Supply Chain Analytics Research

This report covers four major pillars of the supply chain analytics project:

1. Customer Analytics & Profitability Analysis
2. Inventory Management & Stock Optimization
3. Logistics & Delivery Performance Optimization
4. Demand Forecasting & Predictive Analytics

Each section includes analysis objectives, methodologies, insights, and recommended KPIs.

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1. Customer Analytics & Profitability Analysis

Focus: Customer behavior, segmentation, and financial performance

1.1 Customer Segmentation Analysis

Segments Analyzed:

- Home Office
- Consumer
- Corporate

Key Analytical Areas:

- Ordering frequency & purchasing cycles
- Customer Lifetime Value (CLV) estimation
- Retention & repeat order patterns
- Segment-specific behaviors & preferences

Insights Framework (Template):

- **Which segment orders most frequently?**
- **Which segment has the highest average order value?**
- **Which segment contributes the highest total profit?**
- **How loyal is each segment based on repeat purchase rates?**

1.2 Profitability Analysis

Components:

- Profit per order
- Profit per product
- Segment profitability (Consumer vs Corporate vs Home Office)
- Market-level profitability
- Impact of discounts on margins

Questions Addressed:

- Which customer groups contribute most revenue but low margin?
- Are discounts harming profitability?
- Which market generates the highest profit per order?

1.3 Payment & Sales Analysis

Metrics:

- Payment methods distribution (Payment, Transfer, Debit, Cash)
- Sales per customer & per segment
- Average order value by segment
- Revenue trend analysis by market & segment

1.4 Customer Behavior Insights

Dimensions:

- Order frequency
- Preferred product categories per segment
- Geographic customer distribution
- Relationship between customer segment & delivery performance

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2. Inventory Management & Stock Optimization

Focus: Inventory planning based on order patterns

2.1 Order Pattern Analysis

- Order velocity (orders per product per day)
- Frequency & quantity analysis
- Product demand variability
- Lead time analysis (scheduled vs actual)

2.2 Inventory Metrics Calculation

Key Formulas:

- **Reorder Point:** (Avg Daily Demand × Lead Time) + Safety Stock
- **Safety Stock:** Based on demand variability (σ × Z-score)
- **ABC Analysis:** 80/15/5 importance split
- **EOQ (Economic Order Quantity):** $\sqrt{((2DS)/H)}$
- Stock-out risk assessment by comparing demand vs available stock

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2.3 Product Classification

- Fast-moving vs slow-moving items
- Critical items with high value or impact
- Seasonal product trends

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3. Logistics & Delivery Performance Optimization

Focus: Solving the 54% late delivery crisis

3.1 Delivery Performance Analysis

- Late delivery rate by shipping mode
- Late delivery rate by market/region
- Late delivery rate by customer segment
- Monthly patterns & seasonality in late deliveries

- Root-cause analysis: operational vs geographic vs demand load

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3.2 Shipping Mode Analysis

- Cost vs performance comparisons
- Identifying worst-performing modes
- Recommending optimal shipping mode strategies
- Cost-benefit analysis using sales & delay data

3.3 Geographic Performance

- Use of latitude/longitude to measure delivery distances
- Market-level comparison of on-time delivery
- Identifying problem regions & delay hotspots
- Understanding distance impact on shipping days

3.4 Optimization Recommendations

- Reducing late delivery from 54% to <20%
- Shipping mode restructuring
- Regional logistics enhancements (warehousing, routing)
- Reducing delivery cost while improving speed

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4. Demand Forecasting & Predictive Analytics

Focus: Future demand prediction & trend discovery

4.1 Time-Series Pattern Analysis

- Daily/weekly/monthly ordering trends
- Seasonality detection
- Demand spikes related to product categories or regions

4.2 Forecasting Models

Techniques to be used (Python):

- Moving Average
- Exponential Smoothing
- ARIMA / Prophet
- Linear Regression for trend forecasting

Evaluation Metrics:

- MAPE
- RMSE

Deliverables:

- 3–6 month demand forecasts
- Forecasts per product category
- Forecasts per segment & region

4.3 Market & Segment Demand Analysis

- Demand by market (Pacific Asia, LATAM, Europe, Africa, USCA)
- Demand by segment (Home Office, Consumer, Corporate)
- Product category performance & seasonality
