Solving Inventory Inefficiencies Using SQL

Overview

Urban Retail Co. is a rapidly expanding mid-sized retail business that operates both physical outlets and an e-commerce platform across multiple urban centers. With an inventory exceeding 5,000 SKUs — covering everything from daily groceries to electronics and personal care — our distribution system depends on regional warehouses to restock retail locations. As our operations grow more complex, maintaining ideal inventory levels has become increasingly difficult. While we possess rich data from sales, product catalogs, and warehouse systems, it's currently underutilized, resulting in inventory inefficiencies.

Project Aim

This initiative is designed to:

- Develop a SQL-based framework for real-time inventory tracking and improvement.
- Deliver actionable KPIs like inventory turnover, risk of stockouts or overstocking, and demand prediction accuracy.
- Build a structured relational database schema for more efficient data handling.
- Present inventory performance via a user-friendly dashboard.

Data Structure Design: ERD Overview

Core Components:

1. **Stores Table:** Tracks daily inventory movements at each retail location, including store ID, region, and product ID, while linking to category and inventory data.

2. **Inventory Table:** The central hub for data points such as current stock, sales figures, orders placed, demand forecasts, product pricing, discounts, and competitor pricing.

3. **External Factors Table:** Enriches inventory data with contextual elements like holidays, promotions, seasons, and weather conditions.

4. **Category Table:** Organizes items by product category, aiding store-level classification.

5. **Seasonality Table:** Records seasonal identifiers to support demand trend analysis.

6. **Weather Table:** Logs climate data that could impact customer buying behavior.

Database Efficiency Enhancements

- Normalized data using **Third Normal Form (3NF)** to remove redundancy and support versatile querying.

- Transformed unstructured inventory datasets into a structured relational format.

- Enhanced query performance through techniques such as indexing, joins, and window functions.

Executive Summary

1. Major Findings

A. High vs. Low Velocity Products

- Items like P0046 (Clothing) and P0096 (Toys) show high forecasted and real-time demand — strong performers.

- Items with an average inventory age over 900 days (e.g., P0096, P0016, P0031) are slow-movers, increasing storage costs and risk of product obsolescence.

B. Issues with Stockouts and Overstocking

- Some items (e.g., P0016, P0031, P0171, P0175) experience stockout rates above 95%, signaling issues with restocking strategies.

- Overstocks persist, with some SKUs held for over a year, locking in capital and inviting markdown losses.

C. Supplier Reliability & Inventory Efficiency

- High turnover products maintain ratios near 24–25. Conversely, low turnover and aged stock suggest inefficiencies in procurement or weak supplier performance.

D. Seasonal Sales Patterns

- Categories like Clothing and Toys spike in autumn, aligning with forecasts (e.g., 97,000 units for top-selling Clothing SKUs).

- Inventory plans don’t always align with these trends, resulting in both shortages and surpluses.

---

2. Strategic Recommendations

Inventory Adjustment

- Remove slow-moving items through targeted discounts or vendor returns to free up space and cut storage expenses.

- For fast sellers, increase replenishment frequency and reduce order quantities to lower stockout incidents.

Enhancing Supplier Accountability

- Review supplier performance for long lead times or frequent stockouts; consider contractual penalties or performance reviews.

- Source alternative vendors for problematic SKUs to improve product availability.

Demand-Aligned Inventory Management

- Implement seasonal demand planning, especially for peak-demand categories.

- Use rolling three-month forecasts in procurement to stay agile with demand shifts.

Broader Insights

- Create automated dashboards that monitor key metrics like turnover and stockout rates, enabling quick action.

- Analyze pricing sensitivity and promotion impacts on low-performing products to fine-tune discount strategies.

---

3. Anticipated Outcomes

By implementing these strategies, Urban Retail Co. is expected to:

- Decrease idle capital tied up in outdated stock.

- Improve product availability, enhancing the customer experience.
- Strengthen supplier collaboration and streamline supply chain processes.
- Increase profitability through smarter markdowns, demand alignment, and lower storage costs.
