**BDAT 1009 – Enterprise Analytics**

**Final Assignment**

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# **Task 1 – Background Information**

We have been assigned to assist a company (**L'Oréal Paris**) in developing their data strategy, and for this purpose, we have selected a dataset that encompasses various aspects of the company's operations. The dataset includes information about sales, customer demographics, product performance, and operational efficiency. The project's importance lies in harnessing the power of data to make informed decisions, enhance operational efficiency, and drive strategic initiatives. By analyzing this dataset, the company aims to gain insights into customer behavior, optimize resource allocation, and ultimately improve overall business performance.

# **Task 2 – Strategy Development**

## **SMART Objectives and KPI:**

1. **Objective:** Increase revenue by 15% within the next quarter by implementing targeted marketing strategies and promotional campaigns.

**KPI:** RevenueGeneratedByProducts =

SUMX(

FILTER(

        supply\_chain\_data,

        'supply\_chain\_data'[Product type] = "cosmetics" ||

        'supply\_chain\_data'[Product type] = "haircare" ||

        'supply\_chain\_data'[Product type] = "skincare"

    ),

    'supply\_chain\_data'[Revenue generated]

)

1. **Objective:** Maintain an optimal stock level with a variance of less than 5% by implementing an advanced inventory management system within the next quarter.
   * **KPI:** Inventory Turnover Ratio = SUM('supply\_chain\_data'[Number of products sold]) / AVERAGE('supply\_chain\_data'[Stock levels])
2. **Objective:** Reduce lead times by 20% through process optimization and improved communication with suppliers, aiming to accomplish this within the next six months.
   * **KPI:** Average Lead Time = AVERAGE('supply\_chain\_data'[Lead times])
3. **Objective:** Achieve a defect rate of less than 1% through enhanced quality control measures and employee training within the next three months.
   * **KPI:** Product Defectivity Rate = SUM('supply\_chain\_data'[Defect rates]) / COUNT('supply\_chain\_data'[Defect rates])
4. **Objective:** Reduce manufacturing costs by 12% through the implementation of lean manufacturing practices and strategic sourcing within the next six months.

* **KPI:** Average Cost of Manufacturing = AVERAGE(‘supply\_chain\_data’[Manufacturing\_Cost])

# **Task 3 – Analyze and Visualize**

## **Card Visual:**



1. **Inventory Turnover Ratio:**
   * **Card Visualization:** Display the current Inventory Turnover Ratio.
   * **Formula:** Inventory Turnover Ratio is calculated as Inventory Turnover Ratio = (Ending Inventory / Cost of Goods Sold), where Ending Inventory is the current stock level and Cost of Goods Sold (COGS) is the total manufacturing cost of products sold during a specific period. This ratio indicates how well inventory is managed and how efficiently products are being sold.
2. **Revenue By Products:**
   * **Card Visualization:** Show the total Revenue generated by all products.
   * **Formula:** This value is the sum of revenue generated by each product. It's calculated by aggregating the sales of individual products. It gives an overall view of the company's income from product sales.
3. **Average Manufacture Cost:**
   * **Card Visualization:** Display the average manufacturing cost per product.
   * **Formula:** Average Manufacture Cost = (Total Manufacturing Cost / Number of Products). This provides insight into the average cost incurred in producing each unit of the product. Monitoring this cost is crucial for maintaining profitability.
4. **Product Defectivity Rate:**
   * **Card Visualization:** Present the current Product Defectivity Rate.
   * **Formula:** Product Defectivity Rate = (Number of Defective Products / Total Number of Products) \* 100. This percentage indicates the proportion of products that are defective, offering insights into manufacturing quality and efficiency.
5. **Average Lead Time:**
   * **Card Visualization:** Display the average time taken to produce a product.
   * **Formula:** Average Lead Time is calculated as (Total Production Time / Number of Products). It represents the average time taken to manufacture each product. Monitoring this metric is essential for assessing production efficiency and meeting demand timelines.

## **Clustered Column Chart:**

**A graph of a number of yellow rectangular objects

Description automatically generated with medium confidence**

**Data:**

* **Product Type:** Skincare, Haircare, Cosmetics
* **Revenue Generated:**
  + Skincare: $241,628.16
  + Haircare: $174,455.39
  + Cosmetics: $161,521.27

**Visual Representation:**

The clustered column chart visually represents the revenue generated by different product types. Each product type has its set of columns, and the height of each column corresponds to the revenue it generated.

* **X-Axis:** Product Types (Skincare, Haircare, Cosmetics)
* **Y-Axis:** Revenue in Dollars

**Formulas to Create Visual:**

**1. Data Preparation:**

If your data is not already organized in a way that Excel understands, use formulas to arrange it correctly.

* **For Transposing Data (if needed):**

=TRANSPOSE (A1:B4) // Assuming your data is in columns A and B

**2. Creating the Chart:**

* **Select Data:**
  + Highlight the transposed or original data.
* **Insert Clustered Column Chart:**
  + Go to the "Insert" tab.
  + Choose "Clustered Column Chart."

**3. Customization:**

* **Axis Labels:**
  + Ensure that the X-axis represents product types, and the Y-axis represents revenue.
* **Formatting:**
  + Customize colors, titles, and other design elements.
  + Use conditional formatting for emphasis.

**4. Adding Data Labels:**

* **For Value Labels:**
  + Select the chart.
  + Go to "Chart Elements" (often a '+' near the chart).
  + Choose "Data Labels."

**Report Interpretation:**

* **Insights:**
  + Clearly state the insights derived from the chart.
  + For instance, you can highlight the highest revenue-generating product and any notable trends.
* **Recommendations:**
  + Suggest any actions or strategies based on the insights.

## **Line and Clustered Column Chart:**

A graph of a graph showing cost and inventory

Description automatically generated with medium confidence

**Data:**

* **Product Type:** Haircare, Skincare, Cosmetics
* **Sum of Manufacturing cost:**
  + Haircare: 1959.73
  + Skincare: 1647.57
  + Cosmetics: 1119.37
* **Inventory Turnover Ratio:**
  + Haircare: 281.49
  + Skincare: 515.70
  + Cosmetics: 200.45

**Visual Representation:**

The line and clustered column chart combine two types of visualizations to represent both the stock levels and Inventory Turnover Ratios for each product type.

* **X-Axis:** Product Types (Haircare, Skincare, Cosmetics)
* **Primary Y-Axis (Left):** Sum of Stock Levels
* **Secondary Y-Axis (Right):** Inventory Turnover Ratio

**Formulas to Create Visual:**

**1. Data Preparation:**

If your data is not already organized in a way that Excel understands, use formulas to arrange it correctly.

* **For Transposing Data (if needed):**

=TRANSPOSE (A1:C4) // Assuming your data is in columns A, B, and C

**2. Creating the Chart:**

* **Select Data:**
  + Highlight the transposed or original data.
* **Insert Combo Chart:**
  + Go to the "Insert" tab.
  + Choose "Combo Chart."

**3. Customization:**

* **Primary Axis:**
  + Set the primary axis (left) for the "Sum of Stock Levels."
  + Choose a clustered column chart type.
* **Secondary Axis:**
  + Set the secondary axis (right) for the "Inventory Turnover Ratio."
  + Choose a line chart type.

**4. Adding Data Labels:**

* **For Column Values:**
  + Select the column series in the chart.
  + Go to "Chart Elements."
  + Choose "Data Labels."
* **For Line Values:**
  + Same process but for the line series.

**Report Interpretation:**

* **Insights:**
  + Analyze the relationship between stock levels and Inventory Turnover Ratios for each product type.
  + Identify any patterns or anomalies.
* **Recommendations:**
  + Provide recommendations based on the insights.
  + For instance, if there's a low Inventory Turnover Ratio for a high-stock product, it might indicate overstocking.

## **Pie Chart:**

A yellow pie chart with text

Description automatically generated

**Data:**

* **Product Type:** Haircare, Skincare, Cosmetics
* **Product Defectivity Rate:**
  + Haircare: 2.48%
  + Skincare: 2.33%
  + Cosmetics: 1.92%

**Visual Representation:**

The pie chart represents the distribution of defectivity rates among different product types.

* **Slices:** Each product type is represented by a slice of the pie.
* **Size of Slices:** The size of each slice corresponds to the defectivity rate of the respective product type.

**Formulas to Create Visual:**

**1. Data Preparation:**

If your data is not already organized in a way that Excel understands, use formulas to arrange it correctly.

* **For Transposing Data (if needed):**

=TRANSPOSE (A1:B4) // Assuming your data is in columns A and B

**2. Creating the Chart:**

* **Select Data:**
  + Highlight the transposed or original data.
* **Insert Pie Chart:**
  + Go to the "Insert" tab.
  + Choose "Pie Chart."

**3. Customization:**

* **Labels:**
  + Add data labels to each slice to display the defectivity rates.
* **Legend:**
  + Include a legend to indicate which color corresponds to each product type.
* **Exploding Slices (Optional):**
  + To emphasize a particular slice, you can "explode" it by selecting the slice and dragging it away from the pie.

**4. Adding Data Labels:**

* **Show Percentage Labels:**
  + Click on a slice, right-click, and choose "Add Data Labels."
  + Format the labels to show percentages.

**Report Interpretation:**

* **Comparison:**
  + Easily compare defectivity rates among different product types.
* **Identifying Critical Areas:**
  + Quickly identify if a particular product type has a significantly higher defectivity rate.
* **Actionable Insights:**
  + Provide actionable insights based on the defectivity rates. For instance, if a certain product type has a higher defectivity rate, it might require closer quality control.

## **Line Chart:**

A graph showing the cost of a product type

Description automatically generated

**Data:**

* **Product Type:**
  + Skincare
  + Haircare
  + Cosmetics
* **Average Manufacturing Costs:**
  + Skincare: $48.99
  + Haircare: $48.46
  + Cosmetics: $43.05

**Visual Representation:**

The line chart illustrates the trend in average manufacturing costs across different product types.

* **X-Axis (Horizontal):**
  + Product Types (Skincare, Haircare, Cosmetics)
* **Y-Axis (Vertical):**
  + Average Manufacturing Costs

**Formulas to Create Visual:**

**1. Data Preparation:**

If your data is not already organized in a way that Excel understands, use formulas to arrange it correctly.

* **For Transposing Data (if needed):**

=TRANSPOSE (A1:B4) // Assuming your data is in columns A and B

**2. Creating the Chart:**

* **Select Data:**
  + Highlight the transposed or original data.
* **Insert Line Chart:**
  + Go to the "Insert" tab.
  + Choose "Line Chart."

**3. Customization:**

* **Labels:**
  + Add data labels to each point to display the exact average manufacturing cost.
* **Legend:**
  + Include a legend to indicate which line corresponds to each product type.

**4. Trendlines (Optional):**

* **Add Trendlines:**
  + For a more in-depth analysis, you can add trendlines to show the overall trend in manufacturing costs.

**5. Adding Data Labels:**

* **Show Data Labels:**
  + Click on a data point, right-click, and choose "Add Data Labels."
  + Format the labels to show the average manufacturing cost.

**Report Interpretation:**

* **Cost Trends:**
  + Easily observe the trend in manufacturing costs for each product type over time.
* **Cost Comparison:**
  + Compare the manufacturing costs of different product types at a glance.
* **Identifying Variances:**
  + Quickly identify if there are significant variances in manufacturing costs among different product types.
* **Strategic Insights:**
  + Use the insights gained to make strategic decisions regarding product pricing, cost optimization, or resource allocation.

## **Line Chart:**

A graph of shipping prices

Description automatically generated with medium confidence

**Data:**

* **Product Type:**
  + Skincare
  + Haircare
  + Cosmetics
* **Average Lead Time:**
  + Skincare: 16.7
  + Haircare: 15.53
  + Cosmetics: 15.38
* **Average Shipping Time:**
  + Skincare: 5.33
  + Haircare: 5.62
  + Cosmetics: 6.58

**Visual Representation:**

The line chart illustrates the relationship between the Average Lead Time and the sum of shipping costs for different product types.

* **X-Axis (Horizontal):**
  + Product Types (Skincare, Haircare, Cosmetics)
* **Y-Axis (Vertical):**
  + Average Lead Time
  + Sum of Shipping Costs

**Formulas to Create Visual:**

**1. Data Preparation:**

If your data is not already organized in a way that Excel understands, use formulas to arrange it correctly.

* **For Transposing Data (if needed):**

=TRANSPOSE (A1:C4) // Assuming your data is in columns A, B, and C

**2. Creating the Chart:**

* **Select Data:**
  + Highlight the transposed or original data.
* **Insert Line Chart:**
  + Go to the "Insert" tab.
  + Choose "Line Chart."

**3. Customization:**

* **Labels:**
  + Add data labels to each point to display the exact Average Lead Time and sum of shipping costs.
* **Legend:**
  + Include a legend to indicate which line corresponds to each metric.

**4. Dual-Axis (Optional):**

* **Combine Line Charts:**
  + If the units of measurement for production time and shipping costs are significantly different, consider using a dual-axis to show both metrics clearly.

**5. Adding Data Labels:**

* **Show Data Labels:**
  + Click on a data point, right-click, and choose "Add Data Labels."
  + Format the labels to show the exact Average Lead Time and sum of shipping costs.

**Report Interpretation:**

* **Efficiency Analysis:**
  + Observe the relationship between production time and shipping costs for each product type.
* **Cost vs Time Trends:**
  + Identify if there's a correlation between the Average Lead Time and the associated shipping costs.
* **Cost Management:**
  + Use insights gained to optimize shipping processes and manage costs effectively.
* **Performance Comparison:**
  + Compare the efficiency of production and shipping processes across different product types.
* **Strategic Decision-Making:**
  + Make informed decisions about production and shipping strategies based on the observed trends.

# **Task 4 – Data Flow Diagram**

**A diagram of different types of objects

Description automatically generated**

**Data Sources:**

Identify the various sources of data for the company. This could include internal databases, external APIs, IoT devices, or any other relevant data streams.

**Data Ingestion:**

Use an efficient data ingestion mechanism to collect data from diverse sources. This could involve Extract, Transform, Load (ETL) processes to clean, transform, and integrate data into a unified format. Choose tools such as Apache NiFi, Apache Kafka, or cloud-based services like AWS Glue or Azure Data Factory.

**Data Storage:**

Design a data storage architecture to store the ingested data. This could include a data warehouse for structured data and a data lake for unstructured or raw data. Popular choices are Amazon Redshift, Google BigQuery, or Azure Synapse Analytics.

**Data Processing and Analytics:**

Utilize a processing layer to analyze and derive insights from the stored data. This involves using tools such as Apache Spark, Apache Flink, or cloud-based solutions like Google Dataprep or Azure Databricks.

**Data Modeling:**

Implement a data modeling layer to structure and organize the data for efficient querying and analysis. This could involve creating data cubes, data marts, or using tools like Tableau Prep or Microsoft Power Query.

**Visualization and Reporting:**

Choose a visualization and reporting tool to create dashboards and reports. Options include Tableau, Microsoft Power BI, or Looker. Connect these tools to the data warehouse or data marts to create interactive and informative visualizations.

**Feedback Loop:**

Establish a feedback loop to continuously improve the data pipeline. Monitor the performance, identify bottlenecks, and optimize the pipeline for better efficiency. Use tools like Apache Airflow or cloud-based scheduling services.

**Security and Compliance:**

Integrate security measures throughout the pipeline to ensure data privacy and compliance. Implement encryption, access controls, and auditing. Adhere to relevant data protection regulations.

**Scalability and Flexibility:**

Design the architecture to be scalable and flexible to accommodate future data growth. Consider cloud-based solutions for scalability and pay-as-you-go pricing models.

**Documentation:**

Maintain comprehensive documentation for the entire data pipeline, including data schemas, transformations, and visualization logic. This aids in troubleshooting and onboarding new team members.

This high-level overview provides a roadmap for designing an end-to-end data pipeline, ensuring that data is efficiently processed, analyzed, and visualized for the company's strategic decision-making.

# **Task 5 – Recommendations**

**Recommendations:**

1. **Optimize Shipping Processes:**

* **Insight:** The line chart reveals variations in shipping costs across different product types.
* **Recommendation:** Implement a detailed analysis of the shipping process for each product type. Identify potential bottlenecks and areas for improvement. Streamline logistics to reduce shipping costs.

2. **Efficiency Enhancement in Production:**

* **Insight:** The line chart shows differences in Average Lead Times.
* **Recommendation:** Conduct a thorough review of the production processes. Identify steps that contribute to longer production times. Implement efficiency measures, such as automation or process reengineering, to reduce production time and associated costs.

3. **Cost-Effective Manufacturing:**

* **Insight:** The average manufacturing costs vary among product types.
* **Recommendation:** Investigate the factors contributing to higher manufacturing costs. Explore opportunities to optimize the manufacturing process, negotiate better deals with suppliers, or identify cost-effective alternatives for raw materials.

4. **Inventory Management:**

* **Insight:** The clustered column chart displays stock levels for each product type.
* **Recommendation:** Implement a dynamic inventory management system. Utilize data-driven demand forecasting to prevent overstocking or stockouts. Optimize stock levels to maintain a balance between customer demand and operational costs.

5. **Quality Control and Defect Reduction:**

* **Insight:** The pie chart shows product defectivity rates.
* **Recommendation:** Strengthen quality control processes. Investigate the causes of defects and implement measures to reduce them. Improved product quality not only enhances customer satisfaction but also reduces costs associated with returns and replacements.

**Justification:**

1. **Cost Savings:**
   * By optimizing shipping processes and production efficiency, the company can achieve significant cost savings. This directly contributes to operational objectives by improving the bottom line and overall financial performance.
2. **Competitive Advantage:**
   * Streamlining manufacturing processes, reducing defects, and managing inventory effectively can lead to quicker product turnaround times. This not only reduces costs but also positions the company to respond more rapidly to market demands, providing a competitive advantage.
3. **Customer Satisfaction:**
   * Enhancing product quality through effective quality control measures contributes to higher customer satisfaction. Satisfied customers are more likely to become repeat customers and recommend the brand, contributing to long-term strategic objectives.
4. **Operational Efficiency:**
   * Implementing data-driven strategies for inventory management and production processes enhances overall operational efficiency. This aligns with the strategic objective of creating a lean and agile operation that can adapt to market changes.
5. **Risk Mitigation:**
   * Addressing variations in manufacturing costs and defect rates mitigates risks associated with operational inefficiencies. A proactive approach to quality control and cost management reduces the likelihood of unexpected disruptions.