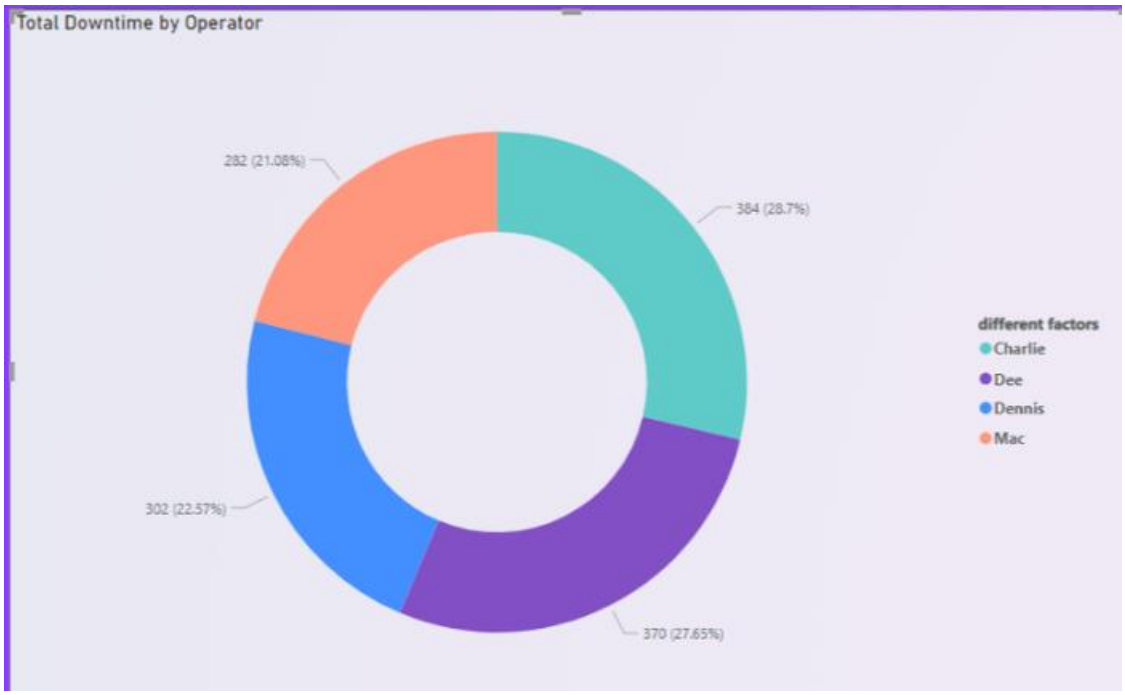
These KPIs are essential for tracking and improving manufacturing processes by highlighting areas needing attention and ensuring alignment with strategic objectives.

Key Data Analysis Questions:

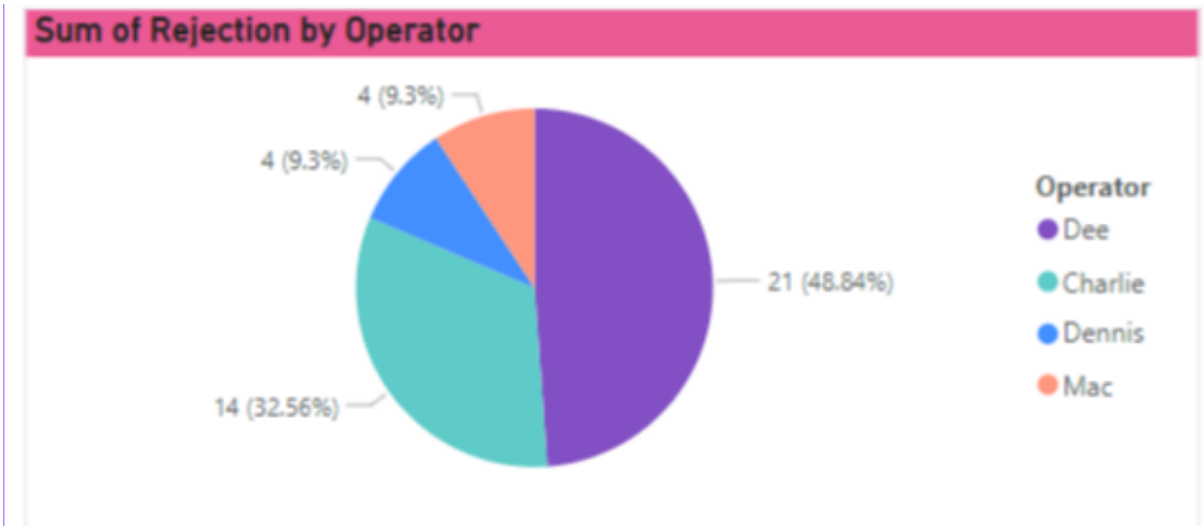
1. **Primary Reasons for Downtime**
    - What are the main causes contributing to downtime?
2. **Correlation Between Downtime and Operators**
    - Is there a link between downtime and specific products or operators?
3. **Correlation Between Rejection and Operators**
    - Is there a relationship between product rejection rates and specific operators?



1. **Primary Reasons for Downtime**: The chart identifies key factors such as machine adjustments, failures, inventory shortages, and other operational issues.

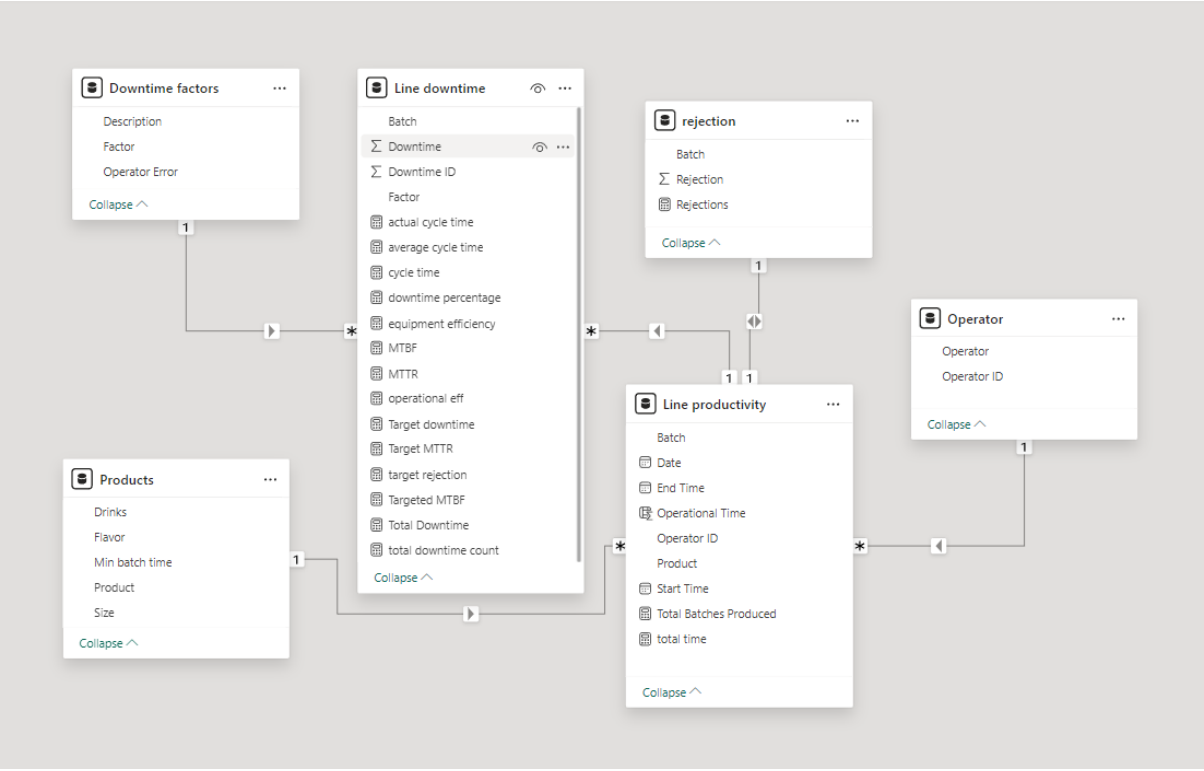


2. **Downtime by Operator**: The data reveals how different operators contribute to overall downtime, with each operator's impact clearly depicted.

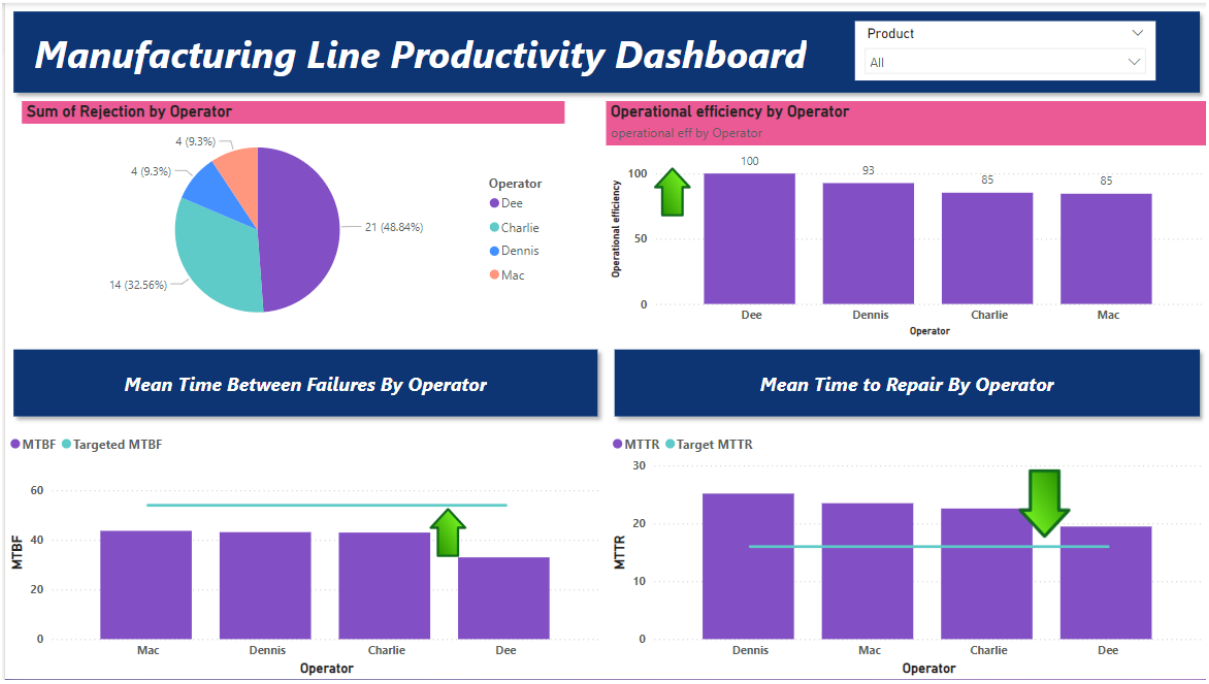


3. **Rejection by Operator**: This analysis shows the percentage of product rejections associated with each operator, highlighting areas for potential improvement.

Data Model:



Dashboard:



Manufacturing Line Productivity Dashboard Analysis:

This dashboard provides a comprehensive view of key performance metrics related to manufacturing line productivity, focusing on operator performance. Here's a detailed breakdown of each chart and the insights they offer:

Sum of Rejection by Operator:

- **Description**: This pie chart illustrates the proportion of product rejections attributed to each operator.
- **Insights**:
  - Dee is responsible for nearly half (48.84%) of the rejections, indicating potential areas for training or process improvement.
  - Charlie and Mac also contribute significantly, with 32.56% and 9.3% respectively.
- **Importance**: Understanding rejection rates per operator helps target specific training needs and improve overall product quality.

Operational Efficiency by Operator:

- **Description**: This bar chart shows the operational efficiency percentage for each operator.
- **Insights**:
  - Dee achieves 100% efficiency, setting a benchmark for others.
  - Dennis follows closely with 93%, while Charlie and Mac both operate at 85%.

- **Importance**: High operational efficiency is crucial for maximizing productivity and minimizing costs. Identifying top performers can help in sharing best practices across the team.

Mean Time Between Failures (MTBF) by Operator:

- **Description**: This bar chart compares the actual MTBF against the targeted MTBF for each operator.
- **Insights**:
    - Charlie exceeds the target MTBF, suggesting robust operational practices.
    - Other operators fall short, indicating areas where maintenance processes could be improved.
- **Importance**: MTBF is a critical measure of reliability. Exceeding targets can reduce downtime and increase production continuity.

Mean Time to Repair (MTTR) by Operator:

- **Description**: This chart displays the MTTR for each operator compared to the target MTTR.
- **Insights**:
    - Dennis has a lower MTTR than the target, showcasing effective problem-solving skills.
    - Other operators exceed the target, suggesting a need for enhanced troubleshooting training.
- **Importance**: Lower MTTR means quicker recovery from failures, reducing overall downtime and improving production flow.

By analyzing these metrics, organization can identify strengths and weaknesses in their operations, optimize resource allocation, and implement targeted improvements to enhance overall productivity.

Open-Source Data:

In this project, we generated our own data to analyze manufacturing line productivity. However, exploring open-source data can offer additional benefits:

1. **Broader Context**: Open-source datasets can provide industry benchmarks and trends, helping to contextualize our findings.
2. **Validation**: Using external data sources allows for cross-validation of our results, ensuring accuracy and reliability.
3. **Innovation**: Access to diverse datasets can inspire new approaches and solutions to common manufacturing challenges.

4. **Collaboration**: Open-source data fosters collaboration with other researchers and industry professionals, enhancing the scope and impact of our work.

By integrating open-source data in future projects, we can enrich our analysis and drive more comprehensive insights.

Conclusion:

The data analysis has identified significant inefficiencies in downtime, product performance, and operator efficiency. By pinpointing root causes, we can implement targeted strategies to enhance Overall Equipment Effectiveness (OEE) and boost throughput. Reducing downtime through preventive measures and improving operator performance is essential for achieving productivity gains. To elevate productivity, we will focus on key KPIs such as OEE, downtime, and throughput. Implementing strategies to minimize downtime, alongside optimizing operator training and maintenance schedules, will ensure long-term efficiency improvements.

Learning Outcomes:

As a student tasked with building this dashboard, I have gained valuable insights and skills:

1. **Data Analysis Skills**: Enhanced ability to identify key inefficiencies in production processes, focusing on downtime, product quality, and operator performance.
2. **Dashboard Development**: Acquired practical experience in designing and implementing a comprehensive dashboard that effectively visualizes critical performance metrics.
3. **Critical Thinking**: Developed the capacity to ask insightful questions about data, such as identifying correlations between downtime and operator efficiency.
4. **Strategic Planning**: Learned how to propose targeted strategies for improving Overall Equipment Effectiveness (OEE) and reducing downtime through data-driven insights.
5. **Communication Skills**: Improved ability to present complex data findings in a clear and professional manner, suitable for informing strategic decisions.

These outcomes have equipped me with the tools to effectively analyze and optimize manufacturing processes, preparing me for future challenges in data analytics and operations management.