

# Final Project Report: Supply Chain Management Dashboard

**Project Title:** Supply Chain Management Dashboard

**Author:** Kammampati Saivamshi

**Objective:** To build a comprehensive dashboard for analyzing and optimizing supply chain operations

## 1. Introduction

Supply chain analytics is a critical part of strategic decision-making for businesses operating in manufacturing, retail, logistics, and healthcare. This project aims to develop a powerful, data-driven Supply Chain Management (SCM) Dashboard to monitor, assess, and improve various functions such as inventory, supplier performance, logistics, and cost management.

## 2. Dataset Overview

- The dataset consists of 100 records across 24 features
- **Covers core supply chain components:**
  - **Product Information:** Product type (Skincare, Haircare, Cosmetics), SKU, Price
  - **Sales Metrics:** Number of products sold, Order quantities, Revenue generated, Profit margin
  - **Inventory & Stock:** Availability, Stock levels
  - **Production Metrics:** Production volumes, Manufacturing lead time, Manufacturing costs
  - **Supplier Data:** Supplier name, Location, Lead time
  - **Logistics & Shipping:** Transportation modes, Routes, Shipping carriers, Shipping times, Shipping costs
  - **Inspection & Quality:** Inspection results (Pass, Fail, Pending), Defect rates
  - **Customer Segments:** Customer demographics (Male, Female, Non-binary, Unknown)

- **Data type distribution:**
  - **Numeric Columns:** Prices, Quantities, Volumes, Costs, Times, Rates
  - **Categorical Columns:** Product types, Supplier names, Locations, Carriers, Transportation modes
  - **Textual Columns:** Customer Demographics, Inspection Results
- Data was cleaned and standardized using Python, with all currency and rate fields rounded to two decimal places for consistency
- No significant missing values were found, allowing full use of the dataset for analysis and visualization
- The dataset consists of 100 records across 24 features
- **Covers core supply chain components:**
  - Product types, SKU, prices, quantities
  - Inventory availability and stock levels
  - Supplier details and manufacturing data
  - Shipping, transportation, and quality metrics

### 3. Step-by-Step Process

#### 3.1 Data Cleaning and Preprocessing (via Python)

##### Performed using a Jupyter Notebook:

- Imported essential libraries: pandas, numpy, matplotlib, seaborn
- Loaded the CSV data into a Data Frame
- Checked for null values and ensured correct data types
- Rounded numerical columns (e.g., Price, Shipping Costs) to 2 decimal points
- Cleaned inconsistent entries and prepared data for analysis

#### 3.2 Exploratory Data Analysis

- Identified trends in pricing, revenue, and defect rates
- Analyzed distribution of products across categories and locations

- Observed supplier performance, shipping timelines, and logistics cost drivers

### 3.3 Feature Engineering

- Created new columns like Profit Margin (Revenue - Manufacturing Cost)
- Averaged key fields like Lead Time and Shipping Time by category and transport mode

## 4. Power BI Dashboard Breakdown – Page by Page

Each page contains key visual insights from the project as presented in the PDF dashboard.

### Page 1: Overall Supply Chain Performance Summary

#### 1. KPI Cards:

- **Total Revenue:** ₹577.60K
  - **Availability:** 4840 units
  - **Total Order Quantities:** 4922
  - **Total Production Volume:** 57K
- Purpose:** Gives a quick overview of how the supply chain is performing in real-time. These KPIs act as top-level indicators for business health.

#### 2. Revenue Generated by Price (Bar Chart)

- X-axis: Price range
  - Y-axis: Sum of Revenue
- Insight:** Identifies which price points bring in the most revenue, useful for pricing strategy.

#### 3. Manufacturing Costs by Production Volume (Bar)

- X-axis: Production volume
  - Y-axis: Manufacturing costs
- Insight:** Helps determine cost efficiency — are you spending more when you produce more?

#### 4. Order Quantities by Transportation Mode (Bar)

- **Modes:** Road, Rail, Air, Sea  
**Insight:** Road and Rail are most used. Indicates logistics preferences and delivery strategies.

## Page 2: Revenue & Product Category Analysis

### 1. Revenue by Product Type (Bar)

- Skincare: ₹241.63K (41.83%)
- Haircare: ₹174.46K (30.20%)
- Cosmetics: ₹161.52K (27.96%)  
**Insight:** Skincare is the revenue leader; Cosmetics performs well despite being lower in sales.

### 2. Profit Margin by Product Type (Bar)

- Cosmetics: ₹372
- Skincare: -₹83
- Haircare: -₹69  
**Insight:** Only cosmetics are profitable. Skincare and Haircare suffer losses due to high cost or low pricing.

### 3. Average Defect Rate by Product Type (Bar)

- Haircare: 36.86%
- Skincare: 34.65%
- Cosmetics: 28.49%  
**Insight:** Haircare has quality control issues; cosmetics show consistent quality.

## Page 3: Supplier & Manufacturing Quality Analysis

### 1. Manufacturing Costs by Supplier Name (Bar)

- Supplier 1: ₹1.22K
- Supplier 4: ₹1.13K  
**Insight:** Supplier 1 & 4 are most expensive. Optimization needed.

## 2. Manufacturing Costs by Product Type (Bar)

- Skincare: ₹1960
- Haircare: ₹1648
- Cosmetics: ₹1119

**Insight:** Skincare is costliest to produce.

## 3. Manufacturing Costs by Inspection Result (Stacked Bar)

- Fail: ₹1.88K
- Pending: ₹1.79K
- Pass: ₹1.06K

**Insight:** Higher costs don't guarantee quality. Fail rates are high despite spending.

## 4. Defect Rates by Inspection Results (Pie Chart)

- Pass: 20.59%
- Pending: 38.79%
- Fail: 40.62%

**Insight:** Only 1 in 5 products pass quality checks. Serious quality control issues.

## Page 4: Transportation & Logistics Optimization

### 1. Shipping Costs by Transportation Mode (Bar)

- Road: ₹161
- Air: ₹156
- Rail: ₹153
- Sea: ₹84

**Insight:** Sea is cheapest, underused. Road and Air are costlier.

### 2. Shipping Costs by Shipping Carrier (Bar)

- Carrier B: ₹237
- Carrier C: ₹162

- Carrier A: ₹156  
**Insight:** Carrier B is overpriced — needs reevaluation.

### 3. Order Quantity by Location (Bar)

- Kolkata: 1228
- Chennai: 1109
- Mumbai: 1083
- Bangalore: 769
- Delhi: 733

**Insight:** Kolkata has the highest demand — possible distribution hub.

### 4. Production Volume by Location (Bar)

- Kolkata, Mumbai, Chennai: Highest  
**Insight:** Align production with demand regions.

### 5. Average Lead Time & Shipping Time by Mode (Line Chart)

- Air: Fastest (15.96 days)
- Sea: Cheapest  
**Insight:** Balance cost vs speed depending on priority.

### 6. Average Lead Time & Cost by Route (Combo Chart)

- Route A: Fastest (16.40 days), Cheapest (₹485)
- Route B: Slowest (18.16 days), Most Expensive (₹596)  
**Insight:** Route A is best option for efficiency.

### 7. Number of Products Sold by Route (Bar)

- Route A: Highest  
**Insight:** Most sales flow through Route A — critical to maintain.

### 8. Transportation Mode Frequency (Pie Chart)

- Rail: 29.27%
- Road: 28.46%
- Air: 23.61%

- Sea: 18.66%

**Insight:** Rail is most used despite moderate cost/speed. Sea underused.

Each page contains key visual insights from the project as presented in the PDF dashboard.

## 5. Key Findings

- **Cosmetics are most profitable**, but haircare has highest defect rates
- **Carrier B is expensive**, yet frequently used
- **Sea transport is cheapest**, Air is fastest
- **Quality control is poor** with only 20.59% products passing inspection
- **Kolkata leads in order quantity and production volume**
- **Skincare and Haircare have high demand** but suffer from negative profit margins
- **Sea transport is underutilized** despite being the most economical option
- **Route A is most efficient** (fastest and cheapest), while Route B is the least efficient
- **Supplier 1 and Supplier 4** have the highest manufacturing costs
- **Only 20.59% of products pass inspection**, indicating serious quality control gaps
- **Cosmetics have the lowest defect rate** and offer the best balance of quality and profitability
- **Rail is the most used transport mode**, followed by Road, despite Road having higher costs

## 6. Tools and Technologies

- **Microsoft Power BI** – Core tool for dashboard creation
- **Power Query** – Used for data cleaning and transformation
- **DAX (Data Analysis Expressions)** – For custom metric calculations and KPI modeling
- **CSV Dataset** – Provided internal dataset for analysis
- **Python (Jupyter Notebook)** – Data preprocessing and exploratory analysis

## 7. Conclusion

This project successfully demonstrates the value of data-driven insights in optimizing supply chain operations. By leveraging Python for data cleaning and exploration, and Power BI for rich, interactive visualization, we were able to uncover key trends and performance gaps across procurement, production, logistics, and quality control.

The dashboard provides a comprehensive overview of the supply chain, from high-level KPIs like revenue and production volume, to granular insights such as profit margins by product type and defect rates by inspection result. Critical issues—such as high defect rates, inefficient transportation choices, and negative margins in key product categories—were identified, offering clear areas for operational improvement.

Power BI's advanced features like DAX for dynamic calculations, slicers for user-driven filtering, and interactive drilldowns allowed for a responsive and intuitive user experience. Business Intelligence in this project enabled:

- Real-time monitoring of KPIs
- Trend analysis across categories, suppliers, and regions
- Visual storytelling through dynamic graphs and custom visuals
- Decision support for reducing costs and improving quality

Overall, this project highlights how businesses can use analytics to enhance supplier performance, reduce logistics costs, increase product quality, and ultimately improve profitability. It sets the foundation for continuous monitoring, strategic planning, and smarter supply chain decisions.

## 8. Recommendations

- Shift from Carrier B to more cost-effective carriers
- Re-evaluate pricing and production strategies for Haircare
- Implement strict quality control practices to reduce defect rates
- Leverage insights from top-performing cities like Kolkata and Mumbai



- Promote the most profitable product (Cosmetics) with focused marketing and production
- Increase use of Sea transport where feasible to reduce shipping costs
- Reduce reliance on underperforming suppliers with high costs and low pass rates
- Implement a continuous monitoring system using Power BI alerts and thresholds
- Use DAX-driven metrics to track profit margin fluctuations over time
- Develop supplier scorecards to benchmark quality, cost, and delivery metrics

## **9. Future Enhancements**

- Integrate real-time data pipelines
- Add forecasting models for demand and inventory
- Include supply chain risk scoring based on delay and defect patterns