**Supply Chain Project**

**1. Project Description:**

The **Supply Chain Project** is an interactive Power BI solution developed to monitor, analyze, and optimize various aspects of a cosmetics supply chain. The project integrates SQL for comprehensive data cleaning, transformation, and enrichment, ensuring high-quality, consistent data for analysis. By combining robust data processing with dynamic visualizations, the dashboard enables decision-makers to track shipping performance, monitor defect rates, evaluate warehouse efficiency, and analyze expense breakdowns. This, in turn, supports cost reduction initiatives and process improvements across the supply chain.

**2. Team Leader:**

* **The team leader is: Adham Atef Hussein**.

**3. Team Members & Roles:**

* **Adham Atef**:

**Data Cleaning & SQL Transformations:**  
Led the data cleaning process by writing advanced SQL scripts to remove invalid entries, handle missing data, and perform outlier detection.

**DAX Calculations & Data Modeling:**  
Developed complex DAX measures for key performance indicators (KPIs) to enhance the interactive analysis of key performance indicators.

**Dashboard Creation & Chart Design:**  
Designed and built all the Power BI dashboard pages (Overview, Shipping Analysis, Defect Analysis, Warehouse Analysis, and Expenses Analysis).

**Chart Selection & Visualization:**  
Chose the appropriate chart types (bar, line, pie, maps, Sankey diagram, etc.) and formatted them for clarity and impact.

**New Enhancements:**  
Implemented new features such as unpivoting cost columns into a dynamic “Expense Type” field, adding interactive slicers, and optimizing the overall data model for performance.

* **Adham Osama**:

**Data Review & Column Selection:**  
Participated in reviewing the data and selecting the relevant columns necessary for analysis and visualization.

**Brainstorming KPIs:**  
Assisted in brainstorming sessions to decide which KPIs to implement and how to measure them effectively.

**Dashboard Element Implementation:**  
Contributed to executing some tasks in Power BI by designing key visual elements and ensuring that insights were clearly communicated through the visuals.

**Collaboration on EDA:**  
Worked closely with Adham Atef and Mohamed Saif during the EDA phase to understand data relationships and support actionable recommendations.

* **Mohamed Saif**:

**Exploratory Data Analysis (EDA):**  
Focused on reading and exploring the raw data to extract initial insights and determine potential KPIs.

**Initial KPI Identification:**  
Helped identify some of the early performance indicators, although he did not delve deeply into their optimization.

**Visual Consistency:**  
Collaborated with the team to review and suggest improvements for the color schemes and visual consistency within Power BI.

* **Manar Mohamed**:

**Dashboard Interface & Design:**  
Took charge of designing the Home Page and overall look & feel of the dashboard, ensuring a clean, intuitive user interface.

**Visual Aesthetics:**  
Selected the color schemes and visual themes to make the dashboard easy to understand and visually appealing.

**Data Visualization Support:**  
Collaborated with Adham Atef & Adham Osama on designing charts and refining the layout of various pages, contributing to an enhanced user experience.

**Feedback & Discussion**: Actively participated in team discussions, offering insights and feedback on the data analysis, visualizations, and overall design.

* **Haidy Mahmoud Ahmed**:

**Feedback & Discussion**: Actively participated in team discussions, offering insights and feedback on the data analysis, visualizations, and overall design.

**Support Role:**  
Played a supportive role by reviewing draft versions of the dashboard and ensuring that the visual and analytical outputs met the project’s goals.

* **Ibrahim Ahmed Fawy:**

**Presentation & Final Reporting:** Will be responsible for preparing and delivering the final project presentation.

**Organizing Insights:**  
Organized the key findings, results, and recommendations from the analysis into a clear, comprehensive presentation.

**4. Project Objectives:**

The primary objectives of the project are:

* **Optimize Operations:** Identify bottlenecks and inefficiencies in shipping, inventory management, and supplier performance.
* **Enhance Quality Control:** Monitor and reduce defect rates through detailed inspection data analysis.
* **Improve Cost Management:** Break down and analyze expenses to identify major cost drivers and opportunities for savings.
* **Enable Data-Driven Decisions:** Provide interactive, real-time insights through Power BI visualizations, allowing stakeholders to quickly assess key performance areas and respond proactively.
* **Establish a Reproducible Process:** Use SQL to automate data cleaning and transformation, ensuring that the dashboard remains updated with accurate, high-quality data.

**5. Tools & Technologies:**

* **Data Analysis Tools**: SQL, Power BI (DAX).
* **Visualization Tools**: Power BI.

**6. Milestones & Deadlines:**

* **February 10, 2025**: Complete data collection.
* **February 13, 2025**: Complete data cleaning.
* **March 10, 2025**: Complete initial analysis.
* **March 14, 2025**: Submit the final report.

**7. Key Performance Indicators (KPIs):**

The dashboard includes several KPIs to provide a quick snapshot of supply chain performance:

* **Total Revenue:** Sum of all revenue generated from sales.
* **Total Orders:** Total number of orders processed.
* **Average Revenue per Product:** Revenue divided by the number of products sold.
* **Profit Margin (%):** Calculated as ((Revenue – Total Costs) / Revenue) \* 100, indicating the efficiency of profit generation.
* **Order Fulfillment Rate:** The percentage of orders successfully fulfilled based on available stock.
* **Stock Turnover Ratio:** A measure of how often inventory is sold and replenished over a specific period.
* **Shipping Costs & Lead Times:** Average shipping cost per unit and average lead times, which help assess the efficiency of logistics.
* **Inventory Health Score:** An index that evaluates stock availability relative to demand.

These KPIs are displayed using Card visuals in Power BI to offer stakeholders a real-time, high-level view of the overall supply chain performance.

**8. Data Cleaning & Processing:**

Data quality is paramount for accurate analysis. Our process involves:

* **SQL Data Cleaning:**
  + **Removing Invalid Data:** Deleting records with negative values in Price, Revenue, or Availability.
  + **Text-to-Number Conversion:** Extracting numeric data from columns like SKU.
  + **Handling Missing Values:** Replacing nulls in key fields (e.g., Customer\_demographics) with default values such as 'Unknown'.
  + **Outlier Detection:** Identifying and handling outliers using statistical thresholds (e.g., values beyond three standard deviations).
* **Data Transformation:**
  + Adding new calculated columns (e.g., Profit Margin, Stock Turnover Ratio, Lead Time Variance) using SQL ALTER TABLE and UPDATE statements.
  + Standardizing data types and formatting (e.g., converting Defect\_rates to a percentage format).

This rigorous SQL-based preprocessing ensures that the dataset imported into Power BI is clean, reliable, and enriched with the necessary metrics for further analysis.

**9. Analysis & Insights:**

The dashboard is structured to provide actionable insights into different supply chain areas:

* **Shipping Analysis:**
  + Analyzes lead times, shipping costs, and carrier performance to identify delays and cost inefficiencies.
  + Insights help in selecting the best-performing carriers and optimizing transport modes.
* **Defect Analysis:**
  + Monitors inspection results and defect rates across products and suppliers.
  + Identifies quality issues and helps pinpoint areas for improvement in production and supplier management.
* **Warehouse Analysis:**
  + Assesses inventory levels, order fulfillment, and stock turnover.
  + Provides insights into warehouse efficiency and stock health, ensuring that supply meets demand.
* **Expenses Analysis:**
  + Breaks down costs across manufacturing, shipping, and other expenses.
  + Evaluates the impact of costs on overall profitability and helps identify cost-saving opportunities.

By aggregating these insights, the dashboard empowers stakeholders to make informed decisions, streamline operations, and enhance overall supply chain performance.

**10. Forecasting & Predictions:**

Although the current version of the dashboard focuses primarily on descriptive analytics, it lays the groundwork for future forecasting:

* **Trend Analysis:** Historical data trends (e.g., lead times, defect rates, expenses) can be used to forecast future performance.
* **Predictive Models:** Advanced techniques such as linear regression or machine learning could be integrated to predict key metrics like shipping delays, defect occurrences, or cost fluctuations.
* **Scenario Analysis:** Future improvements may include simulation models that help predict the impact of changes in supplier performance or shipping strategies on overall profitability.

These predictive capabilities, once implemented, will further enhance proactive decision-making within the supply chain.

**11. Visualization & Reporting:**

The project utilizes a variety of visualizations in Power BI to clearly communicate data insights:

* **KPI Cards:** Display critical metrics at a glance.
* **Bar and Column Charts:** Compare performance across different categories (e.g., expense breakdown, revenue per product, defect rates by supplier).
* **Line Charts:** Illustrate trends over indicators like lead times or expense changes.
* **Pie/Donut Charts:** Present proportional data such as expense distribution and inspection results.
* **Maps:** Visualize geographic data, such as shipping locations and inventory distribution across cities.
* **Slicers & Filters:** Enable dynamic interaction, allowing users to drill down by location, supplier, customer segment, and more.

These visuals are carefully selected to ensure that complex data is easily understandable and that stakeholders can interact with the dashboard to extract the precise insights they need.

**12. Final Documentation & Presentation:**

The final deliverables for this project include:

* **Complete Documentation:**
  + A comprehensive README (this document) that explains project objectives, methodologies, data cleaning processes, and visualization choices.
  + Detailed SQL scripts outlining the data cleaning and transformation steps.
* **Power BI Report:**
  + A multi-page Power BI dashboard (Home, Overview, Shipping Analysis, Defect Analysis, Warehouse Analysis, Expenses Analysis) with interactive visuals and slicers.
* **Reproducibility:**
  + All source files (SQL, Excel, Power BI) are provided, ensuring that the project can be updated and maintained as new data becomes available.