

Logistics and Stock Optimization:

A Comprehensive Capstone Analysis of DataCo Global's Smart Supply Chain

[Constante, F., Silva, F., & Pereira, A. \(2010\). DataCo SMART Supply Chain for Big Data Analysis \(Version 5\) \[Dataset\]. Mendeley Data.](#)

BIO

PORNNAPAS ROONGSUK

Education

*Master of Business Administration
In Industrial Management*

Experience

Inventory Planner (from 2023)

Skills

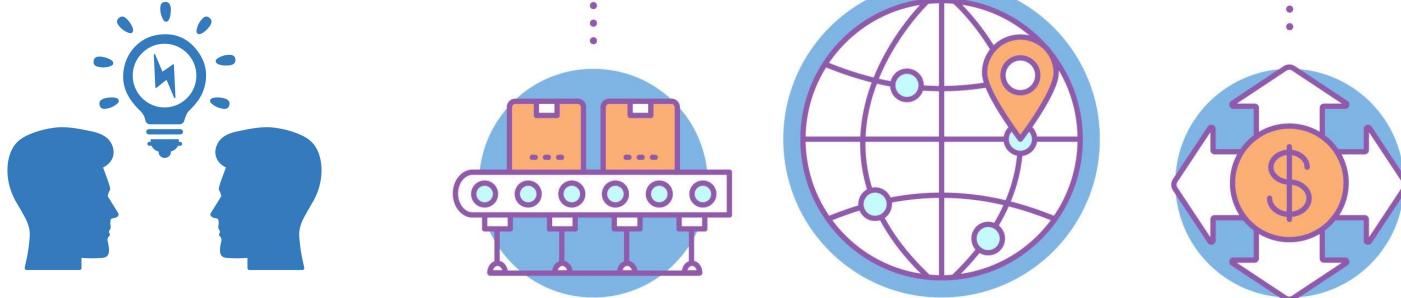
*Data Analysis
Visualisation
Machine Learning*

Relevance to the project

*Stock optimisation
cost modelling
End-to-end supply chain*

BUSINESS ASPECT

WHO	WHAT	WHEN	WHERE	WHY
<p>Industry - Supply Chain related; Manufacturer, Distributer, Retailer, etc</p> <p>Internal - Supply Chain, Logistics, Finance, Sales, and Executive teams</p> <p>External - Supplier, Carriers and distribution partners</p>	<p>Identifying patterns causing transportation delays, high freight cost, and negative margin</p> <p>Analysing profit ratios, product trends</p> <p>Highlighting inefficient route</p>	<p>Based on historical order, freight, and sales data across all available years</p> <p>Issues occur during order fulfilment, shipping, and delivery cycle</p> <p>New product or DC implementation</p>	<p>Across all distribution routes, customer segments, and product categories</p> <p>Focus on high-cost lanes and low-margin product flow</p>	<p>Margin Improvement</p> <p>Reliable On-Time Delivery</p> <p>Stable & Predictable Freight Cost</p>

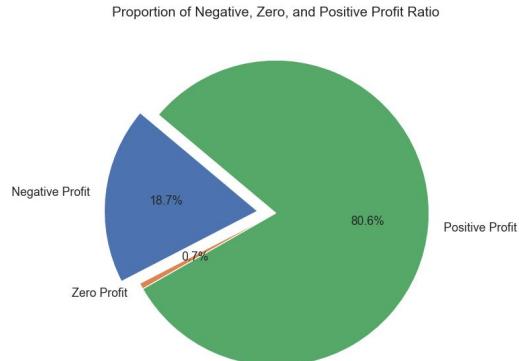


BUSINESS PROBLEM

How can we reduce transportation delays and cost-to-serve while improving delivery reliability and customer satisfaction?

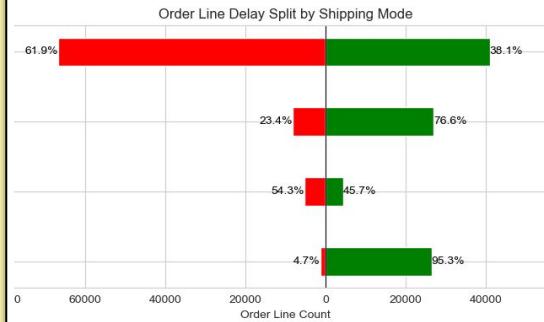
Negative Profitability Margin

19% of total order showing Negative on profit Margin indicates cost-to-serve inefficiencies



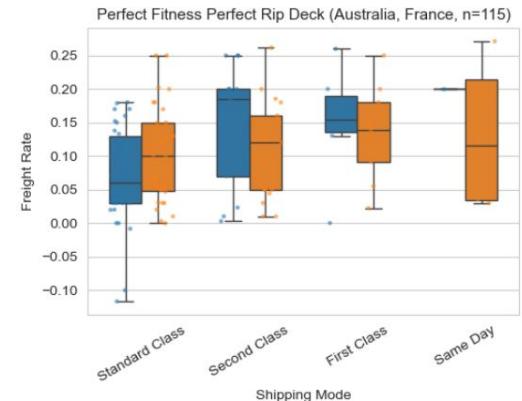
Delivery Delays

Unpredictable lead times
Route-level variability
Shipping Class inconsistency

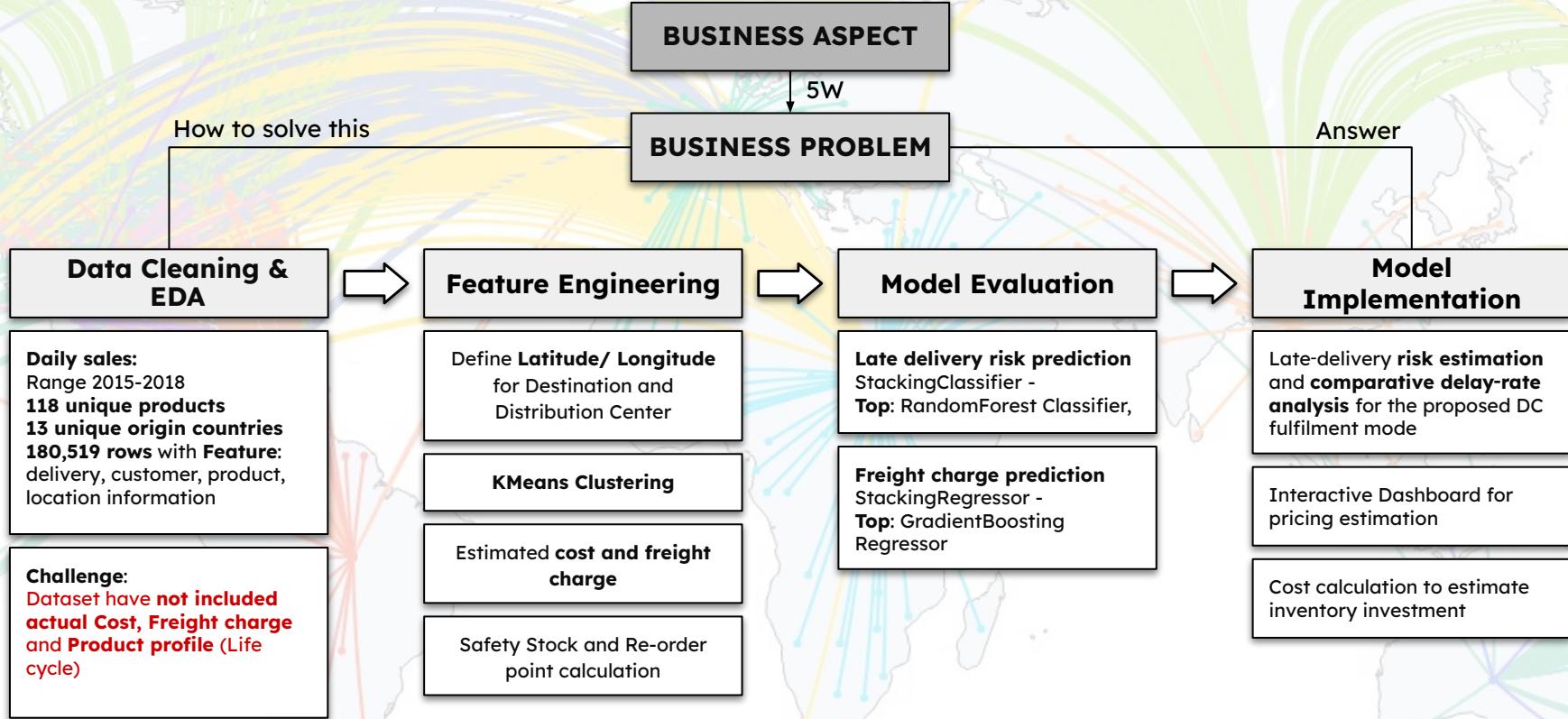


Unstable Freight Cost

Inconsistency across different shipping routes and shipping modes causing difficulties to predict true cost-to-serve

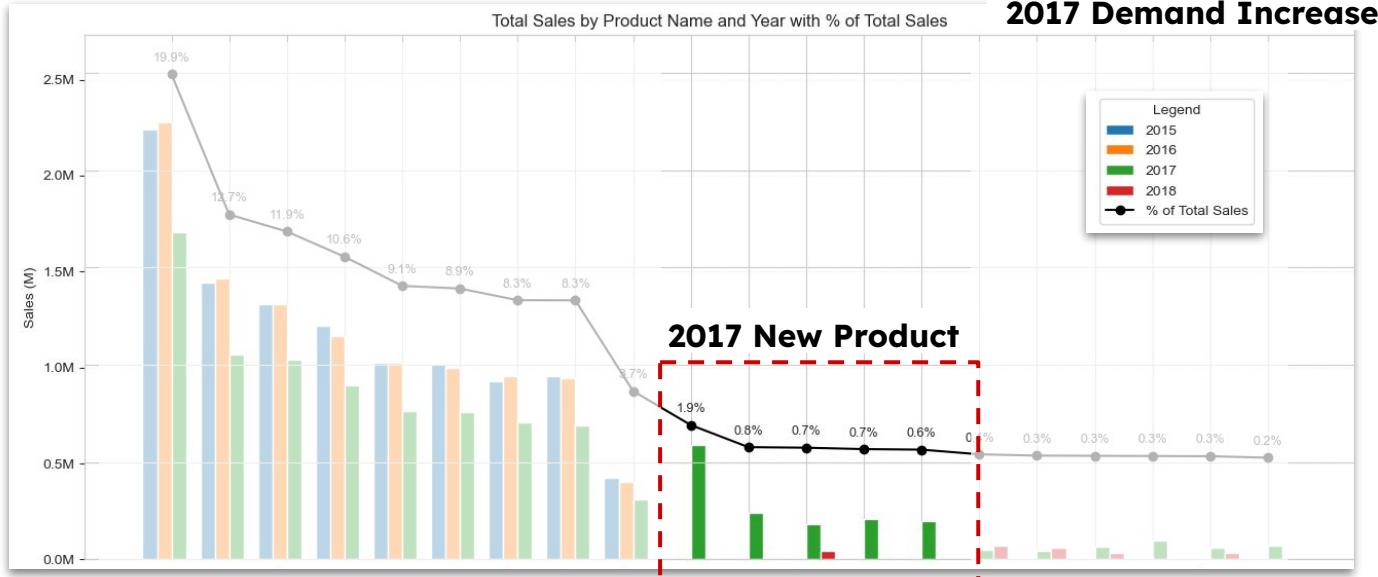
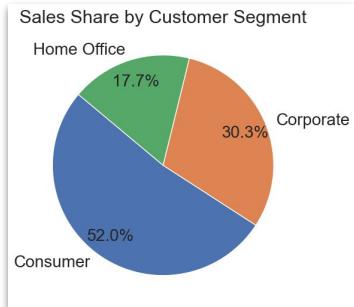


PROJECT DATA PIPELINE



EXPLORING DATA ANALYSIS

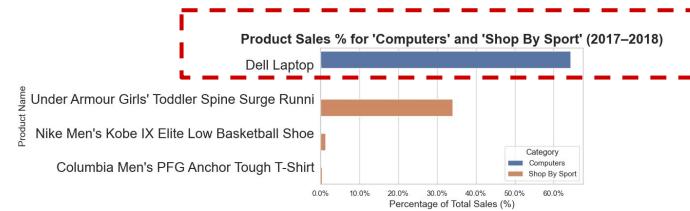
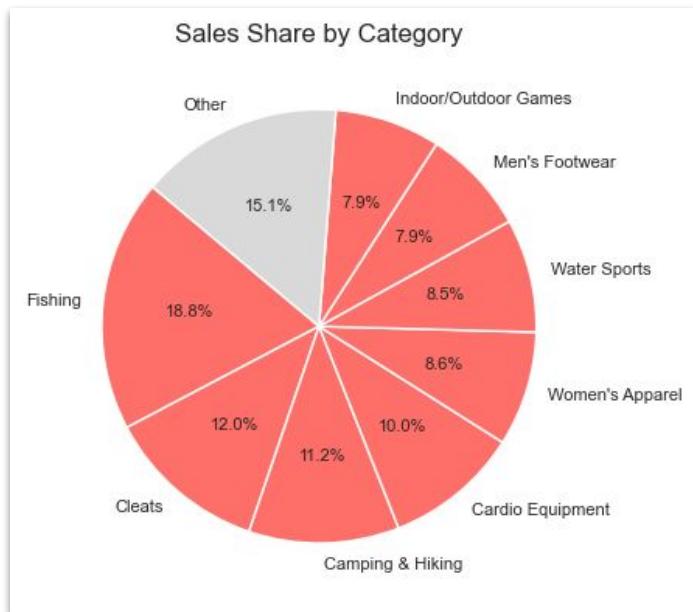
Sales Data History: Determine product trend with time series data



EXPLORING DATA ANALYSIS

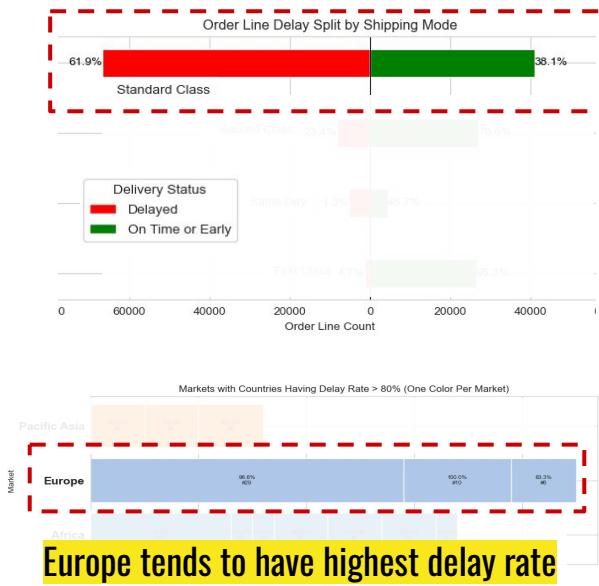
Sales Data History:

Determine product ratio and life cycle
where top segment drive 80% of total sale

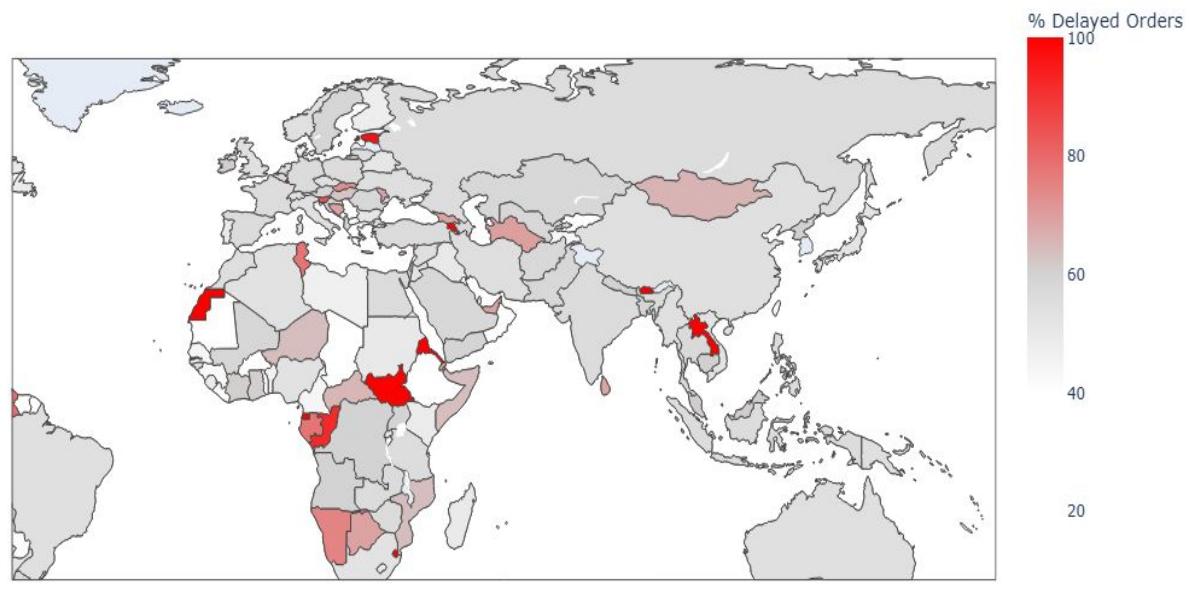


EXPLORING DATA ANALYSIS

Regional Delays: High in Europe & Africa markets



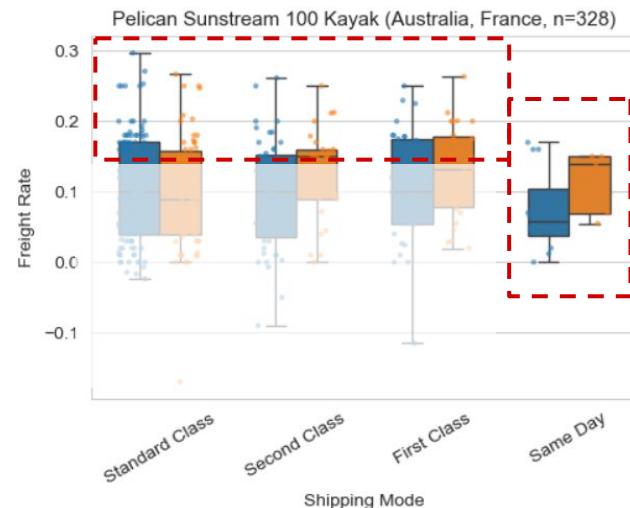
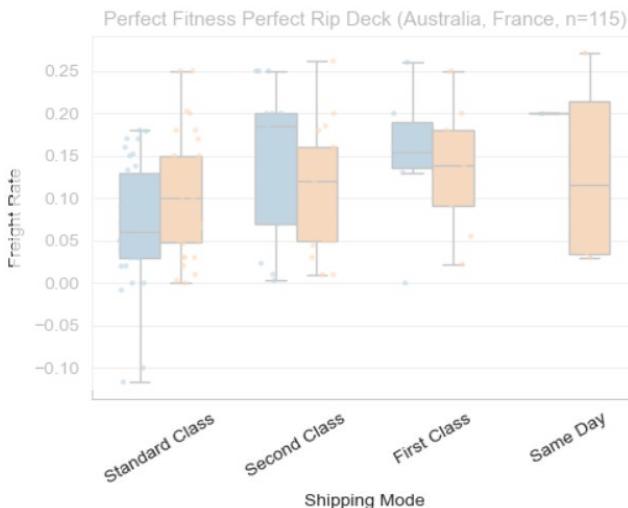
Normalized Rate of Delayed Orders by Country



EXPLORING DATA ANALYSIS

Cost Inconsistency:

Indicates route- and mode-specific cost volatility for this product

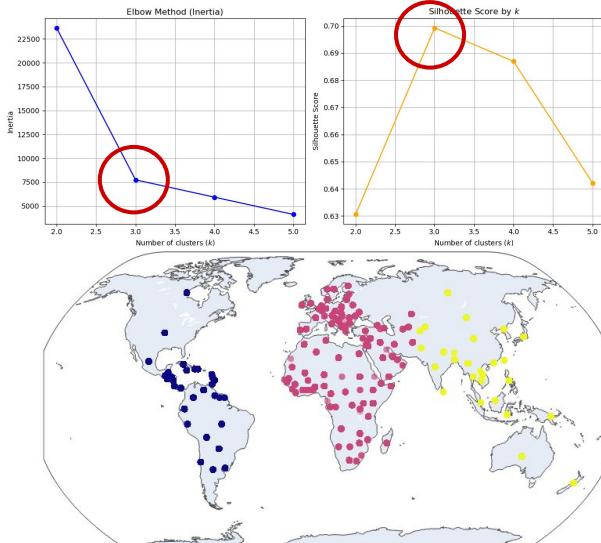


- **Freight rates vary widely** across shipping modes.
- **Same Day shows the highest cost** and largest spread, meaning unstable and unpredictable freight charges.
- Standard / Second / First Class are more stable but still show noticeable differences between countries.

FEATURE ENGINEERING

KMeans:

Define 3 clusters from Silhouette score

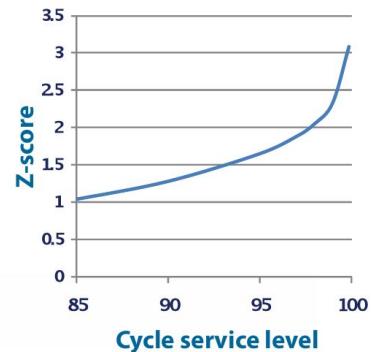


SafetyStock & Reorder Point Calculation:

Estimated Stocking Quantity and value

$$\text{Safety stock} = Z \times \sigma_{LT} \times D_{avg}$$

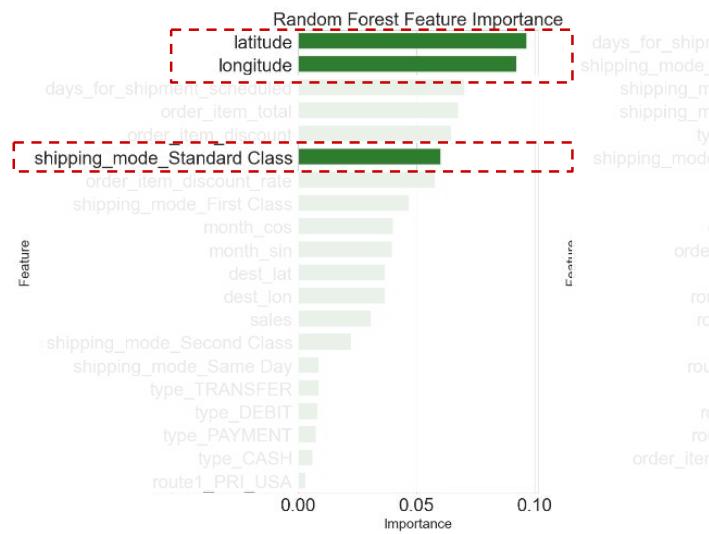
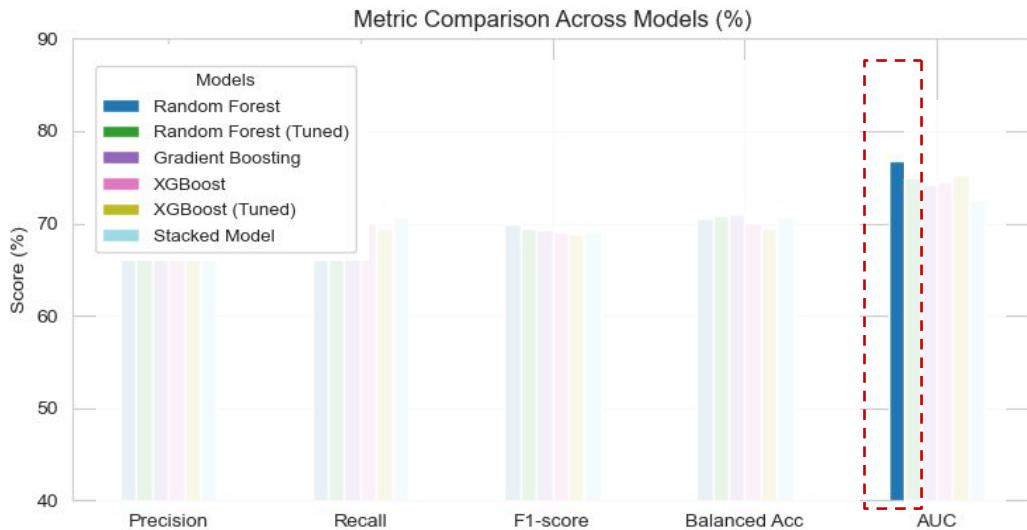
Desired cycle service level	Z-score
84	1
85	1.04
90	1.28
95	1.65
97	1.88
98	2.05
99	2.33
99.9	3.09



MODEL EVALUATION

MODEL 1: Late Delivery Risk prediction:

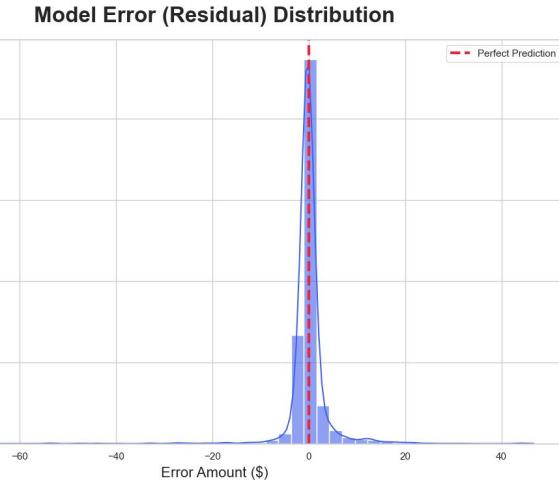
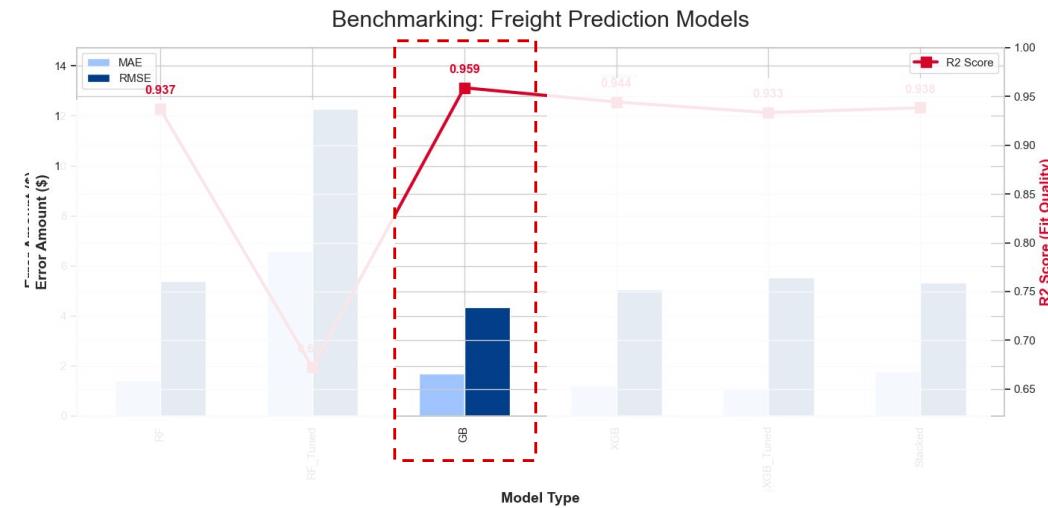
Location is the main feature impact on the delay



MODEL EVALUATION

MODEL 2: Freight Charge Prediction

Predict freight charge for estimating investment on DC implementation



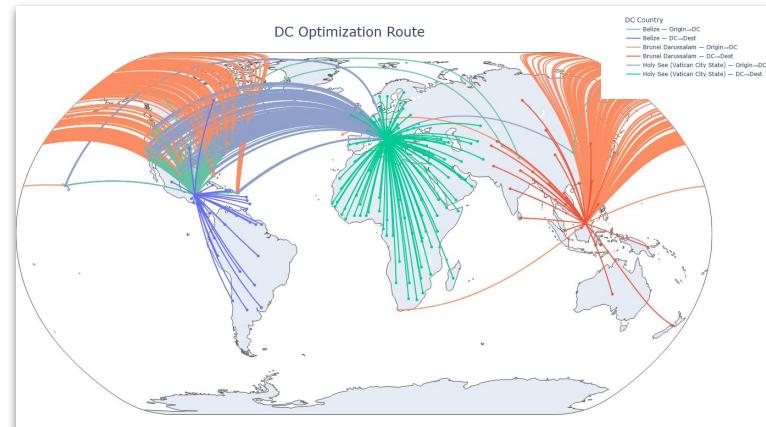
Residuals are narrowly distributed around zero, indicating high predictive accuracy and minimal systematic bias

MODEL IMPLEMENTATION

MODEL 1: Late Delivery Risk prediction: Location Clustering (KMeans) to Determine DC



Current Setting

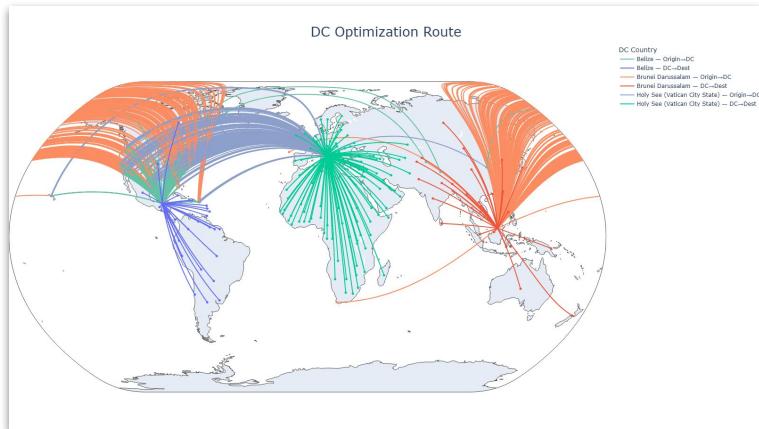


Distribution Center implementation

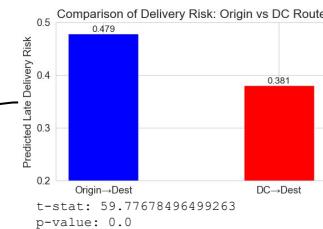
MODEL IMPLEMENTATION

MODEL 1: Late Delivery Risk prediction:

Location Clustering (KMeans) to Determine DC



Distribution Center implementation



Prediction result after apply Machine Learning Model

The difference between the two groups is statistically significant

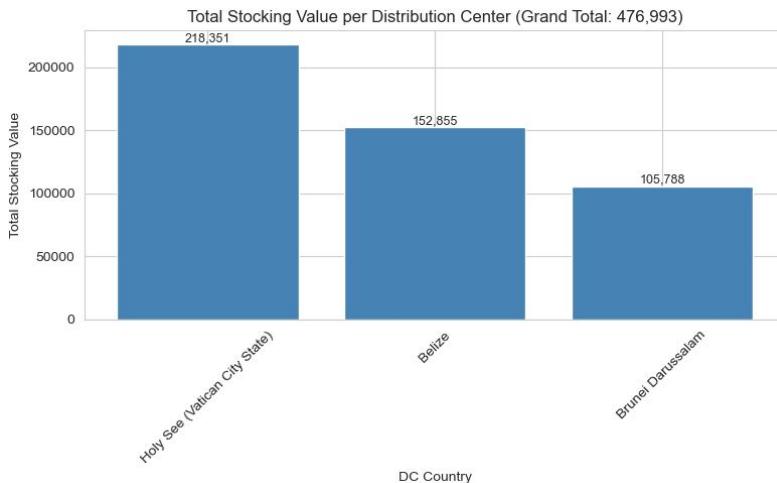
Reduce Late delivery risk

Better route management and Tracking

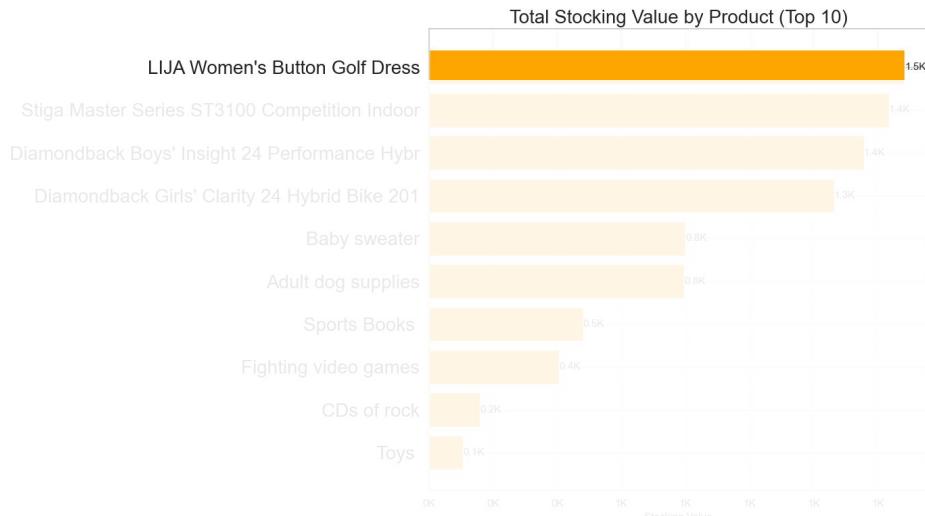
Ease and Simplify operations progress at Origin

MODEL IMPLEMENTATION

MODEL 1: Late Delivery Risk prediction: DC Stocking Investment estimation by utilizing reorder point calculation



Total suggested stocking value USD \$476K across all new DC

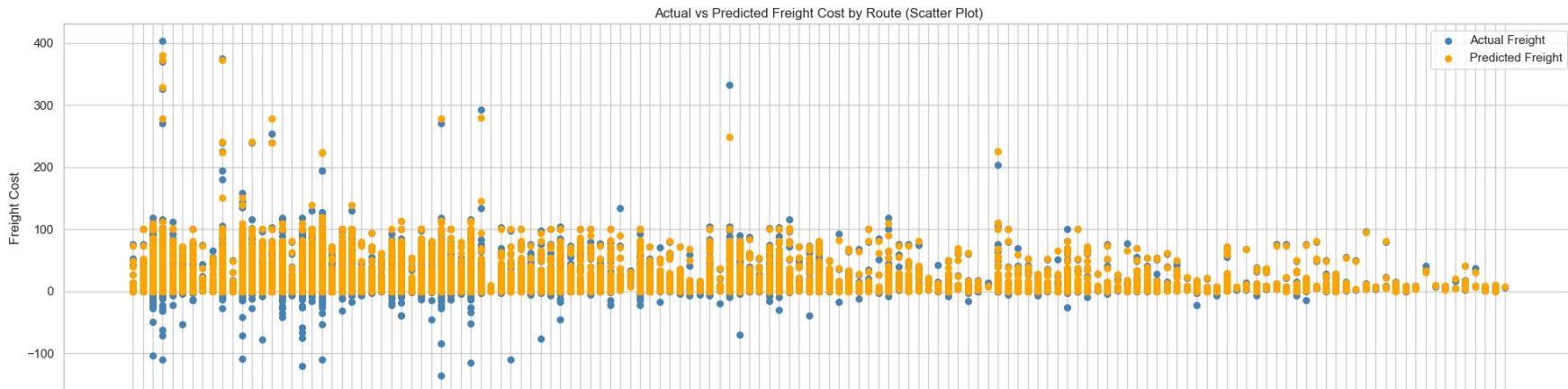


Top product stocking by Value

MODEL IMPLEMENTATION

MODEL 2: Freight Charge Prediction:

Apply freight cost prediction model to estimate selling price to improve sale margin



MODEL IMPLEMENTATION

MODEL 2: Freight Charge Prediction:

Gradio

Professional Logistics & Pricing Suite

Select Products

- Garmin Approach S3 Golf GPS Watch
- Elevation Training Mask 2.0
- Diamondback Boys' Insight 24 Performance Hybr

Product	Quantity	Discount %
Garmin Approach S3 Golf GPS Watch	1	0
Elevation Training Mask 2.0	1	20
Diamondback Boys' Insight 24 Performance Hybr	1	0

Select Destination

- Madagascar

Analyze Order



GRAND TOTAL ORDER VALUE	
\$660.06	
DC ORIGIN	DESTINATION
VAT	Madagascar

PROFIT (MARGIN)
\$56.02 (8.49%)

Full Technical Breakdown

Product	Qty	Disc%	Freight	Subtotal	Margin %	Late Risk
Garmin Approach S3 Golf GPS Watch	1	0%	\$22.13	\$272.12	✓ 9.18%	✓ Low
Elevation Training Mask 2.0	1	20%	\$5.85	\$69.84	✗ -13.38%	✓ Low
Diamondback Boys' Insight 24 Performance Hybr	1	0%	\$18.11	\$318.10	✓ 12.69%	⚠ HIGH

SUMMARY AND CONCLUSION

SOLUTIONS

NEXT

Negative Profitability Margin

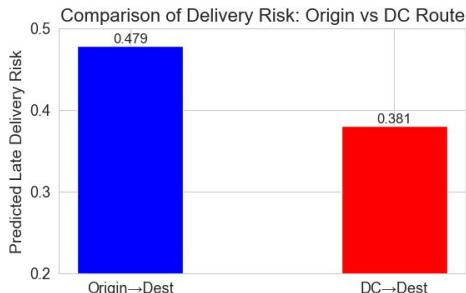
Unstable Freight Cost

Delivery Delays

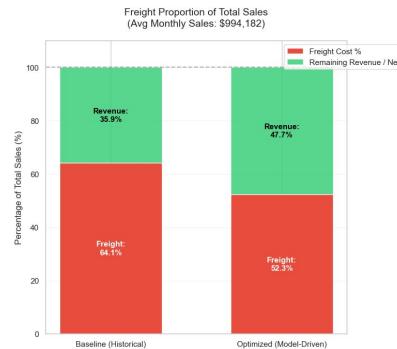
MODEL 1: Implement DC and Inventory Optimization Operations, Supply Chain

MODEL 2: Product Sales Driven Sales, Pricing, Marketing

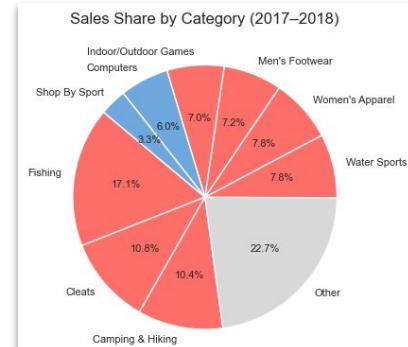
Reduce 20% of Delayed risk
by Implement DC fulfilment



Dropped monthly freight-to-sales ratio
by reclaiming more revenue 11.8% of
total sales while providing precise cost
estimations for the stakeholder



Focusing on sale strategy by Top
sale product which cover approx
80% sales and implement Product
Life Cycle



Track All Costs: Log every freight charge and actual expense to keep profits accurate.
Set Up Regional Hubs: Choose the best DC in each area to keep shipping smooth and fast.
Estimate Time and Fees: Predict delivery times and shipping costs for every route

THANK YOU

CONTACT

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[https://github.com/rphornnapas/
DataCo-SupplyChain-DC](https://github.com/rphornnapas/DataCo-SupplyChain-DC)

