# Supply Chain Inventory Optimization & Supplier Performance Report

**📌** Executive Summary

This project addresses the challenge of stockouts, excess holding costs, and late supplier deliveries. Using a realistic synthesized dataset, it demonstrates how advanced analytics can optimize inventory levels, track supplier performance, and provide actionable business recommendations.

**📂** Data & Tools

* **PostgreSQL:** For relational schema design and complex queries.
* **Python:** For EDA, statistical tests, trend analysis.
* **Power BI:** For dynamic dashboards with advanced DAX measures.
* **Excel:** For scenario modeling, pivot tables, and business-ready reports.

**📊** Key Findings

* ~30% of SKUs are at risk of stockouts under current ReorderPoints.
* Average supplier lead time ranges from 7 to 14 days.
* ~20% of orders delivered late, impacting warehouse stock levels.
* A +15% ReorderPoint buffer scenario indicates reduced stockout risk but increases inventory holding cost.

## 📈 Solution Approach

1. **Database & Queries:** Schema with products, suppliers, warehouses, inventory snapshots, and orders. Complex SQL joins, CTEs, and window functions reveal supplier performance patterns and reorder needs.
2. **Python EDA:** Identified trends, tested significance with chi-square and ANOVA where relevant, visualized stock level trends.
3. **Power BI:** Built a 2-page dashboard:
   * *Inventory Health:* Total stock, % stockouts, MoM stock change, buffer needed.
   * *Supplier Performance:* % late deliveries, avg lead time, supplier ranking by lateness.
   * DAX measures: CALCULATE, DATEADD, RANKX, IF logic.
4. **Excel Analysis:** Scenario sheet tested +15% ReorderPoint impact with pivot tables showing stock risk shift across categories and warehouses.

## **✅** Business Impact

This solution supports supply chain teams by:

* Reducing surprise stockouts through proactive reorder policies.
* Identifying top late suppliers for SLA renegotiation.
* Improving inventory cost planning with clear scenario testing.