End-to-End Supply Chain Diagnostics & Inventory Health Dashboard

1. Executive Summary

A high-volume UK online retailer processes over 500,000 transactions annually but relies on static spreadsheets for decision-making. This lack of automated visibility has led to capital inefficiency—money is tied up in stagnant stock, while "hidden" operational costs (like high return rates) eat into profit margins.

This project creates a **centralized data ecosystem** using **SQL, Python, and Power BI** to move the company from reactive reporting to proactive Supply Chain Optimization.

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2. The Business Problem (The "Pain Points")

The business is currently facing a "Triple Threat" to profitability that simple revenue analysis cannot detect:

1. **Capital Lock-up (Dead Stock):** Significant capital is frozen in inventory that hasn't sold in 3+ months. The business doesn't know *which* items these are or their total value.
2. **The "Toxic Asset" Blind Spot (Quality Control):** Some "Best Selling" items actually have massive Return Rates (>10%). Without analysing returns alongside sales, the company keeps restocking defective products that destroy margins.
3. **Customer Concentration Risk:** Certain high-revenue items are purchased by only 1-2 unique customers. If these customers leave, the product immediately becomes Dead Stock.

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3. The Technical Solution (The "Architecture")

To solve these problems, I built an automated **ETL (Extract, Transform, Load)** pipeline:

- **Storage (MariaDB SQL):** Serves as the "Single Source of Truth," replacing disparate Excel files with a structured relational database.
- **Processing (Python/Pandas):** An automated script that separates "Sales" from "Returns," calculates complex ratios, and performs statistical segmentation (ABC Analysis).
- **Visualization (Power BI):** An interactive dashboard allowing stakeholders to filter inventory by Risk, Quality, and Value.

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4. Key Analytical Metrics

The system evaluates every product across four dimensions of health:

Dimension	Metric Used	Business Question Solved
Value	**ABC Analysis** (Pareto)	*"Which 20% of items generate 80% of our cash?"*
Efficiency	**Dead Stock Flag** (Recency)	*"What should we liquidate immediately to free up cash?"*
Quality	**Return Rate %**	*"Which items have technical defects or misleading descriptions?"*
Stability	**Customer Concentration**	*"Are we relying on too few customers for this product's success?"*

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5. The Deliverables

1. **Automated ETL Script:** A Python application that cleans raw logs and updates the SQL warehouse.
2. **Inventory Health Database:** A SQL table (inventory_analytics) enriched with 12+ diagnostic features per product.
3. **Strategic Dashboard:** A Power BI report identifying:
    - Liquidation Targets (Dead Stock).
    - Quality Control Alerts (High Returns).
    - Top Revenue Drivers (Class A).