

Project Requirements Document (PRD)

Project Overview

Title: Delivery Performance, Delay Risk, and Logistics Efficiency Analysis in Global Supply Chain Operations

Domain: Supply Chain Analytics

Collaborating Organizations:

- [Unified Mentor](#)
- [APL Logistics \(KWE Group\)](#)

Background and Context:

In large-scale global logistics operations:

- Delivery delays lead to SLA violations and penalties
- Mismatch between planned vs actual shipping time increases cost
- Inefficient shipping modes impact customer satisfaction
- Regional bottlenecks are often detected too late

APL Logistics handles high-volume, multi-region shipments, making delivery performance monitoring critical for operational excellence.

This project provides operational transparency into delivery timelines and delay risks.

Problem Statement

Despite having detailed order and shipping data, the organization lacks:

- Clear measurement of **on-time vs delayed deliveries**
- Understanding of **why shipments are delayed**
- Visibility into **high-risk regions, markets, and shipping modes**
- Diagnostics to explain **late_delivery_risk**

As a result, logistics teams operate **reactively** rather than **preventively**.

Dataset Fields Description:

Column Name	Description
Type	Payment method used for the order (e.g., Debit, Credit).
Days for shipping (real)	Actual number of days taken to ship the order.
Days for shipment (scheduled)	Planned or scheduled shipping duration in days.
Benefit per order	Net profit or benefit earned from a single order.
Sales per customer	Total sales value generated by the customer.
Delivery Status	Current delivery status of the order.
Late_delivery_risk	Indicator showing whether the delivery was late (1 = Yes, 0 = No).
Category Id	Unique identifier for the product category.
Category Name	Name of the product category.
Customer City	City where the customer is located.
Customer Country	Country of the customer.
Customer Fname	Customer's first name.
Customer Id	Unique identifier for each customer.
Customer Lname	Customer's last name.
Customer Segment	Segment to which the customer belongs (e.g., Consumer, Corporate)
Customer State	State or region of the customer.
Customer Street	Street address of the customer.
Customer Zipcode	Zip or postal code of the customer.
Department Id	Unique identifier for the department.
Department Name	Name of the department responsible for the product.
Latitude	Latitude coordinate of the customer location.
Longitude	Longitude coordinate of the customer location.
Market	Global market region where the order belongs.

Order City	City where the order was delivered.
Order Country	Country where the order was delivered.
Order Customer Id	Customer identifier linked to the order.
Order Item Discount	Discount amount applied to the order item.
Order Item Discount Rate	Discount rate applied to the product price.
Order Item Product Price	Original price of the product before discount.
Order Item Profit Ratio	Profit ratio achieved on the order item.
Order Item Quantity	Number of units ordered for the product.
Sales	Total sales amount generated from the order.
Order Item Total	Final total value of the order item after discount.
Order Profit Per Order	Profit earned from the order after costs.
Order Region	Regional classification of the order.
Order State	State or province where the order was delivered.
Order Status	Current status of the order (e.g., Complete, On Hold).
Product Name	Name of the product ordered.
Product Price	Selling price of the product.
Shipping Mode	Shipping method used for delivery (e.g., Standard, Express).

Analytical Methodology (Step-by-Step)

Step 1: Data Cleaning & Validation

- Validate shipping duration values
 - Remove inconsistent or missing delivery records
 - Standardize region and market naming
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Step 2: Delivery Gap Calculation

- Compute **Delivery Delay Gap**
$$\text{Delay Gap} = \text{Days for shipping (real)} - \text{Days for shipment (scheduled)}$$
 - Classify deliveries as:
 - On-time
 - Delayed
 - Early
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Step 3: Overall Delivery Performance Analysis

- Calculate on-time delivery percentage
 - Analyze late_delivery_risk distribution
 - Establish baseline logistics performance
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Step 4: Shipping Mode Efficiency Analysis

- Compare delay gap by:
 - Shipping Mode
 - Delivery Status
 - Identify modes with highest delay frequency
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Step 5: Regional & Market Diagnostics

- Analyze delay risk by:
 - Order Region
 - Order Country
 - Market
 - Identify high-risk geographies
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Step 6: Customer Segment Impact Analysis

- Compare delays across customer segments
 - Evaluate whether premium or enterprise customers are impacted
 - Identify SLA risk exposure
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Key Performance Indicators (KPIs)

KPI	Description
On-Time Delivery Rate (%)	% of orders delivered within scheduled time
Average Delivery Delay (Days)	Mean difference between actual and scheduled days
Late Delivery Risk Ratio	Proportion of delayed shipments
Shipping Mode Efficiency Index	Delay comparison across shipping modes
Regional Delay Index	Delay intensity by region/market

Streamlit Web Application Requirements

Dashboard Modules

Delivery Performance Overview

- On-time vs late delivery KPIs
- Average delay scorecards

Delay Risk Analysis Dashboard

- Late_delivery_risk distribution
- Delay gap histograms

Shipping Mode Comparison

- Mode-wise delay performance
- SLA compliance by mode

Regional & Market Heatmaps

- Geographic delay visualization
- Market-wise logistics efficiency

User Capabilities

- Shipping mode filter
- Region & market selector
- Customer segment filter
- Date range selector

Deliverables and Submission

- Research paper (EDA, insights, recommendations)
- Streamlit dashboard (live analytics)
- Executive summary for government stakeholders

Conclusion

This project establishes a **diagnostic intelligence layer** for APL Logistics' supply chain operations. By systematically analyzing delivery timelines, shipping modes, and regional delay patterns, it enables logistics teams to move from **reactive firefighting** to **data-driven operational control**. This analysis forms the **critical first step** before deploying predictive or optimization-based supply chain models

[Access Dataset](#)