

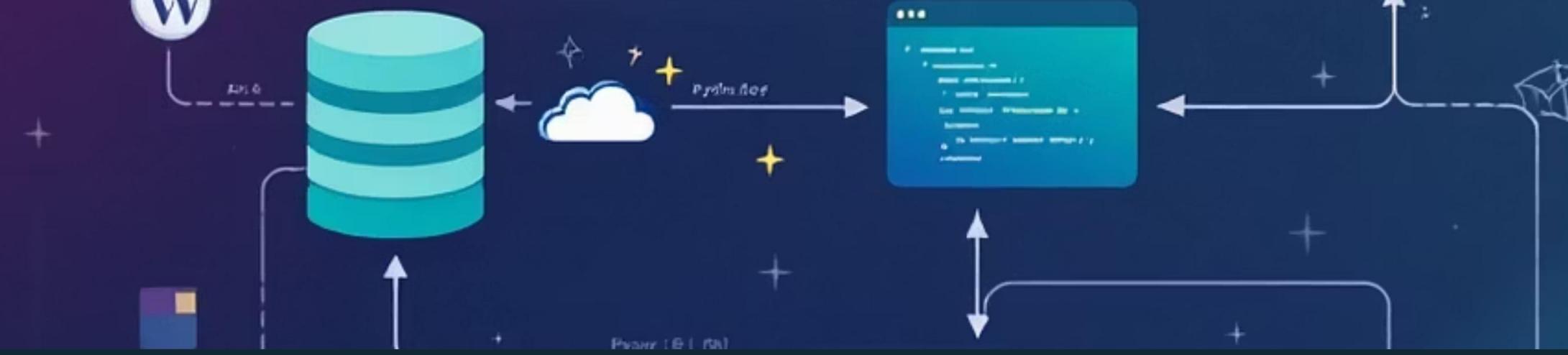
📌 End-to-End Supply Chain Analytics Project

From Raw Data to Insightful Dashboards

Presented by: Nagwan Khaled Sagea

Team members: Nagwan Khaled Sagea, Osama Essam Mohamed, Mina Salama Fayed, Mohamed Osama Ali, Mohamed Mamdouh Mohamed, Ghada Ibrahim





Project Pipeline Overview

This project encompasses a full-spectrum data analytics journey, transforming raw supply chain data into actionable insights.



1. SQL Server

Data loading, initial querying, and structure exploration.



2. Python

Extensive data cleaning, EDA, and statistical analysis.



3. Export Cleaned CSV

A pristine dataset ready for visualization.



4. Power BI Dashboard

Interactive visualizations, KPIs, and strategic insights.

SQL Section Overview

SQL Server serves as the foundational layer, ensuring data integrity and providing initial insights into the raw supply chain data.

Loading Raw Data

Efficiently ingested the raw supply chain dataset into SQL Server, establishing the primary data source.

Data Quality Checks

Performed initial checks on data quality, identifying inconsistencies and potential issues early in the process.

Column Relationships

Explored and understood the intrinsic relationships between various columns, crucial for subsequent analysis.

Initial Insights

Executed queries to extract preliminary insights, guiding further data exploration and cleaning steps.

```
Query3.sql - 1 row(s) selected
GO

-- ✓ Display the primary key information of the table
EXEC sp_pkeys @table_name = 'supply_chain_data';

-- ✓ Check the number of NULL values in each column (for data cleaning purposes)
SELECT
    SUM(CASE WHEN Product_type IS NULL THEN 1 ELSE 0 END) AS Null_Product_type,
    SUM(CASE WHEN SKU IS NULL THEN 1 ELSE 0 END) AS Null_SKU,
    SUM(CASE WHEN Price IS NULL THEN 1 ELSE 0 END) AS Null_Price,
    SUM(CASE WHEN Availability IS NULL THEN 1 ELSE 0 END) AS Null_Availability,
    SUM(CASE WHEN Number_of_products_sold IS NULL THEN 1 ELSE 0 END) AS Null_Num_Sold,
    SUM(CASE WHEN Revenue_generated IS NULL THEN 1 ELSE 0 END) AS Null_Revenue,
    SUM(CASE WHEN Customer_demographics IS NULL THEN 1 ELSE 0 END) AS Null_Demographics,
    SUM(CASE WHEN Stock_levels IS NULL THEN 1 ELSE 0 END) AS Null_Stock,
    SUM(CASE WHEN Production_Lead_Time IS NULL THEN 1 ELSE 0 END) AS Null_ProductionLeadTime,
    SUM(CASE WHEN Order_quantities IS NULL THEN 1 ELSE 0 END) AS Null_OrderQuantities,
    SUM(CASE WHEN Shipping_times IS NULL THEN 1 ELSE 0 END) AS Null_ShippingTimes,
    SUM(CASE WHEN Shipping_carriers IS NULL THEN 1 ELSE 0 END) AS Null_Carriers,
    SUM(CASE WHEN Shipping_costs IS NULL THEN 1 ELSE 0 END) AS Null_ShippingCosts,
    SUM(CASE WHEN Supplier_name IS NULL THEN 1 ELSE 0 END) AS Null_SupplierName,
    SUM(CASE WHEN Location IS NULL THEN 1 ELSE 0 END) AS Null_Location,
    SUM(CASE WHEN Supplier Lead Time IS NULL THEN 1 ELSE 0 END) AS Null_SupplierLeadTime
```

Order_ID	SKU	Product_Type	Customer_Demographics	Stock_Levels	Supplier_Name	Supplier_Location	Lead_Time	Manufacturing_Lead_Time	Order_Quantities	Transportation_Modes	Shipping_Costs	Customer_Rating	Revenue_Generated	Profit_Margin	Freight_Rate	Unit_Cost	Total_Cost
ORD001	S001	Laptop	Gen-Z	High	Supplier A	New York	3	5	100	Air	\$100	4.5	\$1000	20%	\$100	\$1000	
ORD002	S002	Smartphone	Millennials	Medium	Supplier B	Los Angeles	2	4	150	Land	\$80	4.2	\$1200	18%	\$80	\$1200	
ORD003	S003	Tablet	Gen-Z	Medium	Supplier C	Chicago	3	6	100	Land	\$70	4.0	\$900	15%	\$70	\$900	
ORD004	S004	Smartwatch	Gen-Z	Low	Supplier D	Seattle	1	3	50	Land	\$60	3.8	\$600	12%	\$60	\$600	
ORD005	S005	Headphones	Millennials	Medium	Supplier E	Boston	2	5	100	Land	\$50	3.5	\$500	10%	\$50	\$500	
ORD006	S006	Cameras	Gen-Z	Medium	Supplier F	Philadelphia	3	8	120	Land	\$40	3.2	\$480	8%	\$40	\$480	
ORD007	S007	PCs	Gen-Z	Medium	Supplier G	Atlanta	1	2	200	Land	\$30	3.0	\$600	6%	\$30	\$600	
ORD008	S008	Monitors	Gen-Z	Medium	Supplier H	Tampa	2	4	150	Land	\$25	2.8	\$375	5%	\$25	\$375	
ORD009	S009	Peripherals	Gen-Z	Medium	Supplier I	Phoenix	3	6	100	Land	\$20	2.5	\$200	4%	\$20	\$200	
ORD010	S010	Software	Gen-Z	Medium	Supplier J	Las Vegas	1	1	500	Land	\$15	2.2	\$750	3%	\$15	\$750	
ORD011	S011	Books	Gen-Z	Medium	Supplier K	Houston	2	3	300	Land	\$10	2.0	\$300	2%	\$10	\$300	
ORD012	S012	Electronics	Gen-Z	Medium	Supplier L	Dallas	3	5	200	Land	\$8	1.8	\$160	1.5%	\$8	\$160	
ORD013	S013	Smartphones	Gen-Z	Medium	Supplier M	Portland	1	2	100	Land	\$7	1.6	\$70	1.2%	\$7	\$70	
ORD014	S014	Tablets	Gen-Z	Medium	Supplier N	Oklahoma City	2	4	150	Land	\$6	1.4	\$90	1.0%	\$6	\$90	
ORD015	S015	Cameras	Gen-Z	Medium	Supplier O	Austin	3	8	120	Land	\$5	1.2	\$60	0.8%	\$5	\$60	
ORD016	S016	PCs	Gen-Z	Medium	Supplier P	San Antonio	1	2	200	Land	\$4	1.0	\$80	0.6%	\$4	\$80	
ORD017	S017	Monitors	Gen-Z	Medium	Supplier Q	San Diego	2	4	150	Land	\$3	0.8	\$45	0.4%	\$3	\$45	
ORD018	S018	Peripherals	Gen-Z	Medium	Supplier R	San Jose	3	6	100	Land	\$2	0.6	\$30	0.3%	\$2	\$30	
ORD019	S019	Software	Gen-Z	Medium	Supplier S	Seattle	1	1	500	Land	\$1.5	0.4	\$750	0.2%	\$1.5	\$750	
ORD020	S020	Books	Gen-Z	Medium	Supplier T	Portland	2	3	300	Land	\$1.0	0.2	\$300	0.15%	\$1.0	\$300	
ORD021	S021	Electronics	Gen-Z	Medium	Supplier U	Oklahoma City	3	5	200	Land	\$0.8	0.1	\$160	0.1%	\$0.8	\$160	
ORD022	S022	Smartphones	Gen-Z	Medium	Supplier V	Austin	1	2	100	Land	\$0.7	0.05	\$70	0.08%	\$0.7	\$70	
ORD023	S023	Tablets	Gen-Z	Medium	Supplier W	San Antonio	2	4	150	Land	\$0.6	0.03	\$45	0.06%	\$0.6	\$45	
ORD024	S024	Cameras	Gen-Z	Medium	Supplier X	San Jose	3	8	120	Land	\$0.5	0.02	\$30	0.04%	\$0.5	\$30	
ORD025	S025	PCs	Gen-Z	Medium	Supplier Y	Seattle	1	1	500	Land	\$0.4	0.01	\$750	0.02%	\$0.4	\$750	
ORD026	S026	Monitors	Gen-Z	Medium	Supplier Z	Portland	2	3	300	Land	\$0.3	0.005	\$300	0.01%	\$0.3	\$300	
ORD027	S027	Peripherals	Gen-Z	Medium	Supplier AA	Oklahoma City	3	5	200	Land	\$0.2	0.002	\$160	0.008%	\$0.2	\$160	
ORD028	S028	Software	Gen-Z	Medium	Supplier BB	Austin	1	2	100	Land	\$0.15	0.001	\$70	0.005%	\$0.15	\$70	
ORD029	S029	Books	Gen-Z	Medium	Supplier CC	San Antonio	2	3	150	Land	\$0.1	0.0005	\$30	0.003%	\$0.1	\$30	
ORD030	S030	Electronics	Gen-Z	Medium	Supplier DD	San Jose	3	5	100	Land	\$0.08	0.0002	\$20	0.002%	\$0.08	\$20	
ORD031	S031	Smartphones	Gen-Z	Medium	Supplier EE	Seattle	1	1	500	Land	\$0.05	0.0001	\$750	0.001%	\$0.05	\$750	
ORD032	S032	Tablets	Gen-Z	Medium	Supplier FF	Portland	2	3	300	Land	\$0.03	0.00005	\$300	0.0008%	\$0.03	\$300	
ORD033	S033	Cameras	Gen-Z	Medium	Supplier GG	Oklahoma City	3	5	200	Land	\$0.02	0.00002	\$160	0.0005%	\$0.02	\$160	
ORD034	S034	PCs	Gen-Z	Medium	Supplier HH	Austin	1	2	100	Land	\$0.01	0.00001	\$70	0.0003%	\$0.01	\$70	
ORD035	S035	Monitors	Gen-Z	Medium	Supplier II	San Antonio	2	3	150	Land	\$0.008	0.000005	\$30	0.0002%	\$0.008	\$30	
ORD036	S036	Peripherals	Gen-Z	Medium	Supplier JJ	San Jose	3	5	100	Land	\$0.005	0.000002	\$20	0.0001%	\$0.005	\$20	
ORD037	S037	Software	Gen-Z	Medium	Supplier KK	Seattle	1	1	500	Land	\$0.002	0.000001	\$750	0.00008%	\$0.002	\$750	
ORD038	S038	Books	Gen-Z	Medium	Supplier LL	Portland	2	3	300	Land	\$0.001	0.0000005	\$300	0.00005%	\$0.001	\$300	
ORD039	S039	Electronics	Gen-Z	Medium	Supplier MM	Oklahoma City	3	5	200	Land	\$0.0008	0.0000002	\$160	0.00003%	\$0.0008	\$160	
ORD040	S040	Smartphones	Gen-Z	Medium	Supplier NN	Austin	1	2	100	Land	\$0.0005	0.0000001	\$70	0.00002%	\$0.0005	\$70	
ORD041	S041	Tablets	Gen-Z	Medium	Supplier OO	San Antonio	2	3	150	Land	\$0.0003	0.00000005	\$30	0.00001%	\$0.0003	\$30	
ORD042	S042	Cameras	Gen-Z	Medium	Supplier PP	San Jose	3	5	100	Land	\$0.0002	0.00000002	\$20	0.000008%	\$0.0002	\$20	
ORD043	S043	PCs	Gen-Z	Medium	Supplier QQ	Seattle	1	1	500	Land	\$0.0001	0.00000001	\$750	0.000005%	\$0.0001	\$750	
ORD044	S044	Monitors	Gen-Z	Medium	Supplier RR	Portland	2	3	300	Land	\$0.00008	0.000000005	\$300	0.000003%	\$0.00008	\$300	
ORD045	S045	Peripherals	Gen-Z	Medium	Supplier SS	Oklahoma City	3	5	200	Land	\$0.00005	0.000000002	\$160	0.000002%	\$0.00005	\$160	
ORD046	S046	Software	Gen-Z	Medium	Supplier TT	Austin	1	2	100	Land	\$0.00002	0.000000001	\$70	0.000001%	\$0.00002	\$70	
ORD047	S047	Books	Gen-Z	Medium	Supplier UU	San Antonio	2	3	150	Land	\$0.00001	0.0000000005	\$30	0.0000008%	\$0.00001	\$30	
ORD048	S048	Electronics	Gen-Z	Medium	Supplier VV	San Jose	3	5	100	Land	\$0.000008	0.0000000002	\$20	0.0000005%	\$0.000008	\$20	
ORD049	S049	Smartphones	Gen-Z	Medium	Supplier WW	Seattle	1	1	500	Land	\$0.000002	0.0000000001	\$750	0.0000003%	\$0.000002	\$750	
ORD050	S050	Tablets	Gen-Z	Medium	Supplier XX	Portland	2	3	300	Land	\$0.000001	0.00000000005	\$300	0.0000002%	\$0.000001	\$300	
ORD051	S051	Cameras	Gen-Z	Medium	Supplier YY	Oklahoma City	3	5	200	Land	\$0.0000008	0.00000000002	\$160	0.00000015%	\$0.0000008	\$160	
ORD052	S052	PCs	Gen-Z	Medium	Supplier ZZ	Austin	1	2	100	Land	\$0.0000002	0.00000000001	\$70	0.0000001%	\$0.0000002	\$70	
ORD053	S053	Monitors	Gen-Z	Medium	Supplier AA	San Antonio	2	3	150	Land	\$0.0000001	0.000000000005	\$30	0.00000008%	\$0.0000001	\$30	
ORD054	S054	Peripherals	Gen-Z	Medium	Supplier BB	San Jose	3	5	100	Land	\$0.00000008	0.000000000002	\$20	0.00000005%	\$0.00000008	\$20	
ORD055	S055	Software	Gen-Z	Medium	Supplier CC	Seattle	1	1	500	Land	\$0.00000002	0.000000000001	\$750	0.00000003%	\$0.00000002	\$750	
ORD056	S056	Books	Gen-Z	Medium	Supplier DD	Portland	2	3	300	Land	\$0.00000001	0.0000000000005	\$300	0.00000002%	\$0.00000001	\$300	
ORD057	S057	Electronics	Gen-Z	Medium	Supplier EE	Oklahoma City	3	5	200	Land	\$0.000000008	0.0000000000002	\$160	0.000000015%	\$0.000000008	\$160	
ORD058	S058	Smartphones	Gen-Z	Medium	Supplier FF	Austin	1	2	100	Land	\$0.000000002	0.0000000000001	\$70	0.00000001%	\$0.000000002	\$70	
ORD059	S059	Tablets	Gen-Z	Medium	Supplier GG	San Antonio	2	3	150	Land	\$0.000000001	0.00000000000005	\$30	0.000000008%	\$0.000000001	\$30	
ORD060	S060	Cameras	Gen-Z	Medium	Supplier HH	San Jose	3	5	100	Land	\$0.0000000008	0.00000000000002	\$20	0.000000005%	\$0.0000000008	\$20	
ORD061	S061	PCs	Gen-Z	Medium	Supplier II	Seattle	1	1	500	Land	\$0.0000000002	0.00000000000001</td					

SQL Queries Explained

Strategic SQL queries were crafted to quickly assess data and extract initial performance indicators.

Preview Data

```
SELECT TOP 10 * FROM SupplyChain;
```

Purpose: Quick data inspection and schema verification



Total Orders

```
SELECT Location, COUNT(*) FROM SupplyChain GROUP BY Location
```

Purpose: Identify high-volume order locations



Avg Shipping Time

```
SELECT Transportation_modes, AVG(Shipping times) FROM SupplyChain GROUP BY Transportation_modes;
```

Purpose: Evaluate efficiency of transport modes.



Supplier Cost

```
SELECT Supplier_name, SUM(Manufacturing_costs) AS TotalManCost, SUM(Shipping_costs) AS TotalShipCost FROM SupplyChain GROUP BY Supplier_name;
```

Purpose: Analyze supplier cost-efficiency

```
283 --  Identify potentially risky suppliers with both high manufacturing cost and defect rate
284
285 SELECT
286     Supplier_name,
287     ROUND(AVG(CAST(Manufacturing_costs AS FLOAT)), 2) AS Avg_Manufacturing_Cost,
288     ROUND(AVG(CAST(Defect_rates AS FLOAT)), 3) AS Avg_Defect_Rate
289 FROM dbo.supply_chain_data
290 GROUP BY Supplier_name
291 HAVING AVG(CAST(Manufacturing_costs AS FLOAT)) > 2 AND AVG(CAST(Defect_rates AS FLOAT)) > 0.02
292 ORDER BY Avg_Manufacturing_Cost DESC, Avg_Defect_Rate DESC
293
294 --  Identify the most cost-efficient supplier per product type
295 -- This helps understand which supplier offers the lowest manufacturing cost for each product type.
296 --  Find the most cost-efficient supplier per product type
297
298 WITH AvgCostPerSupplier AS (
299     SELECT
300         Product_type,
301         Supplier_name,
302         ROUND(AVG(CAST(Manufacturing_costs AS FLOAT)), 2) AS Avg_Manufacturing_Cost
303
100% ▾ ① 0 ↑ ↓

```

Results Messages

	Supplier_name	Avg_Manufacturing_Cost	Avg_Defect_Rate
1	Supplier 4	62.71	2.337
2	Supplier 1	45.25	1.804
3	Supplier 5	44.77	2.665
4	Supplier 3	43.63	2.466
5	Supplier 2	41.62	2.363



SQL Business Questions Answered

The SQL analysis directly addressed critical business questions, laying the groundwork for the Power BI dashboard's KPIs.

1

Average Lead Time?

Calculated to understand production and delivery cycles.

2

Highest Revenue Supplier?

Identified top-performing suppliers based on revenue contribution.

3

Cost Distribution by Mode?

Analyzed shipping costs across different transportation methods.

4

Avg. Defect Rate?

Determined product quality metrics per type.

Python Section Overview

Python was instrumental for advanced data manipulation, ensuring the dataset's quality and readiness for in-depth analysis.



Advanced Cleaning

Utilized Pandas for sophisticated data cleansing routines.



Handle Missing Values

Strategically addressed and imputed or removed null values.



Outlier Detection

Implemented robust methods to identify and manage data outliers.



Statistical Profiling

Generated comprehensive summary statistics and visual EDA.



Python Cleaning Steps

A systematic approach to data cleaning in Python ensured a high-quality dataset, enhancing the reliability of subsequent analysis.

01

Remove Duplicates

```
df = df.drop_duplicates()
```

Eliminated redundant entries to maintain data integrity.

02

Remove Missing Values

```
df = df.dropna()
```

Addressed gaps in the dataset for complete analysis.

03

Outlier Removal (IQR)

```
IQR = Q3 - Q1; lower = Q1 - 1.5 * IQR; upper = Q3 + 1.5 * IQR  
df = df[(df[col] >= lower) & (df[col] <= upper)]
```

Used Interquartile Range to prevent skewed analyses from extreme values.

04

Standardize Text Fields

Cleaned text data by removing extra spaces and normalizing casing (e.g., title case) for consistency.



This ensures accuracy, prevents category duplication, and enhances dashboard clarity.



Python EDA (Before Cleaning)

Exploratory Data Analysis before cleaning revealed crucial patterns and issues within the raw data, guiding our remediation efforts.

Visuals Generated:

- Boxplots (for outlier detection)
- Missing values summary
- Duplicate count reports
- Histograms (for distribution analysis)
- Correlation matrices (for relationships)

Key Findings:

- Numerous outliers in **Price**, **Revenue**, and **Shipping Time**.
- Presence of duplicate rows affecting data integrity.
- Significant missing values across several key columns.
- Strong positive correlation identified between **Revenue** and **Price**.
- **Manufacturing Lead Time** emerged as a bottleneck for specific SKUs.

Python EDA (After Cleaning)

The post-cleaning EDA confirmed the successful transformation of the raw data into a reliable and robust dataset, primed for Power BI.



Cleaned Dataset

Ready for advanced analytics.



Outliers Removed

Ensuring accurate insights.



Missing Values Resolved

Complete and comprehensive data.



Text Values Standardized

Improved consistency and clarity.

Final Output: [cleaned_data.csv](#)

This polished dataset is now the cornerstone for generating dynamic visualizations and strategic insights in Power BI.

```
# ---  
# 1) IMPORTS  
# ======  
import pandas as pd  
import numpy as np  
import matplotlib.pyplot as plt  
import seaborn as sns  
from sqlalchemy import create_engine  
from IPython.display import display  
  
# ======  
# 2) LOAD FULL DATA FROM SQL  
# ======  
engine = create_engine(  
    "mssql+pyodbc://LAPTOP-ENGNAGWA/SupplyChain"  
    "?driver=ODBC+Driver+18+for+SQL+Server"  
    "&trusted_connection=yes"  
    "&Encrypt=no"  
)  
  
#  هنا جينا كل الجدول من غير TOP 10  
df_original = pd.read_sql("SELECT * FROM SupplyChain", engine)  
  
print("📊 Original dataset shape:", df_original.shape)  
print("\n📊 Preview of dataset (first 5 rows):")  
print(df_original.head())  
  
# ======  
# 3) BASIC INFO BEFORE CLEANING  
# ======  
print("\n◆ Data Overview BEFORE cleaning:")  
print(df_original.info())  
  
print("\n◆ Missing Values per Column (BEFORE):")  
print(df_original.isnull().sum())
```

Power BI Dashboard Overview

The Power BI dashboard consolidates our analysis into an intuitive and interactive experience, providing clear strategic insights across three key analytical pages.

Analytical Pages:

- Overview
- Product Insights
- Supplier Insights

Key Dashboard Features:

- Dynamic KPIs for quick performance assessment
- Advanced DAX measures for complex calculations
- Interactive slicers for granular data exploration
- Customized UI design for enhanced user experience
- Business story-driven visuals for actionable insights



KPIs & DAX Measures Used

Key Performance Indicators and their DAX measures were meticulously crafted in Power BI to provide actionable insights into the supply chain's performance.

1 Total Revenue

```
Total Revenue = SUM(cleaned_data[Revenue_generated])
```

Measures overall sales performance.

2 Total Orders

```
Total Orders = SUM(cleaned_data[Order_quantities])
```

Quantifies the total volume of customer orders.

3 Average Delivery Time

```
Average Delivery Time = AVERAGE(cleaned_data[Shipping_times])
```

Assesses the efficiency of logistics and delivery processes.

4 Average Profit Margin

```
Profit Margin = DIVIDE(SUM(cleaned_data[Revenue_generated]) - SUM(cleaned_data[Shipping_costs]),  
SUM(cleaned_data[Revenue_generated])))
```

Evaluates profitability after accounting for shipping costs, converted to percentage for clarity.

5 Orders by Demographics

```
Orders by Demo = SUM(cleaned_data[Order_quantities])
```

Analyzes order distribution across different customer segments.

Overview Page Insights

The Power BI Overview Page presents a high-level summary of the supply chain's performance, highlighting critical metrics and strategic insights derived from our cleaned and analyzed data.

577.6K

Total Revenue

5.75

Avg. Delivery Time (Days)

5000

Total Orders

87.44%

Avg. Profit Margin

Overall financial performance, demonstrating top-line growth.

Efficiency of logistics, showing swift fulfillment processes.

Volume of transactions, indicating market demand and operational scale.

Core profitability, reflecting effective cost management.

Key Strategic Insights

- Female customers drive the highest order volume, indicating a key demographic focus.
- Mumbai & Chennai stand out as the top-performing locations for sales and distribution.
- Air transportation mode is demonstrably the fastest, crucial for urgent deliveries.
- Road transport is most utilized but shows longer average shipping times.
- Haircare products exhibit comparatively higher defect rates, requiring further quality control investigation.

Product Page Insights

The Product Insights page in Power BI provides granular details on individual product performance, stock management, and demand patterns, enabling data-driven decisions for product optimization.



Key Visualizations:

- Orders by SKU
- Stock levels by SKU
- Lead time vs manufacturing lead time
- Scatter plot: Price vs Orders
- Profit margin by product type

Strategic Insights:

- Overstock Risk:** Some SKUs show high stock levels despite low demand, indicating potential overstocking issues.
- Profit Drivers:** Cosmetics products consistently generate the highest profit margins across the portfolio.
- Demand Sweet Spot:** Mid-priced products demonstrate the highest overall demand, suggesting optimal market positioning.
- Bottleneck Alert:** Specific SKUs are experiencing manufacturing bottlenecks, impacting lead times and product availability.

Supplier Page Insights

The Power BI Supplier Page offers a deep dive into vendor performance, evaluating key metrics to optimize procurement and foster strong supply chain partnerships.

Key Visualizations:

- Manufacturing & shipping costs per supplier
- Defect rates by transportation mode
- Supplier stock comparison
- Profit margin vs defect rate

Strategic Insights:

Supplier 3: Top Performer

- **High Margin:** Consistently delivers products with excellent profit margins.
- **Low Defects:** Maintains superior quality control, resulting in minimal defect rates.
- **Cost Efficient:** Offers competitive pricing and efficient manufacturing processes.

Supplier 5: Underperforming

- **Lower Margins:** Products from this supplier yield reduced profitability.
- **Higher Defect Rates:** Experiences more frequent quality issues, impacting customer satisfaction.
- **Needs Evaluation:** Requires immediate review for potential corrective actions or replacement.

Final Recommendations

Based on our comprehensive analysis, these strategic recommendations are designed to optimize supply chain performance, reduce costs, and enhance overall profitability.



Allocate More Orders to Supplier 3

Leverage [Supplier 3's high margins and low defect rates](#) to maximize profitability and product quality.



Reduce Sea Transportation

Minimize the use of [Sea transportation due to its high defect rates](#), impacting product quality and delivery timelines.



Optimize Inventory for Low-Demand SKUs

Implement stricter inventory controls for [SKUs identified with potential overstocking issues](#) to free up capital and storage space.



Improve Quality Control for Haircare Products

Address the [comparatively higher defect rates in haircare products](#) through targeted quality assurance initiatives.



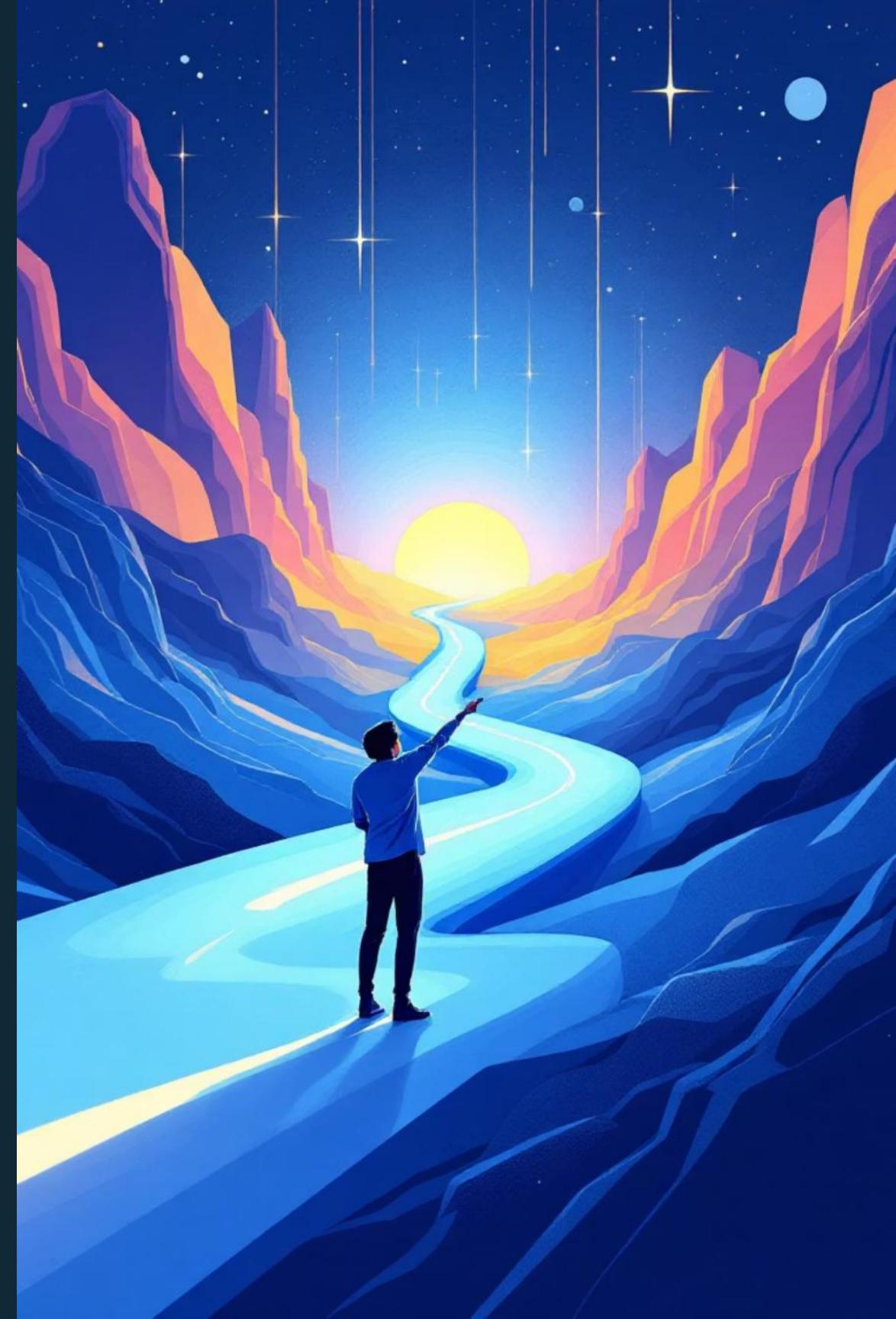
Increase Targeted Marketing for Female Customers

Capitalize on the fact that [female customers drive the highest order volume](#) with tailored marketing campaigns.



Use Air Transport for Urgent Shipments

Utilize [Air transportation for critical or urgent deliveries](#), benefiting from its demonstrably faster shipping times.



Thank You!

Further analytics enhancements will continue to improve supply chain efficiency and drive sustained business growth.