EDA / Descriptive Statistics

## Introduction:

Inventory management is a crucial aspect of many businesses, and effective control of inventory levels is essential to meet customer demand while optimizing costs. The right products must always be available when needed, and overstocking and understocking situations must be avoided. Inventory management is essential to achieving this.The project's objective is to develop insightful and useful visualizations that can be used to reduce stock volatility, improve decision-making, and optimize inventory levels. Our visualization project will help us reduce the need for manual intervention in the inventory management procedures while enabling us to make data-driven decisions.

## Overall design strategy

The data covers information related Customer and their Transaction type.

Use ETL processes to extract data. Establish a relational database (e.g., PostgreSQL, MySQL) to store the extracted data.Establish a relational database (e.g., PostgreSQL, MySQL) to store the extracted data.

Perform exploratory data analysis (EDA) using Python libraries like Pandas and SQL queries to gain initial insights into the dataset. Create visualizations (e.g., histograms, scatter plots, box plots) to understand data distributions, trends, and outliers. Conduct statistical analysis to identify patterns and correlations in the data. Profile the data to identify any data quality issues, missing values, or inconsistencies.

Clean missing values, duplicates, and outliers using Python and SQL data manipulation techniques. Create calculated fields or aggregates as needed for dashboard visualizations.

Choose a Bi tool (powerbi, Tableau etc.) for dashboard creation. Establish a connection between the BI tool and the relational database to enable real-time data retrieval. Create relationships between the created tables form the data. Design interactive dashboards with key performance indicators (KPIs), charts, tables, and filters. Enable user interactivity by adding slicers, drill-through functionality etc. Create Scheduled refresh for dynamic dashborads upon any additional data.

## Data Overview

The dataset comprises a total of 80,961 records, spanning from January 1, 2019, to August 23, 2023. It offers valuable insights into pallet management and inventory transactions.

Date: This column represents the date and time of each transaction. It captures when the inventory movement occurred.

CustName: This column likely corresponds to the customer's name or identifier involved in the transaction, providing insights into customer interactions .

City: This denotes the location of the transaction, offering geographical information about where inventory is being managed.

Region: The region column categorizes the transactions into different regions (e.g., North, South, East, West), facilitating regional analysis.

State: This column specifies the state where the transaction took place, adding granularity to the geographical analysis.

Product Code: Product Code likely represents a unique identifier for each product in inventory, helps tracking the product movements in the inventory.

Transaction Type: Transaction Type categorizes the nature of each inventory movement, "Allot," indicating allocation ,”Return” indicating product Return

QTY: This column represents the count of pallets involved in each transaction , essential to calculate the inventory levels.

WHName: This seems to refer to the warehouse name or identifier, indicating which warehouse was involved in the transaction.

## Users

Users of the visualization dashboard will be:

* Inventory Managers: Those responsible for overseeing and optimizing inventory levels within the organization.
* Decision-Makers: Senior management using the dashboard for strategic decision-making related to inventory .
* Sales and Customer Service Teams: Teams monitoring stock availability to fulfill customer orders efficiently.

## Questions

Questions which will be answered by this visualization:

**Inventory Managers:**

* Can you provide a breakdown of pallets in inventory by product code?
* What is the total quantity of returned pallets in the inventory?
* Can you identify any specific product codes with high return rates?
* Can you identify the top customers with the highest transaction volumes?
* Are there specific days of the week when we have higher transaction activity?
* What is the most frequently ordered quantity ?
* What is the inventory turnover ratio?

**Operations Managers:**

* What are the top-performing warehouses and which ones need improvement?
* How does the warehouse usage vary across different regions or cities?
* Are there any notable trends or patterns in our inventory data?
* What is the average Time gap between next order?
* How many Outstanding pallets are there?

**Customer Service Teams:**

Can you provide a list of customers with outstanding pallets?

Is there a breakdown of order quantities by product code for each customer?

Can you provide insights into the historical order trends for specific customers?

What is the most frequently ordered quantity by specific customers?

## Describe Visualization and how it answers the questions

**Inventory Managers:**

**Breakdown of Pallets by Product Code:**

Visualization: Stacked Bar Chart showing pallets by product code.

Answer: This chart provides a clear breakdown of which product codes make up the inventory, helping managers allocate resources effectively.

**Total Quantity of Returned Pallets:**

Visualization: A simple card displaying the total quantity of returned pallets.

Answer: This provides a quick summary of the quantity of returned pallets currently in the inventory.

**High Return Rates for Specific Product Codes:**

Visualization: Stacked Bar Chart highlighting product codes with high return rates.

Answer: This chart identifies which product codes are being returned frequently, potentially indicating quality issues or customer preferences.

**Top Customers with Highest Transaction Volumes:**

Visualization: Table displaying top customers based on transaction volumes.

Answer: This chart identifies the most valuable customers in terms of order quantities.

**Days of the Week with Higher Transaction Activity:**

Visualization: Line Chart showing transaction activity by day of the week.

Answer: Managers can see which days experience higher order volumes and plan staffing and resources accordingly.

**Frequently Ordered Quantity:**

Visualization: Bar Chart showcasing order quantity frequencies.

Answer: Managers can identify the most common order quantities, helping optimize stock levels.

**Inventory Turnover Ratio:**

Visualization: Card displaying the inventory turnover ratio over time.

Answer: This metric shows how efficiently inventory is being managed. Higher turnover ratios indicate efficient stock management.

**Operations Managers:**

**Top-Performing Warehouses:**

Visualization: Stacked Bar Chart showing performance metrics for different warehouses.

Answer: This chart helps identify the best-performing warehouses, guiding resource allocation, and improvement efforts.

**Warehouse Usage by Region :**

Visualization: Donut Chart displaying warehouse usage across regions

Answer: Operations managers can analyze warehouse distribution and make location-specific decisions.

**Trends and Patterns in Inventory Data:**

Visualization: Line Chart showing historical inventory trends and patterns.

Answer: Identifying trends can lead to more informed decision-making, such as adjusting stock levels based on seasonal fluctuations.

**Average Time Gap Between Next Orders:**

Visualization: Card displaying the average time gap between orders.

Answer: This provides insight into customer ordering behavior and can guide supply chain management.

**Outstanding Pallets:**

Visualization: Card visual displaying the number of outstanding pallets.

Answer: Operations managers can monitor the backlog of pallets and make decisions to expedite processing.

**Customer Service Teams:**

**List of Customers with Outstanding Pallets:**

Visualization: Table visual .

Answer: This provides a clear list of customers with outstanding orders, helping customer service address inquiries efficiently.

**Breakdown of Order Quantities by Product Code:**

Visualization: Stacked Bar Chart showing order quantities by product code for each customer.

Answer: This visual answers queries about the composition of customer orders.

**Historical Order Trends for Specific Customers:**

Visualization: Line Chart showing order history for selected customers.

Answer: This helps customer service teams understand the ordering behavior of specific customers.

**Frequently Ordered Quantity by Specific Customers:**

Visualization: Bar Chart showing the most frequently ordered quantity for individual customers.

Answer: This information helps in catering to specific customer preferences efficiently.

## Conclusion

This project helps Inventory Managers, Decision-Makers, Sales, and Customer Service Teams manage and optimize inventory levels. It uses visualizations and key performance indicators (KPIs) to answer important questions and provide insights for data-driven decisions. By doing this, it reduces the need for manual intervention and contributes to improved inventory management and enhanced customer satisfaction.