Exploratory Analysis Questions

# Cause Analysis

1. **Which factors are most associated with downtime?**

* Tables: Downtime Factors, Line Downtime.
* Visualizations: Draw a Pareto chart that shows how much each factor contributes to downtime, and factors that collectively contribute to 80% of downtime (vital few).
* Steps:
  1. Join Downtime Factors and Line Downtime.
  2. Group factors by the sum of downtime minutes.
  3. Sort data by total downtime minutes in a descending order.
  4. Calculate downtime contributed by each factor as a percent of the total, and a cumulative percent of total.
  5. Draw a pareto chart.

1. **Are some downtime factors more frequent than others?**

* Tables: Downtime Factors, Line Downtime.
* Visualization: Scatter chart.
* Steps:
  1. Join Line Downtime and Downtime Factors.
  2. Group factors by the sum of downtime minutes and their frequency of occurrence using any non-null column.
  3. Draw a scatter chart with total downtime minutes on the x-axis and the frequency of occurrence on the y-axis.

1. **Does operator error cause more downtime than other causes?**

* Tables: Downtime Factors, Line Downtime.
* Visualizations: Pie chart.
* Steps:

1. Join Downtime Factors with Line Downtime.
2. Plot operator error and the sum of downtime minutes in a pie.
3. **Which operator causes more downtime and through which factors?**

* Tables: Downtime Factors, Line Downtime, Line Productivity.
* Visualizations: Stacked bar chart that compares downtimes caused by each operator, and breaks downtime by factors for each operator.
* Steps:
  1. Join tables.
  2. Plot the stacked bar.

1. **Does downtime occur at higher rates for in products with certain flavors?**

* Tables: Line Downtime, Line Productivity, Products.
* Visualization: Bar chart showing average downtime for each flavor.
* Steps:
  1. Join tables.
  2. Plot product flavors by average downtime in minutes.

1. **How does product size impact the occurrence of downtime?**

* Tables: Line Downtime, Line Productivity, Products.
* Visualizations: Bar chart showing average downtime for each product size.
* Steps:
  1. Join tables.
  2. Plot product size and average downtime in minutes.

1. **Does product spill occur more often with products of large volume?**

* Tables: Downtime Factors, Line Downtime, Line Productivity, Products.
* Visualization: bar chart showing downtime due to product spill in different product sizes.
* Steps:

1. Join data.
2. Filter by product spill.
3. Plot the graph.
4. **Which products experience more downtime?**

* Tables: Line Downtime, Line Productivity.
* Visualization: bar chart showing total Downtime for each product.
* Steps:
  1. Join data.
  2. Plot product by sum downtime in minutes.

# Time Analysis

Time analysis is based on batch start times.

1. **How does downtime vary overtime?**

* Tables: Line Downtime, Line Productivity.
* Visualizations: Line chart showing total downtime by day.
* Steps:
  1. Join tables.
  2. Plot chart.

1. **How does downtime vary by work shifts?**

* Tables: Line Downtime, Line Productivity.
* Visualizations: Bar chart showing total downtime for each work shift.
* Steps:

1. Join tables.
2. Add a new column for work shifts (Night: 00 – 08, Morning: 08 – 16, Afternoon: 16 – 24).
3. Plot bar chart.
4. **How much production time was lost due to downtime?**

# Impact Analysis

1. **How does down time impact productivity?**

* Tables: Line Downtime, Line Productivity
* Visualizations: Line plot comparing the number of produced batches per hour to total downtime.
* Steps:

1. Join tables.
2. Group by days, count of batches divided by day work time (last end time – first start time in hours), sum of downtime.
3. Plot graph.

# Task Assignment

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| --- | --- | --- |
| **Analysis Area** | **Question Number** | **Assigned to** |
| Cause Analysis | 1 | Mohamed |
| 2 | Mohamed |
| 3 | Mohamed |
| 4 | Ahmed |
| 5 | Ahmed |
| 6 | Ahmed |
| 7 | Abd Al-Rahman |
| Time Analysis | 1 | Omar |
| 2 | Omar |
| 3 | Omar |
| Impact Analysis | 1 | Abd Al-Rahman |
| 2 | Abd Al-Rahman |