Reverse Logistics Optimization Project

🚚 Reverse Logistics Optimization

Duration: Jan’25 – Mar’25

Type: Self Project

📌 Overview

E-commerce businesses face significant challenges in handling product returns, as they involve high transportation costs, longer turnaround times, and complex processing steps. This project focused on **optimizing reverse logistics operations** by leveraging data analysis, linear programming, and visualization tools to design cost-efficient and time-effective return flows.

🎯 Objectives

- Analyze return data to identify cost, distance, and time-related inefficiencies.
- Build a **linear programming model** to minimize supply chain costs.
- Design **dashboards and KPIs** to continuously monitor return operations.
- Demonstrate the impact of optimization through data-driven insights.

🔍 Process

1. Data Analysis

- Collected and structured synthetic return datasets with attributes such as product category, return distance, processing time, and costs.
- Performed exploratory analysis to identify **patterns and bottlenecks** in the reverse logistics process.

2. Optimization Model

- Modeled the problem as a **linear programming task** with the goal of minimizing total costs while respecting constraints such as processing capacity, turnaround time, and geographical limits.
- Implemented optimization using **Python (PuLP / OR-Tools)**.
- Compared “baseline” vs “optimized” costs to measure improvements.

3. Visualization & Dashboards

- Built **interactive dashboards** to visualize:
  - Return rates across product categories
  - Processing & transportation costs over time
  - Average turnaround times per return
  - Before vs After optimization comparisons
- Dashboards built using **PowerBI / Tableau / Plotly** helped track KPIs and evaluate scenarios.

📊 Outcomes

- Identified key inefficiencies in high-cost, long-distance return routes.
- Achieved **~12–15% potential cost savings** through optimized routing.
- Reduced average turnaround time of returns by streamlining allocation.
- Created dashboards enabling **real-time KPI tracking** for return rates, costs, and processing times.

💡 Key Learnings

- Application of **Operations Research** (linear programming) in real-world supply chain problems.
- Integration of optimization with **data visualization** for decision-making.

- Importance of **data-driven strategies** in improving efficiency and customer satisfaction.