Innovation & Entrepreneurship Hub for Educated Rural Youth (SURE Trust – IERY)

SUPPLY CHAIN ANALYSIS DASHBOARD

The domain of the Project

Supply Chain Analysis Dashboard
(SQL and Power BI)

Under the guidance of

Mrs.Siddhika Shah

By

Mr. MOHAMMAD IMTIAZ AHMED
(M C A)

Period of the project

December 2024 to March 2025

SURE TRUST PUTTAPARTHI,

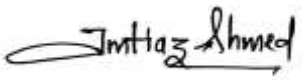
ANDHRA PRADESH

DECLARATION

The project titled **"*Supply Chain Analysis Dashboard With Power BI*"** has been mentored by **Mrs.Siddhika Shah** and organized by SURE Trust from December 2024 to March 2025**.** This initiative aims to benefit educated unemployed rural youth by providing hands-on experience in industry-relevant projects, thereby enhancing employability.

I, **Mr. Mohammad Imtiaz Ahmed ,** hereby declare that I have solely worked on this project under the guidance of my mentor. This project has significantly enhanced my practical knowledge and skills in the domain.

Name **Signature**



Mr. Mohammad Imtiaz Ahmed

Mentor **Signature**

Mrs . Siddhika Shah

Seal & Signature

Prof.Radhakumari
Executive Director & Founder
SURE Trust

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Executive Summary

This project leverages Power BI to perform an in-depth supply chain analysis for a fashion and beauty startup. Using a dataset containing 100 product-related entries across categories such as skincare, haircare, and cosmetics, the study aims to uncover inefficiencies and hidden patterns across cost structures, production timelines, logistics networks, and financial performance.

Two major goals are achieved through this analysis: providing operational clarity on cost and production inefficiencies, and Equipping decision-makers with interactive dashboards to monitor and improve performance across different locations and product types. The insights gained enable stakeholders to optimize manufacturing strategies, minimize transport costs, reduce defect rates, and align inventory and production with market demands.

Introduction

Background and Context

Supply chain management is a cornerstone of operational success, especially in the fast-paced fashion and beauty industry. Effective coordination of resources—from raw materials to final delivery—not only reduces costs but also enhances customer satisfaction and profitability.

With rising consumer expectations and market competition, startups must transform traditional, reactive supply chain systems into proactive, data-driven engines. This project integrates data analytics and visualization to monitor critical supply chain metrics such as manufacturing cost, lead time, transportation efficiency, and quality control outcomes.

By utilizing Microsoft Power BI, the project bridges the gap between raw operational data and high-level decision-making. It transforms spreadsheets into dashboards that offer dynamic filtering, trend detection, and correlation analysis—all without manual intervention.

Problem Statement

Small and medium-sized businesses often face several supply chain challenges due to limited visibility, resource constraints, and lack of advanced data infrastructure. The following key problems were identified:

- **Rising Production Costs:** Without detailed analysis, businesses struggle to identify cost drivers across different product lines.
- **Inefficient Lead Times:** Long and inconsistent lead times disrupt customer delivery schedules and inventory control.
- **Transport Overheads:** Improper mode selection and route planning increase logistics expenses.
- **Quality Failures:** Products failing inspection increase rework costs and delay delivery.

- **Profitability Gaps:** Discrepancy between revenue and profit margins across regions remains poorly understood.

This project addresses these challenges by creating visual dashboards that allow for transparent, data-driven decision-making.

Scope

The scope of the project covers the entire supply chain lifecycle, from manufacturing to delivery, and evaluates the impact of operational decisions on financial performance. The analysis includes:

- **Cost Analysis:** Identifying the most expensive products to produce and comparing manufacturing costs against their selling price.
- **Supply Chain Dynamics:** Understanding lead times and their implications for production planning.
- **Logistics Efficiency:** Evaluating how different transportation modes and routes impact total costs.
- **Product Quality:** Investigating the relationship between inspection outcomes, manufacturing costs, and defect rates.
- **Production Planning:** Analyzing if production volumes are aligned with actual market demand.
- **Financial Performance:** Comparing revenue, profit, and profit margins across different cities and product categories.

The project does not include real-time integration or predictive analytics but lays a foundation for both.

Innovation

This project introduces a comprehensive, **cross-functional BI solution** that combines cost accounting, logistics management, production planning, and performance evaluation into a single Power BI framework. Key innovations include:

- **Unified Data Model:** Integrates multiple datasets (cost, logistics, quality, and financials) for a single source of truth.
- **Interactive Dashboards:** Allow stakeholders to slice and drill down by location, product, and transport mode.
- **Custom DAX Measures:** Advanced metrics are created to reveal profit margins, defect rates, cost-to-price ratios, and more.
- **Correlative Analysis:** Highlights connections between operational inefficiencies and financial impact (e.g., failed quality inspections and manufacturing costs).
- **Scalability:** Dashboards are designed to be expandable for real-time feeds and predictive modeling in the future.

Project Objectives

1. **Clean and Structure Raw Data**
   - Use Power Query Editor to transform messy data into a structured format.
   - Handle missing values, rename columns, change data types, and create relationships between tables.
   - Standardize data to improve usability in dashboards.
2. **Develop Insightful Dashboards**
   - Create multiple dashboards that cover cost, logistics, production, and profitability.
   - Include slicers and filters to allow real-time interaction.
   - Visuals include bar charts, pie charts, scatter plots, and KPI cards.
3. **Analyze Cost and Logistics Drivers**
   - Identify how transport methods and routes influence total operational costs.
   - Highlight which product categories are driving up manufacturing expenses and why.
4. **Evaluate Quality Control Metrics**
   - Examine correlations between inspection results and defect rates.
   - Assess how failed inspections affect cost and production timelines.
5. **Visualize Financial Outcomes**
   - Show revenue and profit margins across cities and product categories.
   - Identify which markets are performing well and where improvements are needed.
6. **Support Strategic Planning**
   - Provide actionable recommendations based on the visualized data.
   - Help in inventory optimization, cost control, and production alignment with demand.

Expected Outcomes

- **Clear Product Cost Hierarchy:** Skincare emerges as the most expensive product to produce, guiding pricing and production strategies.
- **Efficient Transportation Planning:** Identification of the costliest transport mode (road) and routes (Route B) supports logistics optimization.
- **Enhanced Quality Control:** High defect rates are correlated with inspection failures, helping to prioritize quality improvement initiatives.
- **Better Inventory Control:** Long lead times indicate the need for improved raw material management and forecasting.
- **Geographic Profitability Insights:** Mumbai contributes the most in both revenue and profit, but Delhi exhibits a stronger profit margin.
- **Data-Driven Decisions:** Dashboards empower decision-makers to make informed changes to reduce cost and improve operational efficiency.

Methodology and Results

Methods / Technology Used

The project follows a structured data analytics methodology combining both **descriptive and diagnostic analysis** techniques to derive meaningful insights from supply chain data. The process involves:

- **Data Cleaning and Transformation:** Raw datasets are preprocessed to eliminate inconsistencies, missing values, and duplicates using Power BI's Power Query Editor.
- **Data Modeling:** Logical data models are created by establishing relationships between different tables such as product types, locations, and inspection outcomes.
- **DAX Calculations:** Advanced formulas and KPIs are developed using DAX (Data Analysis Expressions) to derive profit margins, cost-to-price ratios, defect percentages, and more.
- **Visual Analytics:** Power BI is used to create interactive dashboards utilizing bar charts, pie charts, scatter plots, and filters to visualize cost, quality, and performance metrics.

This methodology enables a **comprehensive and dynamic exploration** of supply chain performance across cost, quality, logistics, and profitability dimensions.

Tools / Software Used

- **Microsoft Power BI Desktop:** Main tool used for building dashboards, modeling relationships, and creating calculated metrics.
- **Power Query Editor:** Utilized for data wrangling tasks such as cleaning, transforming, merging, and shaping raw datasets.
- **DAX (Data Analysis Expressions):** Used for creating custom calculations like total cost, profit margin %, average lead times, and quality performance indicators.
- **Microsoft Excel / CSV Files:** Served as the primary data sources; Excel was also used for initial data exploration before importing into Power BI.
- **(Optional) Google Sheets:** May be used as an alternative for collaborative data preparation or version control.

Data Collection Approach

The dataset was curated from a simulated business environment to reflect real-world supply chain conditions for a fashion and beauty startup. Key characteristics include:

- **Size:** 100 unique records covering multiple product categories.
- **Variables Included:**
  - Product Type (Skincare, Haircare, Cosmetics)
  - Price, Manufacturing Cost, and Total Cost
  - Transportation Mode and Routes
  - Lead Times and Stock Levels
  - Revenue and Profit by Location
  - Inspection Results and Defect Rates
- **Format:** Data was provided in CSV format, without real-time API integration.
- **Simulation Objective:** To mimic challenges faced by retail and beauty sector businesses in tracking cost, quality, and performance metrics.

The data simulates typical supply chain behavior to analyze trends, correlations, and operational bottlenecks in a controlled scenario.

Project Architecture

The architecture of the project follows a layered approach, enabling modular analysis and flexibility:

1. **Data Source Layer**
   - Static CSV files containing operational, logistical, and financial data.
2. **Data Preparation Layer**
   - Performed using Power Query Editor for:
     - Column renaming
     - Data type corrections
     - Removal of duplicates or missing values
3. **Data Modeling Layer**
   - Establishing relationships across datasets (e.g., product ↔ location ↔ inspection results)
   - DAX-based calculations for metrics like total cost, profit margin, lead times, and defect rates

4. **Visualization Layer**

    - Dashboards created using bar charts, pie charts, cards, scatter plots, and line graphs to depict:
        - Cost distribution
        - Revenue/profit trends
        - Quality analysis
        - Transport cost breakdown

5. **User Interaction Layer**
    - Filters and slicers included to allow end-users to:
        - Select specific product categories or cities
        - Drill down into time periods, transportation modes, and cost types

Results

The results of the analysis are categorized by key performance areas:

Cost Insights

- **Skincare** is the most expensive product to manufacture (₹1,959.73), accounting for over 41% of manufacturing costs.
- **Cosmetics** offer a better manufacturing cost-to-price ratio compared to skincare and haircare.

Logistics Insights

- **Road transport** is the most expensive mode (₹16,048.19), due to last-mile delivery costs despite being more accessible.
- **Route B** is the least cost-effective route, contributing to over 40% of total logistics expenditure.

Quality Insights

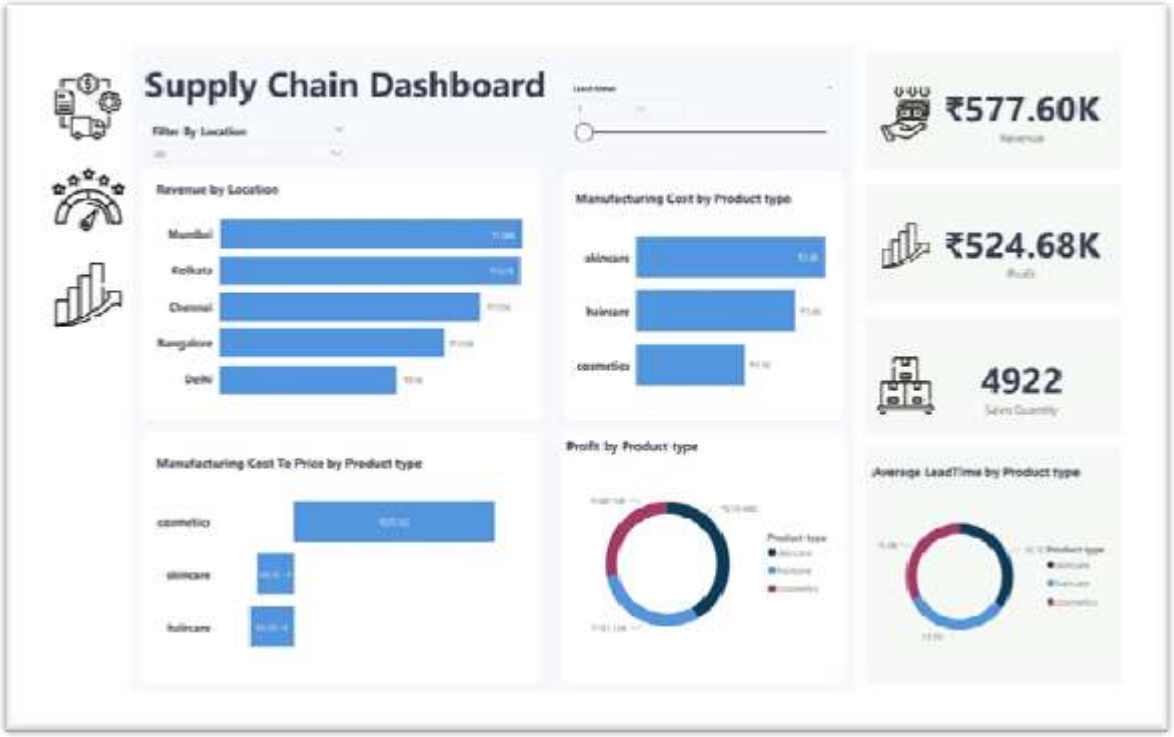
- Products marked as **"Fail"** in inspection correlate with the **highest defect rates** and manufacturing costs.
- **Inspection results** play a crucial role in understanding operational waste and production rework requirements.

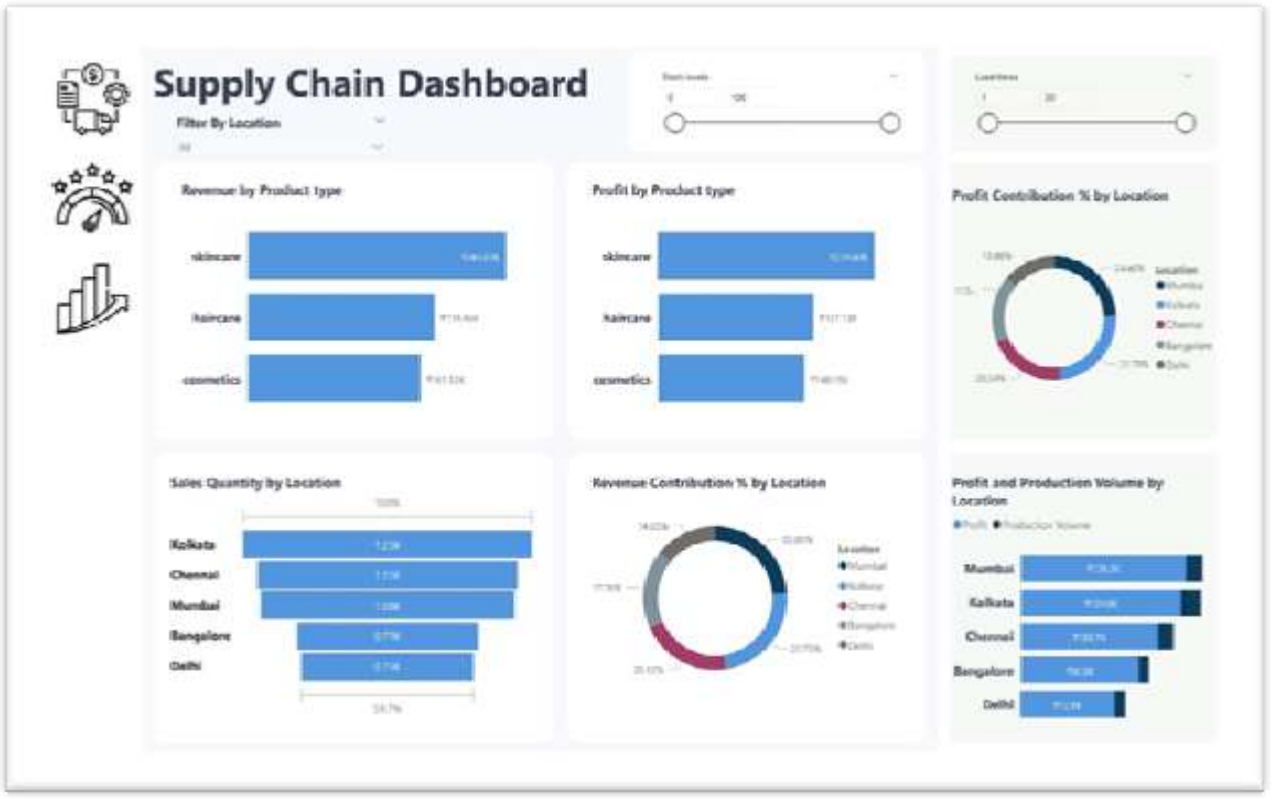
Financial Insights

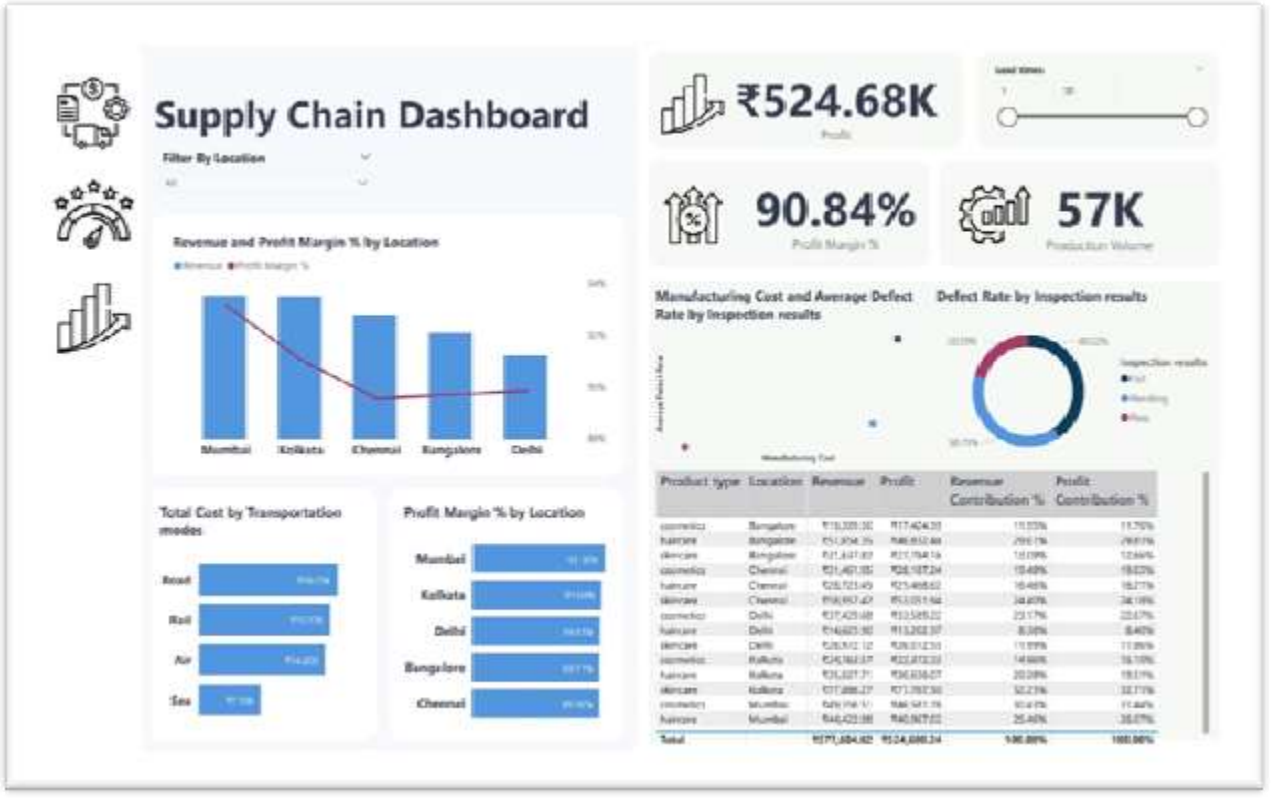
- **Mumbai** generated the highest revenue (₹137,755.03) and profit (₹128,331.50), but **Delhi** had the highest profit margin.
- Skincare generated the **highest revenue and profit**, but also carried the **greatest operational cost**—a classic example of high-cost, high-return.

Final Project Working Screenshots

- **Dashboard**




Supply Chain Dashboard
Filter By Location
Revenue by Product type
skincare
haircare
cosmetics
Profit by Product type
skincare
haircare
cosmetics
Profit Contribution % by Location
Sales Quantity by Location
Kolkata
Chennai
Mumbai
Bangalore
Delhi
Revenue Contribution % by Location
Profit and Production Volume by Location
Mumbai
Kolkata
Chennai
Bangalore
Delhi


Supply Chain Dashboard
Filter By Location
₹524.68K
Profit
90.84%
Profit Margin %
57K
Production Volume
Revenue and Profit Margin % by Location
Mumbai
Kolkata
Chennai
Bangalore
Delhi
Manufacturing Cost and Average Defect Rate by Inspection results
Defect Rate by Inspection results
Total Cost by Transportation modes
Road
Rail
Air
Sea
Profit Margin % by Location
Mumbai
Kolkata
Delhi
Bangalore
Chennai
Product type
Location
Revenue
Profit
Revenue Contribution %
Profit Contribution %

GitHub Link :

- https://github.com/Imtiazsalaf-01/Supply-chain-Analysis.git

Learning and Reflection

This project served as a hands-on opportunity to apply theoretical knowledge of supply chain concepts in a real-world simulation. Working on the dataset required an understanding of key business operations including procurement, production, quality inspection, and logistics. Through Power BI, I developed a deep appreciation for the power of **visual storytelling** and its role in **business decision-making**.

Key learnings include:

- **Supply Chain Interconnectivity:** Every element—from manufacturing cost to delivery route—has a ripple effect on profitability and customer satisfaction.
- **Importance of Data Quality:** Accurate and clean data is essential. Minor inconsistencies in product labels or cost formats can significantly impact dashboard outputs and insights.
- **KPI Formulation with DAX:** I strengthened my skills in building dynamic KPIs such as profit margin %, cost-to-price ratio, and defect rate analysis, enabling advanced comparative studies.
- **Inventory Optimization Strategies:** By analyzing lead times and stock levels, I learned the value of maintaining optimal inventory—not too much to drive up costs, and not too little to delay fulfillment.
- **User-Focused Dashboard Design:** Creating dashboards with clear filters and intuitive navigation improved not only aesthetics but also usability for stakeholders.

Overall, the experience bridged the gap between data analysis and strategic insight, reinforcing the real-world relevance of business intelligence tools.

Experience

This project was both **technically enriching and intellectually rewarding**. It offered a well-rounded learning curve across different domains:

- **Technical Experience:**
  - Worked extensively with Power BI's Power Query for data cleaning and transformation.
  - Applied DAX to create calculated measures and KPIs.
  - Built complex data models and relationships from scratch.
  - Designed interactive dashboards that communicate insights visually and effectively.
- **Analytical Experience:**
  - Explored multi-dimensional analysis across cost, quality, production, and sales.
  - Used correlation analysis to link inspection outcomes with defect rates and profitability.
  - Conducted root-cause evaluation using visual diagnostics.
- **Soft Skills:**
  - Strengthened my critical thinking and problem-solving capabilities.
  - Improved my communication skills by documenting findings clearly and structuring a compelling project narrative.
  - Gained a structured project execution mindset—from setting goals to delivering results.

Conclusion and Future Scope

Objectives Revisited

The project set out to explore the operational backbone of a fashion and beauty startup by analyzing:

- Manufacturing and logistics costs
- Quality control performance
- Inventory and lead times
- Revenue and profit across cities and product categories

Each objective was met by building structured dashboards and performing deep-dive analysis on key supply chain variables.

8.2. Achievements

The following milestones were successfully achieved during the project:

- **Created a comprehensive BI framework** to visualize and evaluate supply chain efficiency.
- **Identified key cost and quality drivers** such as skincare manufacturing cost and inspection failure impacts.
- **Developed dynamic dashboards** that offer actionable insights to support logistics, production, and financial strategies.
- **Delivered a clear profitability view** across locations, showing where operational improvements could yield the greatest returns.
- **Showcased analytical rigor** through correlation studies and custom KPIs.

These accomplishments demonstrate the viability of using Power BI as a decision-support system for operational excellence in retail and manufacturing.

Conclusion

The **Supply Chain Analysis Project** provided strong evidence that modern BI tools can simplify complex operational data into powerful, real-time insights. By identifying inefficiencies in cost, quality, and logistics, the project offers valuable guidance for improving profitability and streamlining workflows.

From understanding how inspection failures affect costs, to revealing how transport decisions influence margins, the dashboards serve as both a **strategic compass and operational dashboard**. The business can use these insights to reallocate resources, reduce losses, and better align production with market needs.

Most importantly, the project validates that with clean data and the right analytical tools, even small and mid-sized startups can gain a competitive edge through data-driven operations.

Future Scope

While the current analysis is based on static data, several enhancements can be made in future iterations:

- **Integration with Real-Time Data Sources:** Incorporate live feeds from ERP or inventory management systems to enable real-time monitoring.
- **Predictive Analytics:** Extend the project using machine learning models to forecast lead times, demand trends, or defect probabilities.

- **Geospatial Analysis:** Add map-based visualizations to better understand regional trends in delivery or profit performance.
- **Alerts and Thresholds:** Set up automated alerts within dashboards for metrics exceeding predefined thresholds (e.g., high defect rate or lead time spikes).
- **User Access Roles:** Implement role-based dashboard views for different users (e.g., operations manager, financial analyst, warehouse supervisor).

By evolving the dashboards into proactive tools with AI integration and alert mechanisms, this project could form the basis of a **smart supply chain command center**.