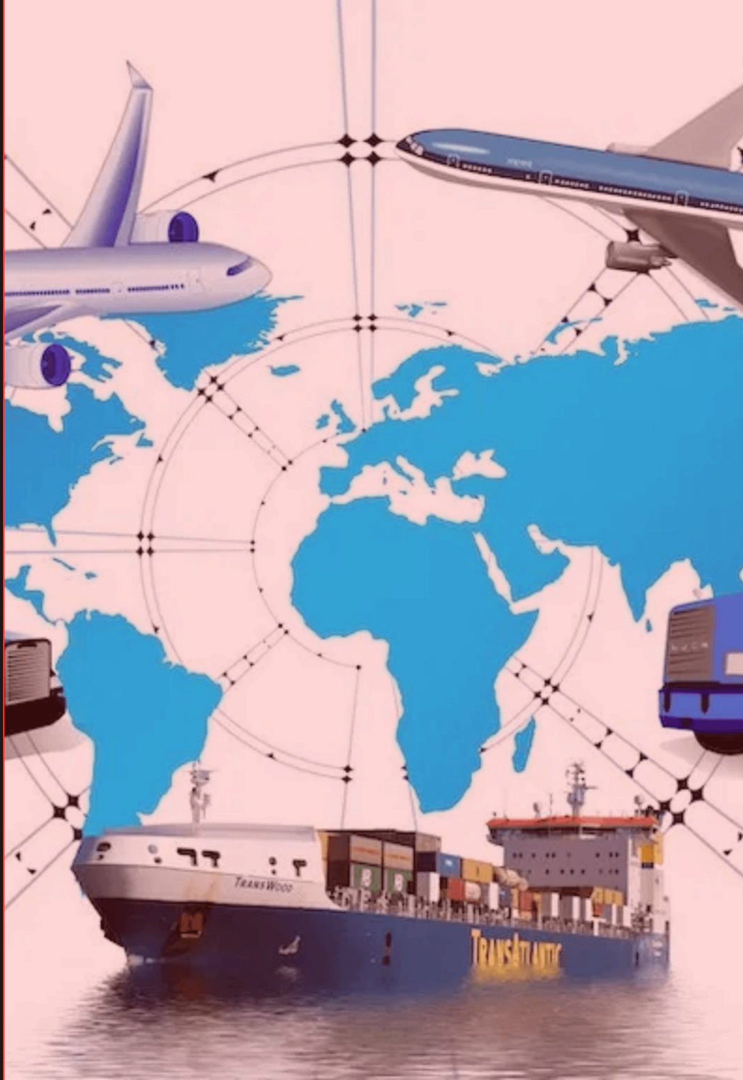
TRANSPORTATION OPTIMIZATION PROJECT

Minimizing Logistics Costs through Linear Programming and Data-Driven Analysis

REHEM AMISI I | January 2026



PROJECT OVERVIEW

Minimizing Costs through Structured Optimization

Primary Objective

Minimize total transportation costs while satisfying all supply and demand constraints across the network.

Two-Step Methodology

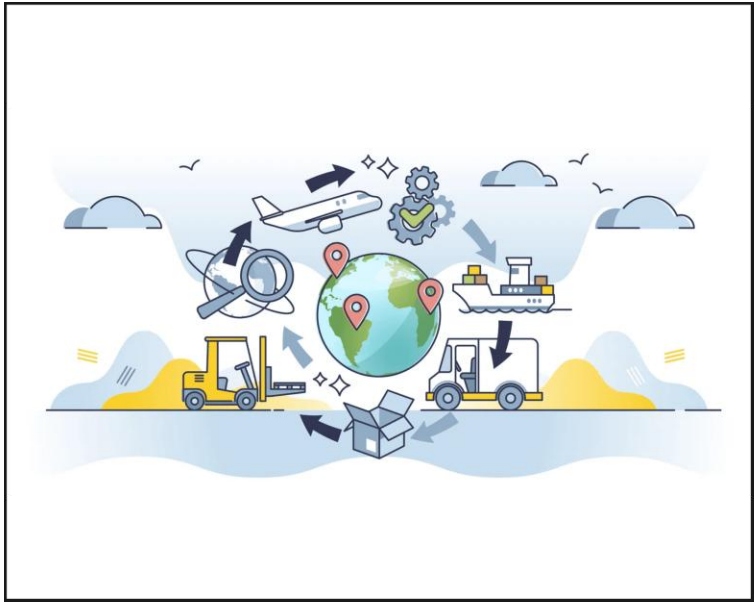
Starting with a deterministic model and extending it for scenario variation analysis.

Mathematical Foundation

Linear programming provides the framework for optimizing shipment allocations from multiple origins to destinations.

Operational Efficiency

Structured framework ensures data-driven decision-making for complex logistical challenges.



METHODOLOGY: MODEL FORMULATION

Variables, Objectives, and Operational Constraints

OBJECTIVE FUNCTION

$$\text{Minimize } Z = \Sigma\, \Sigma\, c_{ij} * x_{ij}$$

Decision Variables

x_{ij}: Quantity transported from supply node i to demand node j.

c_{ij}: The cost of moving one unit of product along a specific route.

Operational Constraints

Supply: Total shipments from each origin cannot exceed its maximum capacity (S_i).

Demand: Each destination must receive its minimum required quantity (D_j).

Non-Negativity: All shipment quantities must be greater than or equal to zero.

Balanced Problem: Total Supply = Total Demand (2,300 units).

SUPPLY NODE CAPACITIES

Total Network Capacity: 2,300 Units

Node ID	Location	Capacity (Units)
S01	Chicago	500
S02	Dallas	450
S03	Atlanta	400
S04	Seattle	550
S05	New York	400
TOTAL	-	**2,300**

DEMAND NODE REQUIREMENTS

Total Network Demand: 2,300 Units

Node ID	Location	Requirement (Units)
D01	Los Angeles	400
D02	Miami	300
D03	Denver	450
D04	Houston	350
D05	Phoenix	450
D06	Boston	350
TOTAL	**-**	**2,300**

UNIT COST MATRIX ($/UNIT)

Identifying Low, Mid, and High Cost Routes

ORIGIN	D01	D02	D03	D04	D05	D06
S01	15.0	22.0	12.0	18.0	10.0	25.0
S02	18.0	14.0	15.0	8.0	12.0	10.0
S03	20.0	9.0	16.0	10.0	18.0	12.0
S04	10.0	25.0	5.0	18.0	8.0	22.0
S05	24.0	12.0	20.0	15.0	22.0	7.0

LOW COST ($5-$10)   MID COST ($11-$19)   HIGH COST ($20+)

SOLVER LOGIC: THE OPTIMIZATION PROCESS

From Data Ingestion to Optimal Output

01

Data Ingestion

Loading supply capacities, demand requirements, and the unit cost matrix into the PuLP framework.

02

Model Mapping

Defining the objective function and translating operational constraints into mathematical inequalities.

03

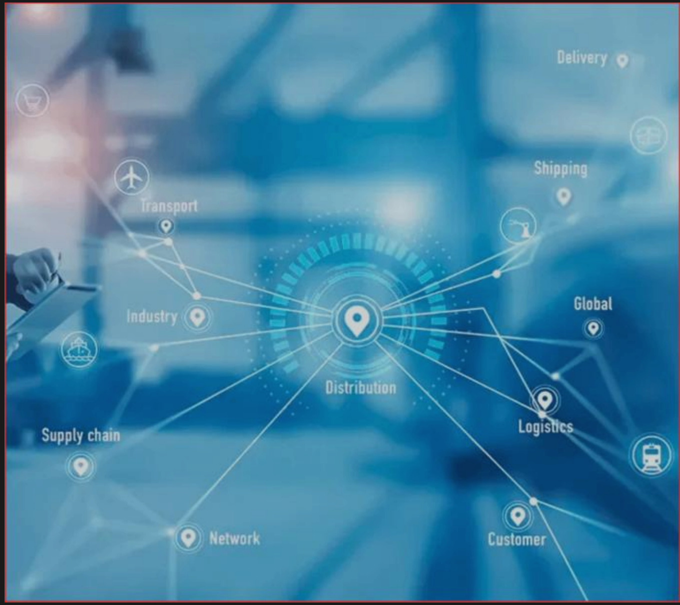
Iterative Solving

The CBC solver executes the Simplex algorithm to navigate the feasible region and find the global minimum.

04

Optimal Output

Extracting the final shipment quantities and total cost for operational implementation.



KEY FINDINGS: COST EFFICIENCY

Achieving Global Minimum Cost

$23,350

Total Optimized Cost

$13,373

Estimated Savings

Network Balance

The model successfully balanced 2,300 units of total supply with 2,300 units of total demand.

Average Unit Cost

Achieved an average unit cost of $10.15 across all active shipment routes.

ROUTE ANALYSIS: EFFICIENCY & VOLUME

Prioritizing Low-Cost Corridors

01 **Efficiency Leaders**

The model prioritized S04 to D03, moving 400 units at the lowest unit cost of $5.00.

02 **High-Volume Corridors**

Major flows were established from S01 to D05 and S02 to D06, each handling 350 units.

03 **Strategic Allocation**

Higher-cost routes are only utilized when necessary to satisfy demand constraints, ensuring maximum cost avoidance.

MAPPING SHIPMENT FLOW

Optimal Shipment Distribution

Corridor Identification

The optimization reveals the primary transportation corridors selected by the model to **minimize total expenditure**.

Cost Avoidance

High-cost routes are systematically bypassed, with shipments concentrated in the **most efficient lanes**.

Optimal Distribution

Visualizing the flow of 2,300 units across the network to achieve the **$23,350 minimum cost**.

UTILIZATION & PERFORMANCE

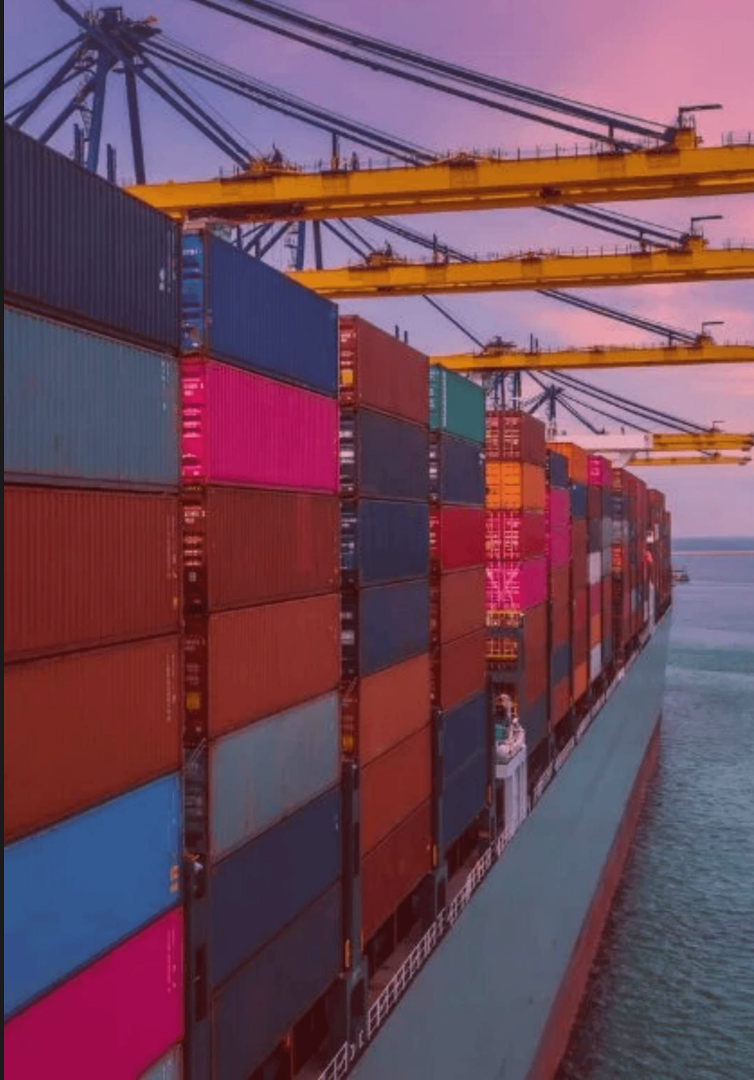
100% Efficiency in Supply and Demand

100% Supply Capacity

Every supply node is leveraged to the maximum operational limit. All 2,300 units of available capacity are actively contributing without waste.

100% Demand Fulfillment

All destination requirements are met with precision. Each of the 6 demand nodes receives the exact specified quantity, maintaining high service levels.



STRATEGIC VALUE OF OPTIMIZATION

Optimizing Today for a More Efficient Tomorrow

Efficiency

Linear programming transforms complex logistical variables into a clear, cost-minimized operational plan.

Scalability

The framework is easily adaptable to include new supply nodes, changing demand, or fluctuating costs.

Savings

Data-driven allocation identifies hidden efficiencies, resulting in significant and measurable cost reductions.

Insight

Advanced visualization and analysis provide stakeholders with actionable intelligence for supply chain strategy.

EFFICIENCY DRIVERS

Strategic Allocation and Cost Avoidance

Low-Cost Corridors

The model prioritized routes such as S04 to D03, which operates at just $5.00 per unit.

Strategic Cost Avoidance

Systematically bypassing high-cost routes across the network to minimize expenditure.

High-Efficiency Lanes

Volume was concentrated in the most efficient lanes, maximizing the impact of every transportation dollar spent.

EXECUTIVE SUMMARY: FINANCIAL IMPACT

Achieving $13,373 in Estimated Savings

$13,373

Total Savings

$23,350

Optimized Cost

The linear programming model successfully reduced the total logistics budget by identifying the global minimum cost while satisfying all network constraints. This represents a significant improvement over non-optimized benchmarks.

THANK YOU

TRANSPORTATION OPTIMIZATION PROJECT

Questions?