INVENTORY OPTIMIZATION REPORT

CONTENT

Project Overview

In today's dynamic retail landscape, ensuring the right products are available at the right time across all stores is vital to business success. This project aimed to solve core operational challenges—such as overstocking, stockouts, inaccurate demand forecasting, and pricing inefficiencies—through structured data modeling and deep analytics.
Starting with a raw, semi-structured dataset, we built a normalized database and executed a series of analytical SQL queries to extract practical, store-level and category-level insights.
By combining SQL modeling with dynamic visual analytics in Power BI, we delivered a full-stack solution from raw data to executive-ready dashboards.

Data Model and Normalization

To convert raw transactional logs into usable intelligence, we first restructured the dataset into four logically connected tables:

- Products Table: Captures unique combinations of Product_ID and Category, each mapped to a new surrogate Product_Key. This enables precise aggregation without duplication.
- Stores Table: Maps every unique Store_ID to its corresponding Region, setting the base for geographic analysis.
- Inventory Table: Contains daily product-store level snapshots including units sold, inventory on hand, forecasted demand, and external drivers such as holiday promotions and weather conditions.
- Pricing Table: Holds daily pricing data including discounts and competitor benchmarks, linked to both products and stores.

Together, these tables enable rich multidimensional analysis with referential integrity.

Key Analytical Components

A. INVENTORY HEALTH & STOCK EFFICIENCY

- Flagged products with inventory levels below 100 units, a threshold set to identify potential stockout risks.
- Computed average inventory by category to identify underperforming or overstocked product lines.
- Derived Inventory Turnover Ratios, providing a clear view of how effectively each product's inventory converts into sales.

B. SALES TRENDS AND FORECAST RELIABILITY

- Identified the top 2 and bottom 2 selling products in each category using historical sales data.
- Measured sales uplift during holiday promotions, helping stakeholders understand the real impact of discounts and festive marketing.
- Evaluated forecasting accuracy using Mean Absolute Error (MAE) between predicted and actual sales at the product-store level.

C. PRICING AND PROMOTION ANALYSIS

- Analyzed price differences vs competitors to spot overpricing or undercutting trends.
- Compared seasonal pricing variations to detect optimal pricing periods.
- Measured average discounts by category, supporting future discount planning and margin protection.

D. DEMAND-DRIVEN REORDERING

- Implemented a 7-day reorder point calculation, using moving averages of daily sales to suggest when and how much stock to reorder by store-product pair.

Regional & Store-Level Metrics

- Total inventory by region was calculated to assist in balanced supply chain distribution.
- Counted active stores per region and ranked regional performance by total sales.
- Compared category-level performance across regions, highlighting localized demand trends.

Dashboards & Reporting Layer

A dynamic Power BI dashboard was developed to transform raw KPIs into actionable business visuals. It includes:

- Store-wise and category-wise breakdowns of sales, inventory, and reorder demand.
- Sales Error % dashboards to flag misalignments between forecast and actual orders.
- Visual breakdowns of holiday vs non-holiday promotion performance.
- Forecast Error heatmaps to detect inaccuracies across time and product lines.
- Inventory Turnover visualizations to rank products by operational efficiency.

Interactive filtering by date, region, and category allows real-time scenario analysis for decision-makers.

Business Outcomes and Strategic Value

This data-driven approach empowered stakeholders with:

- A real-time lens into which products need urgent restocking
- Category-specific turnover analysis to improve merchandising strategy
- Quantified proof of promotional success to guide future marketing
- Price benchmarking insights to remain competitive without sacrificing margins

The result was a leaner, smarter inventory and pricing ecosystem with tangible ROI opportunities.

Forward Roadmap

Looking ahead, the following enhancements can be considered:

- Stockout and volatility tracking to add risk prediction layers
- Supplier metrics and lead time monitoring to close the feedback loop from sales to procurement
- ML-based demand prediction using features like weather and seasonality
- Scheduled dashboard automation for daily business readiness