Supply Chain Network Optimization for Vandelay Industries

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1. Executive Summary

Vandelay Industries is expanding its latex paint operations into a new geographic market and requires data-driven decision support to guide supplier selection and supply chain network design. This project applies decision analytics and optimization techniques to help the company identify reliable suppliers and design a cost-efficient logistics network that meets all forecasted customer demand.

Using historical supplier performance data and transportation cost information, we first assess supplier reliability through classification modeling and then design an optimized supply chain network that connects suppliers, ports, and U.S. distribution centers. All analyses are implemented using Excel Analytic Solver Platform, enabling transparent and interpretable decision support suitable for real-world operational use.

The final recommendations allow Vandelay Industries to operate with a streamlined set of reliable suppliers and an optimized logistics network while satisfying the demand at minimum total cost.

2. Business Problem & Objectives

As Vandelay Industries enters a new geographic market, it faces two key operational challenges: supplier selection and supply chain network design. The company must evaluate proposed suppliers and identify those that are sufficiently reliable for inclusion in the new market. Given selected suppliers, Vandelay must design a minimum-cost supply chain network connecting suppliers to ports and distribution centers while meeting all forecasted demand and operational constraints.

Hence, the objectives of this project are to: identify reliable suppliers for the new market, design a cost-minimizing supply chain network, and provide clear, data-driven recommendations to support operational planning.

3. Methodology Overview

The analysis consists of two integrated components: supplier reliability assessment and network optimization.

For Supplier Reliability Classification, a classification tree model is trained using data from 60 existing suppliers and six performance features, including defect rate, on-time delivery, lead time, unit cost, cost variability, and returns. The trained model is then applied to proposed suppliers to predict reliability and select an approved supplier list for further analysis.

For Supply Chain Network Optimization using the selected suppliers, a multi-echelon supply chain network is optimized with the structure: Suppliers → Ports (Seattle, Los Angeles) → Distribution Centers. A linear optimization model is formulated to determine shipment quantities and routing decisions that minimize total transportation cost while meeting the demand and satisfying supplier capacity and flow balance constraints.

4. Key Results

1) Supplier Selection: A subset of proposed suppliers is identified as reliable and recommended for the new market, based on predicted performance.
2) Network Design: The optimized network uses a core group of suppliers and routes shipments through both Seattle and Los Angeles ports.
3) Demand Satisfaction & Cost Efficiency: The final solution meets the distribution center demand while achieving a minimum total transportation cost of approximately $1.997 million.

These results demonstrate that Vandelay Industries can operate an efficient and reliable supply chain by focusing on supplier quality and optimized logistics routing.

5. Recommendations

Based on the analysis, we recommend that Vandelay Industries could adopt a Data-Driven Supplier Screening Process and use defect rate, on-time delivery, and cost stability as primary criteria for supplier approval. And the company could maintain a vetted pool of reliable suppliers and periodically re-evaluate performance as new data becomes available. As demand and costs evolve, the company could leverage the optimized network to guide port selection and distribution center assignments. Moreover, re-optimize the supply chain network when demand forecasts or transportation costs change to ensure continued efficiency.