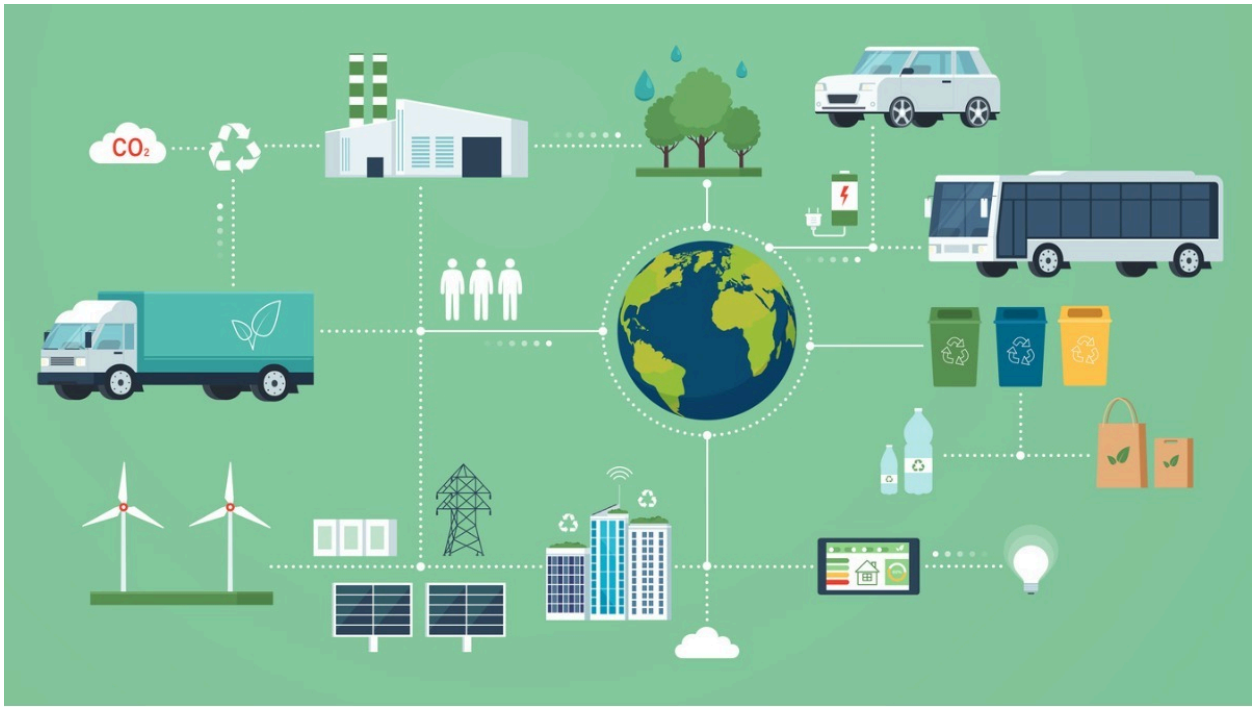
SUSTAINABILITY SUPPLY CHAIN

Sustainable Supply Chain Optimization for Outbound Logistics in Microchip



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OBJECTIVE

To analyze and optimize the outbound logistics network of a global microchip producer, focusing on sustainability improvements by minimizing environmental impact, reducing operational costs, and enhancing the efficiency of logistics operations.

BACKGROUND

- The dataset represents a real-world outbound logistics network for a microchip producer, encompassing 9,215 orders across 19 warehouses, 11 origin ports, and a single destination port. Each warehouse supports specific products and customers, with daily processing limits. The network involves different service levels (DTD, DTP, CRF) and transportation modes (air, ground) managed by multiple couriers with distinct rate structures and minimum shipping charges.
- With sustainability being a growing concern, this analysis aims to explore alternative shipping routes, optimize warehouse utilization, and reduce the reliance on high-carbon-impact transport modes.

PROBLEM STATEMENT

The logistics network faces sustainability and efficiency challenges due to heavy reliance on air transport, varied freight rates, and warehouse capacity limits. High costs from faster shipping and minimum charges add to operational expenses. This project will analyze logistics data to identify cost-effective, sustainable options for routing and warehouse allocation.

SCOPE OF WORK

1. **Transportation Mode Optimization:** Assessing the environmental impact of air versus ground shipments and identifying sustainable alternatives
2. **Warehouse Capacity and Utilization**: Evaluating capacity constraints and optimizing the distribution of orders across warehouses
3. **Freight Rate Analysis:** Analyzing courier rates, weight bands, and service levels to determine the most-cost efficient shipping methods

4. **Sustainability Metrics:** Developing metrics to quantify the carbon footprint, cost-efficiency, and processing efficiency of the supply chain

DATA SOURCES AND DESCRIPTION

TABLE NAME	DESCRIPTION
FactTable	Contains key details on orders, freight rates, costs, and warehouse capacities
OrderList	Includes historical records of order routing and demand satisfaction
PlantProdCust	Details warehouse-product-customer relationships
PortCarrier	Provides information on port locations, carriers, and service levels
FreightRates	List available couriers, transportation modes, and associated rates by weight band
PlantConstraints	Define specific warehouse constraints related to product and port connections
Port_Locations	Geographic and logistical information for ports
Orig_Port_Locations	Geographic and logistical information for origin ports
Dest_Port_Locations	Geographic and logistical information for destination ports

KEY QUESTIONS

1. How can transportation modes be optimized to reduce carbon emissions?
2. Which routes and shipping methods balance cost and environmental sustainability?
3. How can warehouse utilization be optimized to reduce costs and improve efficiency ?
4. What cost savings are achievable through optimal freight rate selection ?

METHODOLOGY

- **Data Cleaning and Preparation**: Validate data types, ensure key integrity, and address missing values.
- **Descriptive Analysis**: Summarize the current logistics setup, including order distribution, warehouse usage, and transportation modes.
- **Optimization Modeling**: Build a Linear Programming (LP) model to optimize routing and warehouse allocations based on cost and sustainability constraints.
- **Cost and Sustainability Analysis**: Calculate potential savings and environmental impact reductions from alternative routing and transportation strategies.

ANALYSIS CRITERIA

- **Carbon Footprint**: Impact analysis based on transportation modes and distances.
- **Cost Efficiency**: Analysis of freight costs, warehouse storage costs, and cost savings potential.
- **Warehouse Utilization**: Evaluation of order processing capacity and distribution efficiency.
- **Shipping Efficiency**: Balance between service speed and cost to identify sustainable options.

EXPECTED OUTCOMES

- Optimal transportation routes and modes for reducing carbon emissions.
- Cost-saving strategies in freight rate and warehouse utilization.
- A more sustainable and efficient logistics network structure to support order processing needs.

DELIVERALBLES

- **Final Report**: Detailed analysis findings, visualizations, and actionable recommendations.
- **Data Dictionary**: A comprehensive reference document defining each field in the dataset.
- **Data Model**: A schematic representation of the data structure and relationships among tables.
- **Optimization Model Documentation**: Description of the model used for routing and warehouse allocation.
- **Visualizations**: Graphs and charts depicting key metrics, sustainability indicators, and efficiency improvements.
- **Dashboard (Optional)**: An interactive dashboard to monitor logistics performance and sustainability metrics.