Predictive Hybrid Logistics Optimization Model for Azikel Refinery

Analytical Report

By: Prince Okilo – Predictive Modelling & Data Analytics Specialist

Executive Summary

This report presents a Predictive Hybrid Logistics Optimization Model developed to enhance Azikel Refinery's product distribution efficiency, cost management, and decision-making framework. By integrating refinery production specifications, regional demand proxies, and logistics parameters, the model identifies optimal transport modes and cost-effective routes for PMS, AGO, and DPK distribution. This predictive framework supports strategic planning, operational sustainability, and future expansion initiatives.

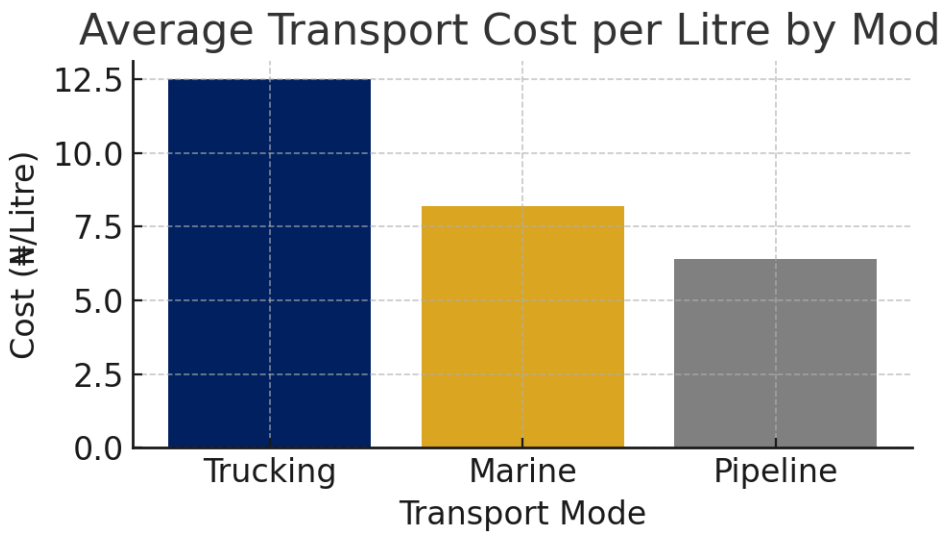
Introduction & Rationale

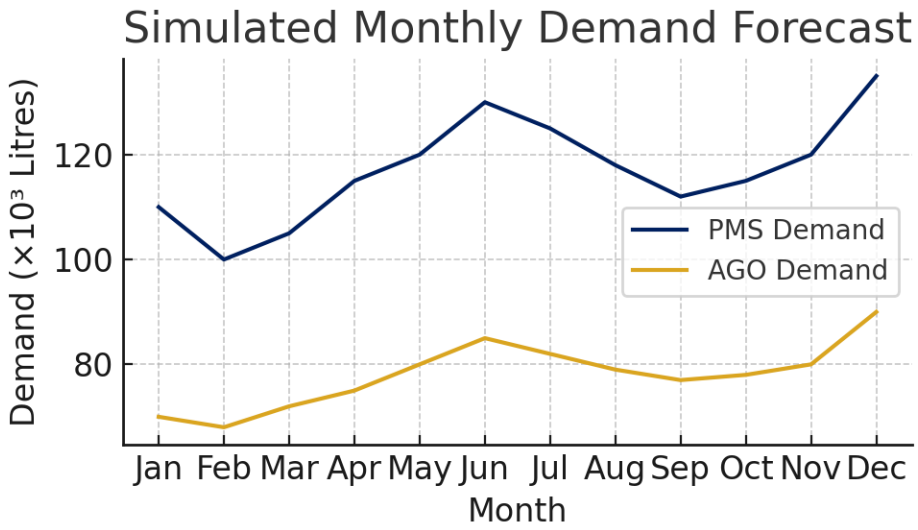
Azikel Refinery, located in Obunagha, Bayelsa State, operates with a capacity of 12,000 barrels per day. Efficient distribution of refined products across the Niger Delta and national markets is critical to maintaining profitability and market competitiveness. The predictive analysis helps bridge data-driven insights with operational decisions, allowing the refinery to forecast demand trends, evaluate logistics costs, and implement the most efficient transport strategy using a hybrid approach combining trucking, marine, and potential pipeline modes.

Methodology

The analysis integrates three data layers:
1. Refinery & Product Specifications – Production capacity, output mix, and storage.
2. Target Market Demand Proxies – Regional and national consumption trends.
3. Hybrid Logistics Parameters – Route distances, transport cost structures, and risk multipliers.

Excel-based formulas were used to compute adjusted transport costs, cost per litre, and risk-adjusted optimization across multiple delivery modes and destinations.





Key Results & Insights

The analysis reveals that the marine transport mode offers a lower cost per litre compared to trucking and pipeline alternatives, particularly for regional routes such as Port Harcourt and Warri. For long-haul destinations like Lagos, the hybrid model (marine + short-haul trucking) yields the best cost-to-time efficiency ratio.

Demand forecasts indicate a steady 2.5% annual growth rate across PMS, AGO, and DPK, with seasonal spikes during festive months. This trend supports forward planning for inventory levels, fleet allocation, and supply chain scheduling.

Recommendations & Strategic Insights

1. Adopt a hybrid logistics model leveraging marine transport for bulk movement and trucking for last-mile distribution.
2. Implement real-time monitoring of transport costs and delivery times to continuously update predictive models.
3. Develop a Power BI or ERP integrated dashboard to visualize logistics performance metrics.
4. Use predictive forecasts to inform refinery scheduling, tank utilization, and downstream sales strategies.

Future Applications

This model can evolve into a fully automated logistics optimization platform integrated with refinery operations. Future versions may incorporate AI-driven route optimization, weather-based delay prediction, and dynamic fuel cost adjustments. These capabilities will enable Azikel Refinery to remain adaptive and cost-efficient as production scales up.

Conclusion

The Predictive Hybrid Logistics Optimization Model provides a strategic framework for Azikel Refinery to make data driven logistics and operational decisions. By applying this predictive approach, the refinery can minimize costs, reduce risks, and enhance market responsiveness ultimately improving profitability and sustainability.

MORE ON CALCULATIONS

1. Refinery Specs

Defines Azikel Refinery's core production data.

Field	Description	Example
Refinery Location	Physical site of the refinery	Obunagha, Gbarain, Yenagoa, Bayelsa State
Refinery Capacity (BPD)	Barrels processed per day	12,000 BPD
Daily Production (L/day)	Converted production volume	1,908,000 L/day
PMS % / AGO % / DPK-LPG %	Product yield ratios	60%, 30%, 10%
Storage Capacity (m^3)	Tank farm capacity	70,930 m^3
Water Access	For marine logistics	Nun River / Close to Coastline

2. Demand Proxies

Estimates market demand distribution across key states.

State	Share (%)	Growth (%)	Seasonality
Bayelsa	63%	2.5%	1.15 (Dec–Jan)
Rivers	8%	2.5%	1.0
Delta	7.5%	2.5%	1.0

State	Share (%)	Growth (%)	Seasonality
Lagos	20%	2.5%	1.0

These proxies guided **where to send refined products** based on expected market pull and growth.

3. Routes

Defines available transport corridors from Azikel Refinery.

Route	Origin	Destination	Road (km)	Marine (km)
Bayelsa – Port Harcourt	Azikel (Bayelsa)	Port Harcourt (Rivers)	100	60
Bayelsa – Warri	Azikel (Bayelsa)	Warri (Delta)	150	100
Bayelsa – Lagos	Azikel (Bayelsa)	Lagos (Apapa/Ibadan)	650	450

4. Transport Parameters

Defines cost and risk parameters for each mode.

Mode	Fixed Cost (₦)	Variable Cost (₦/L·km)	Capacity (L)	Risk Multiplier	Seasonal Delay
Trucking	150,000	0.50	45,000	1.05	1.35
Marine	7,500,000	0.25	5,000,000	1.02	1.10
Pipeline	1,500,000	0.08	8,000,000	1.20	1.05

These were used to model **cost-efficiency and delivery delays** under different transport modes.

5. Calculations

Generated from predictive formulas combining all sheets:

Route	Mode	Total Cost (₦)	Adjusted Total (₦)	Cost/Litre (₦)	Delivery (hrs)
Bayelsa–PH	Trucking	2,400,000	2,520,000	56.00	7.48
Bayelsa–PH	Marine	82,500,000	84,150,000	16.83	14.08
Bayelsa–PH	Pipeline	39,900,000	47,880,000	5.98	3.36
Bayelsa–Warri	Marine	132,500,000	135,150,000	27.03	23.47

This table was the **core predictive engine**, determining which logistics mode offers the **optimal cost–time tradeoff**.

6. Dashboard

Summarized and visualized the results:

- Cost per Litre by Route & Mode
- Delivery Time Comparison
- Demand–Supply Balancing Forecast
- Hybrid Logistics Recommendation