

Title

Supply Chain Analytics Dashboard using Python, SQL, and Power BI

1. Project Objective

The objective of this project is to analyze supply chain performance using retail sales data and identify key logistics inefficiencies. The project focuses on measuring delivery delays, supplier performance, warehouse load, and regional shipment issues. The final goal is to build an interactive Power BI dashboard to support data-driven decision-making in supply chain management.

2. Problem Statement

In retail businesses, delayed deliveries and inefficient logistics directly impact customer satisfaction and operational cost. However, identifying where delays occur — whether at supplier level, shipping mode, or warehouse region — requires systematic data analysis. This project aims to uncover hidden patterns in supply chain data and provide actionable insights through visualization.

3. Dataset Description

The dataset used is a **Retail Supply Chain Sales Dataset** containing:

- Order details (Order ID, Order Date, Ship Date)
- Customer information
- Product categories and sub-categories
- Sales, quantity, and profit
- Shipping modes and regions
- Supplier information
- Return status

This dataset represents real-world retail supply chain operations.

4. Tools & Technologies Used

- **Python (Pandas, NumPy)** – Data cleaning and transformation
- **MySQL** – Data storage and SQL querying

- **Power BI** – Interactive dashboard and visualization
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5. Data Cleaning & Transformation (Python Stage)

Steps performed in Python:

- Converted order_date and ship_date to datetime format
- Created new KPI: **Delivery_Delay_Days = Ship_Date – Order_Date**
- Created **Late_Delivery** flag (Yes if delay > 7 days)
- Aggregated data to create:
 - Supplier performance table
 - Warehouse load table
- Exported cleaned data to MySQL database

These transformations prepared structured tables for SQL analysis.

6. Key Performance Indicators (KPIs)

- **Average Delivery Days**
- **Late Delivery Rate (%)**
- **Supplier Average Delivery Delay**
- **Warehouse Load (Total Quantity per Region)**
- **Late Delivery Percentage per Region**

These KPIs measure logistics efficiency and identify problem areas.

7. SQL Analysis

Multiple SQL queries were executed to answer business questions such as:

- What is the average delivery delay?
- What percentage of orders are delivered late?
- Which suppliers cause maximum delays?
- Which warehouse regions handle the highest load?
- Which regions have the highest late delivery rate?

- How do shipping modes affect delivery delays?
 - Which product categories and sub-categories face the most delays?
 - Are returns related to delivery delays?
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8. Key Insights

Delivery Performance

- Average delivery time: **34.61 days**
- Late delivery rate: **30.15%**

Supplier Performance

- Kelly Williams is the supplier with highest average delivery delay.

Warehouse Load

- West region handles the highest shipment load and sales.

Regional Delays

- Central region has the highest late delivery rate (~31%).

Shipping Mode

- Standard Class shipping has the highest delay (~42 days).
- Same Day shipping is fastest (~1 day).

Product Categories

- Technology category faces highest delivery delay.

Sub-Categories

- Machines and Tables cause the most delays.

Returns Analysis

- Returns are not primarily caused by delivery delays.
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9. Power BI Dashboard

An interactive dashboard was developed to visualize:

- KPI cards for key metrics
- Supplier delay bar chart

- Shipping mode delay analysis
- Warehouse load treemap
- Category and sub-category delay charts
- Regional late delivery donut chart
- Interactive slicers for Region, Category, and Shipping Mode

The dashboard allows real-time filtering and performance monitoring.

10. Final Outcome

The project successfully identifies major supply chain bottlenecks:

- Standard shipping requires optimization
- Certain suppliers need performance improvement
- West warehouse is highly loaded
- Central region faces highest delivery issues
- Bulky product categories need specialized logistics handling

These insights help improve logistics planning, supplier management, and customer satisfaction.

11. Conclusion

This project demonstrates an end-to-end data analytics workflow — from raw data cleaning to SQL-based analysis and interactive visualization. It provides practical business insights into retail supply chain operations and showcases real-world data analyst skills.

12. Live Dashboard Link

Power BI Dashboard:

<https://app.powerbi.com/links/5AeJ-8vh4N>