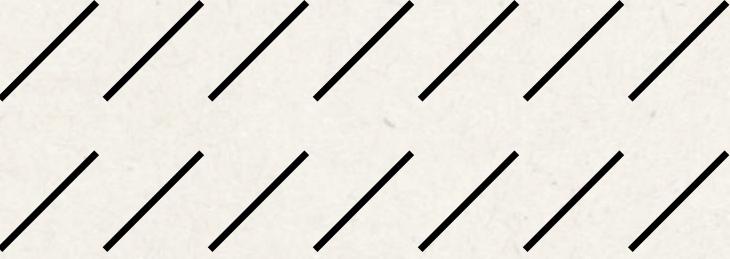


OPERATIONAL EFFICIENCY ANALYSIS OF ORDER FULFILLMENT & DELIVERY PERFORMANCE

Sales & Business Operations Analytics Project

By - Neelaksh Lohani

BUSINESS UNDERSTANDING



Stakeholder:

Operations Manager responsible for overseeing order fulfillment performance and logistics cost efficiency across regional markets.

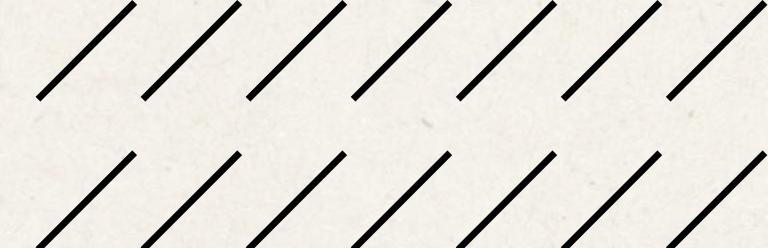
Business Context:

The organization processes customer orders across multiple regions using different shipping modes, each incurring varying fulfillment time and logistics cost.

Operational inefficiencies in the order delivery process can result in:

- Increased shipping cost per order
- Delayed deliveries
- Customer dissatisfaction
- Reduced transactional profitability

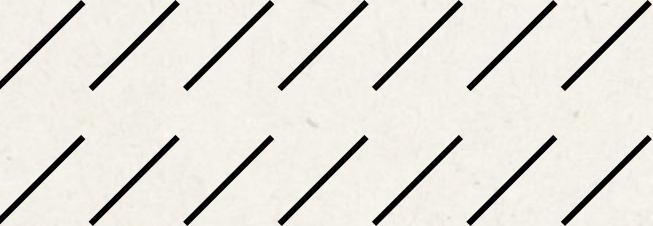
BUSINESS UNDERSTANDING



Key Business Decisions Required:

- Which operational regions experience delayed fulfillment?
- Are delivery delays impacting overall profitability?
- Which shipping modes are cost-inefficient?
- Should logistics strategy vary across product categories?
- How can fulfillment performance be optimized without increasing cost?

KEY METRICS USED



To evaluate operational efficiency and financial performance of the order fulfillment process, the following KPIs were defined:

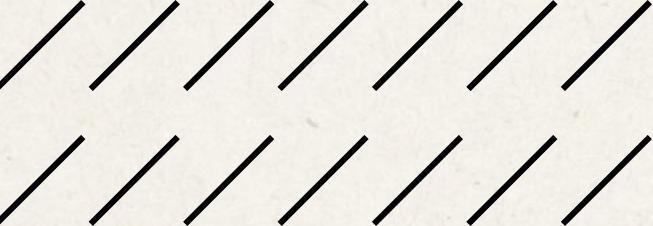
Fulfillment Performance Metrics:

- Average Fulfillment Time (Shipping Days)
- Measures time taken from order placement to shipment.
- Late Delivery Rate (%)
- Indicates proportion of orders exceeding acceptable fulfillment duration.

Financial Performance Metrics:

- Profit Margin (%)
- Evaluates profitability at transaction level.
- Average Shipping Cost per Order
- Measures logistics cost incurred for order fulfillment.
- Average Profit per Order
- Indicates transactional financial return.

DATASET OVERVIEW

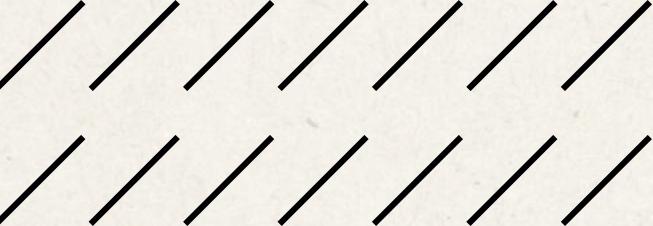


The analysis utilizes the Global Superstore transactional dataset, which captures order-level business events across operational regions.

Dataset Contains:

- Order Placement Date
- Shipment Date
- Shipping Mode
- Product Category
- Customer Segment
- Operational Region
- Sales Revenue
- Profit Earned
- Shipping Cost Incurred
- Order Priority

DATASET OVERVIEW



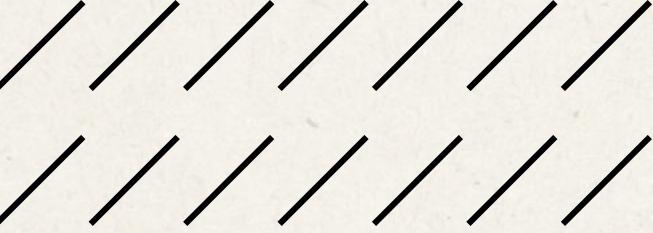
Each record represents:

A single order line transaction containing customer, product, and logistics information.

This dataset enables analysis of:

- Order fulfillment performance
- Delivery delay patterns
- Logistics cost distribution
- Profitability across categories and regions

BUSINESS PROBLEMS



Fulfillment Challenges:

- Delayed deliveries across specific regions
- Variation in order fulfillment time by shipping mode
- Inefficient logistics allocation in certain product categories

Financial Challenges:

- Rising logistics cost per fulfilled order
- Profit margin variation across product categories
- Potential overuse of cost-intensive shipping modes

Analytical Objective:

To identify operational inefficiencies in the order fulfillment process and recommend logistics optimization strategies that improve delivery performance and transactional profitability.

DATA CLEANING & TRANSFORMATION (PostgreSQL)

Transformation Performed in PostgreSQL:

The transactional dataset was cleaned and transformed to standardize fulfillment metrics and enable accurate operational performance analysis.

1.) Handling Mixed Date Formats

```
ALTER TABLE ops_analysis.orders
ADD COLUMN order_date_clean DATE;

UPDATE ops_analysis.orders
SET order_date_clean =
CASE
    WHEN order_date LIKE '%/%'
        THEN TO_DATE(order_date, 'MM/DD/YYYY')
    WHEN order_date LIKE '%-%'
        THEN TO_DATE(order_date, 'DD-MM-YYYY')
END;
```

2.) Creating Shipping Days (Fulfillment Time)

```
ALTER TABLE ops_analysis.orders
ADD COLUMN shipping_days INT;

UPDATE ops_analysis.orders
SET shipping_days = ship_date - order_date;
```

DATA CLEANING & TRANSFORMATION (PostgreSQL)

3.) Creating Shipping Days (Fulfillment Time)

```
ALTER TABLE ops_analysis.orders
ADD COLUMN shipping_days INT;

UPDATE ops_analysis.orders
SET shipping_days = ship_date - order_date;|
```

4.) Delivery Status Classification

```
ALTER TABLE ops_analysis.orders
ADD COLUMN delivery_status TEXT;

UPDATE ops_analysis.orders
SET delivery_status =
CASE
    WHEN shipping_days <= 4 THEN 'On-Time'
    ELSE 'Late Delivery'
END;|
```

DATA CLEANING & TRANSFORMATION (PostgreSQL)

5.) Profit Margin Calculation

```
ALTER TABLE ops_analysis.orders
ADD COLUMN profit_margin NUMERIC;

UPDATE ops_analysis.orders
SET profit_margin =
CASE
    WHEN sales = 0 THEN 0
    ELSE profit / sales
END;|
```

6.) Removing Fulfillment Outliers

```
DELETE FROM ops_analysis.orders
WHERE shipping_days > 30;|
```

KPI ENGINEERING (Power BI - DAX)

Operational KPIs were created using DAX measures to evaluate fulfillment efficiency and profitability across shipping modes and product categories.

1.) Total Orders

```
1 Total Orders =  
2 COUNT('ops_analysis orders'[order_id])
```

2.) Average Fulfillment Time

```
1 Avg Shipping Days (Mode Safe) =  
2 VAR AvgDays =  
3     AVERAGE('ops_analysis orders'[shipping_days])  
4 RETURN  
5     IF(  
6         AvgDays < 1,  
7             1,  
8             AvgDays  
9     )
```

3.) Late Delivery Rate (%)

```
1 Late Shipment % =  
2 DIVIDE(  
3     CALCULATE(  
4         COUNT('ops_analysis orders'[order_id]),  
5         'ops_analysis orders'[delivery_status] = "Late Delivery"  
6     ),  
7     [Total Orders]  
8 )
```

4.) Profit Margin (%)

```
1 Profit Margin % =  
2 DIVIDE(  
3     [Total Profit],  
4     [Total Sales]  
5 )
```

KPI ENGINEERING (Power BI - DAX)

5.) Average Shipping Cost

```
1 Avg Shipping Cost =  
2 AVERAGE('ops_analysis orders'[shipping_cost])
```

6.) Average Profit per Order

```
1 Avg Profit per Order =  
2 DIVIDE(  
3     [Total Profit],  
4     [Total Orders]  
5 )
```

7.) Total Logistics Spend

```
1 Total Shipping Cost =  
2 SUM('ops_analysis orders'[shipping_cost])
```

DATA MODELING

Modeling Approach

To enable accurate analytical computation and performance optimization, a dimensional data model was implemented in Power BI using a Star Schema Architecture.

Fact Table

Orders Table was modeled as the primary fact table containing:

- Order Date
- Ship Date
- Shipping Days
- Sales
- Profit
- Shipping Cost
- Delivery Status

Each row represents:

A single order line transaction used for fulfillment performance analysis.

DATA MODELING

Dimension Tables Created

Derived from the transactional dataset:

- dim_region
- Contains unique operational regions.
- dim_category
- Contains product category and sub-category details.

Relationships Established

From	To	Cardinality
dim_region.region	orders.region	One-to-Many
dim_category.category	orders.category	One-to-Many

DATA MODELING

Single-directional filtering was applied to ensure:

- Accurate KPI aggregation
- Context-driven filtering
- Query performance optimization

Modeling Outcome:

Implementation of the star schema enabled:

- Efficient slice-based analysis
- Reliable regional and category-level KPI computation
- Improved dashboard responsiveness

DASHBOARD 1 OVERVIEW

Regional Fulfillment Performance & Delivery Efficiency

Objective:

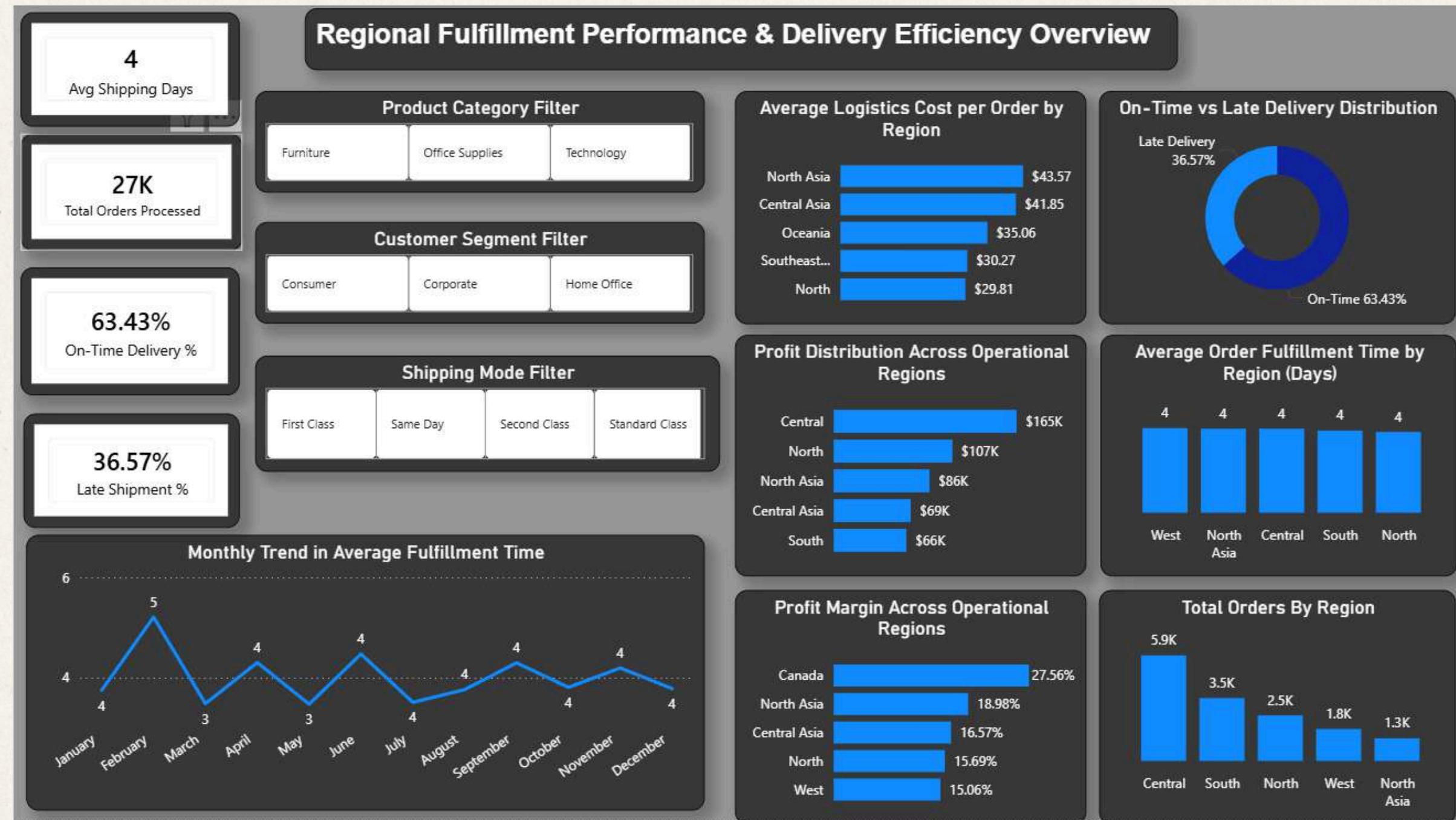
To evaluate delivery performance across operational regions and identify fulfillment inefficiencies impacting logistics cost and profitability.

Analysis Focus:

- Average Order Fulfillment Time by Region
- Late Shipment Rate across Regions
- Logistics Cost per Order
- Regional Profit Contribution
- Monthly Fulfillment Time Trend

Key Operational Metrics Used:

- Average Fulfillment Time (Days)
- Late Delivery Rate (%)
- Average Logistics Cost per Order
- Total Profit by Region



DASHBOARD 1 INSIGHTS

Insight 1:

Analysis of regional fulfillment timelines indicates that the average order processing and dispatch duration remains largely consistent across operational regions, suggesting that internal warehouse and order handling processes are standardized and functioning efficiently at a network-wide level.

This implies that variations in delivery performance across regions are unlikely to be driven by internal fulfillment delays and may instead be attributable to external logistics factors such as transportation lead time or last-mile delivery execution.

Recommendation 1:

Given that internal order processing timelines appear consistent across regions, operational improvement initiatives should focus on optimizing external transit and last-mile delivery performance. This may include revisiting delivery route planning, strengthening coordination with logistics providers, or evaluating alternative transportation strategies to reduce shipment delays.

DASHBOARD 1 INSIGHTS

Insight 2:

Despite consistency in order processing timelines, regional variation in late shipment rates highlights discrepancies in delivery reliability across markets. This suggests that certain operational regions may be experiencing transit-level inefficiencies, potentially arising from suboptimal delivery routes or inconsistent logistics partner performance.

Such discrepancies may adversely impact service-level commitments and customer satisfaction in affected regions.

Recommendation 2:

Regions demonstrating higher late shipment rates should undergo targeted performance audits of logistics partners to identify delivery inefficiencies and ensure adherence to service-level agreements. Enhancing carrier performance through renegotiated delivery timelines or revised route allocation may improve delivery reliability.

DASHBOARD 1 INSIGHTS

Insight 3:

Comparative analysis indicates that regions with relatively higher logistics cost per order tend to demonstrate lower overall profit contribution. This suggests that elevated fulfillment expenditure may be eroding transactional margins and negatively impacting financial performance in specific markets.

This trend highlights the need for closer alignment between logistics spend and revenue contribution across regional operations.

Recommendation 3:

To address elevated logistics cost in certain regions, the organization may consider implementing region-specific fulfillment strategies such as increasing utilization of cost-efficient shipping modes or improving inventory placement across decentralized warehousing facilities to minimize shipping distance and associated cost.

DASHBOARD 1 INSIGHTS

Insight 4:

Monthly trend analysis of average fulfillment time reveals variability in delivery performance across different periods. Such fluctuations may indicate inconsistencies in operational execution or demand-driven logistical strain during peak transaction volumes.

Maintaining stable fulfillment timelines is critical to ensuring consistent service quality and cost control.

Recommendation 4:

Institutionalizing periodic monitoring of regional delivery performance metrics such as fulfillment time and late shipment rate can enable early detection of emerging operational bottlenecks and facilitate proactive intervention to maintain service consistency.

DASHBOARD 2 OVERVIEW

Shipping Mode & Category Impact on Profitability

Objective:

To evaluate the impact of shipping mode selection and product category characteristics on logistics cost and transactional profitability.

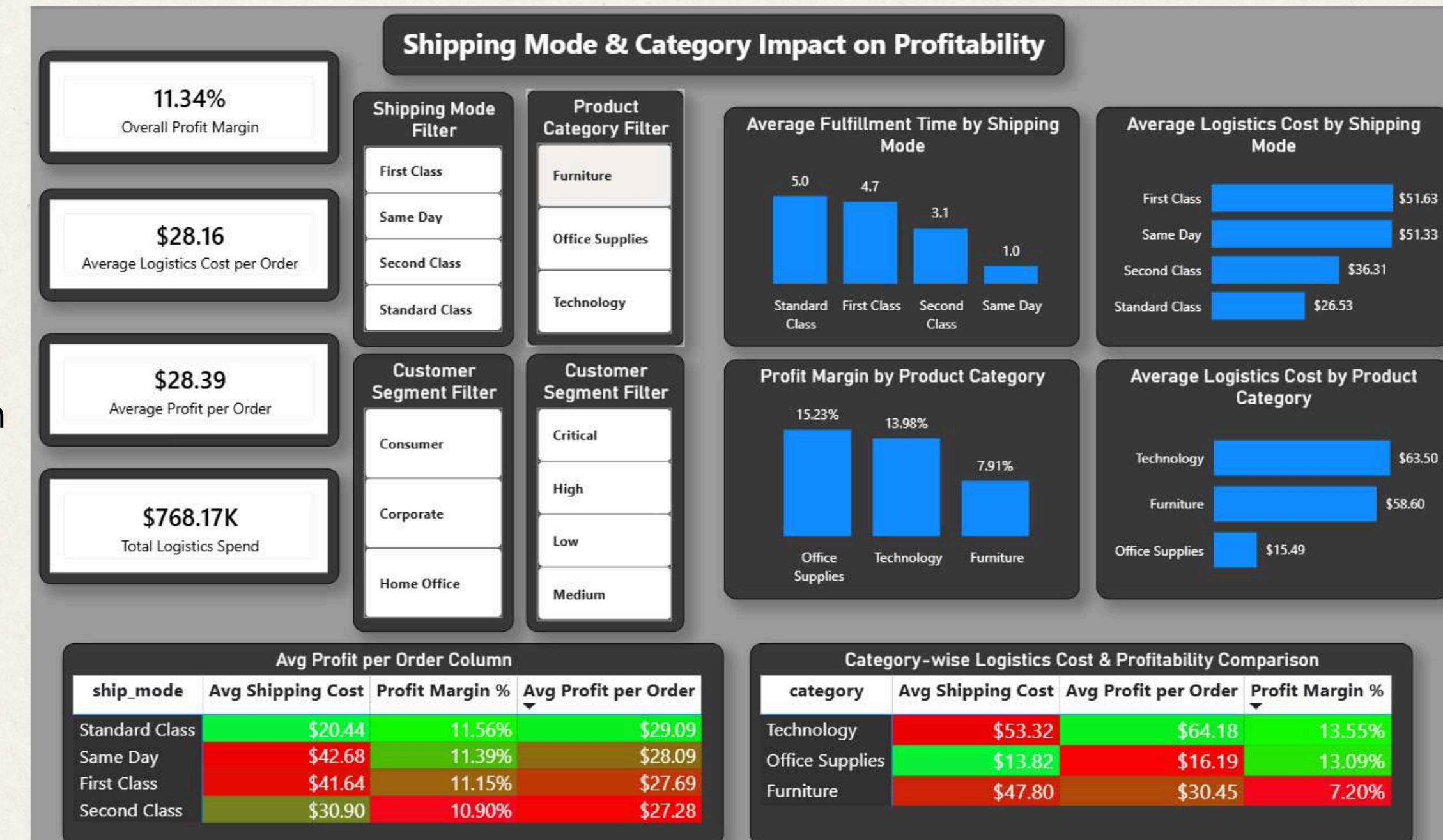
Analysis Focus:

This dashboard assesses:

- Fulfillment time across different shipping modes
- Logistics cost per order by shipping method
- Profit margin variation across product categories
- Unit-level profitability across fulfillment strategies
- Trade-off between shipping cost and financial return

Key Operational Metrics Used:

- Average Fulfillment Time by Shipping Mode
- Average Logistics Cost per Order
- Profit Margin by Product Category
- Average Profit per Order
- Total Logistics Spend



These metrics enable evaluation of:

Logistics strategy effectiveness and its impact on category-level profitability.

DASHBOARD 1 INSIGHTS

Insight 1:

Evaluation of fulfillment performance across shipping modes indicates that premium delivery options such as Same Day and First Class incur substantially higher logistics cost per order compared to Standard Class shipping. However, this increased expenditure does not consistently translate into proportionate improvements in transactional profitability. This suggests that the use of expedited shipping methods may be introducing incremental fulfillment costs without generating corresponding financial return, thereby impacting overall operational efficiency.

Recommendation 1:

It is recommended to selectively utilize premium shipping modes for high-margin product categories where the additional logistics cost can be effectively absorbed without materially affecting profit margins. Restricting expedited fulfillment to financially viable transactions may help reduce unnecessary operational expenditure.

DASHBOARD 1 INSIGHTS

Insight 2:

Category-level analysis highlights that certain product segments, such as Furniture, exhibit comparatively lower profit margins while simultaneously incurring higher average logistics cost per order. This imbalance indicates that fulfillment strategies currently applied to these categories may be disproportionately impacting their transactional profitability. Such categories may be more sensitive to logistics cost variations due to their inherent margin structure.

Recommendation 2:

For product categories demonstrating lower margin performance, it may be beneficial to prioritize cost-efficient shipping modes and reassess fulfillment strategies to mitigate excessive logistics expenditure and preserve unit-level profitability.

DASHBOARD 1 INSIGHTS

Insight 3:

In contrast, Technology products demonstrate relatively higher profit margins alongside moderate fulfillment cost, indicating a more favorable cost-to-margin ratio. This suggests that certain categories may be better positioned to accommodate expedited shipping without significantly compromising profitability.

Recommendation 3:

Consider aligning shipping mode selection with category-level profitability by enabling expedited fulfillment options for categories exhibiting higher margins and stronger financial resilience to logistics cost.

DASHBOARD 1 INSIGHTS

Insight 4:

Shipping mode efficiency analysis reveals variability in both logistics cost and average profit per order across fulfillment strategies, suggesting that shipping mode selection plays a significant role in influencing transactional margin performance. This underscores the importance of strategically managing logistics decisions based on cost-benefit considerations.

Recommendation 4:

Establish periodic performance monitoring of shipping modes in relation to logistics cost and profit contribution to facilitate data-driven fulfillment strategy decisions and support optimal allocation of logistics resources.

BUSINESS IMPACT

Operational Outcome:

The analysis of regional fulfillment performance and logistics cost allocation provided actionable insights into delivery reliability and transactional profitability across shipping modes and product categories.

Identified Opportunities:

- Optimization of last-mile delivery performance in delay-prone regions
- Reduction of logistics cost through selective utilization of shipping modes
- Alignment of fulfillment strategy with product category profitability
- Improved allocation of logistics resources across operational markets

Expected Business Benefits:

Implementation of the recommended fulfillment and shipping strategies can potentially:

- Enhance delivery reliability across regions
- Reduce excessive logistics expenditure
- Improve unit-level profit margins
- Support more cost-efficient operational decision-making

Strategic alignment of logistics execution with financial performance is expected to improve both service consistency and overall profitability.

CONCLUSION

This project analyzed order fulfillment performance across operational regions to identify delivery inefficiencies and logistics cost imbalances affecting transactional profitability.

Through evaluation of shipping mode efficiency and product category-level financial performance, opportunities for optimizing logistics strategy and improving delivery reliability were identified.

Adoption of data-driven fulfillment practices can enable the organization to:

- Improve operational efficiency
- Reduce cost-intensive logistics practices
- Enhance profitability across product categories
- Maintain consistent delivery performance

Effective management of fulfillment operations and logistics expenditure is critical to sustaining delivery reliability and optimizing financial outcomes in sales-driven business environments.