AI-Powered Business Operations & Profit Optimization System

Project Overview
This project develops an end-to-end business decision intelligence system that integrates demand forecasting, inventory optimization, production planning, and financial modeling to enable data-driven operational strategy. The system simulates how organizations plan production and inventory under uncertainty while maximizing profitability.

Business Problem
Retail and supply chain teams often forecast demand but fail to connect predictions with operational decisions such as inventory levels, production allocation, and financial impact. This results in stockouts, excess inventory, and reduced profitability. The objective of this project is to build a unified analytics system linking:

Forecast → Inventory → Production → Profit

to support optimal planning under real-world cost and capacity constraints.

Methodology

1. Data Preparation
   Sales transaction data was cleaned and structured to create daily product-level demand. Business assumptions such as unit cost, holding cost, shortage cost, and capacity limits were incorporated to simulate operational constraints.

2. Demand Forecasting
   Time-series forecasting models (Prophet) were used to predict future demand for multiple products. Forecast outputs served as the foundation for operational planning.

3. Inventory Optimization
   Safety stock and reorder points were calculated using demand variability and lead time, enabling risk-buffered inventory decisions that balance service level with cost.

4. Production Optimization
   A linear programming model determined optimal production quantities under capacity constraints, ensuring forecast demand could be met at minimum cost.

5. Profit Modeling
   Revenue, production cost, holding cost, and shortage penalties were integrated into a profit model to evaluate financial impact of operational decisions.

6. Visualization
   An executive dashboard was developed in Tableau to provide decision-makers with visibility into demand forecasts, inventory strategy, production plans, and profit

outcomes.

Key Results

- Built a scalable multi-product demand forecasting system

- Developed safety stock and reorder point logic

- Optimized production allocation under capacity limits

- Created an integrated profit simulation model

- Delivered executive-level decision dashboard

Business Impact

This project demonstrates how analytics can move beyond prediction to enable operational optimization and financial strategy. The system supports:

- Data-driven production planning

- Reduced risk of stockouts and overstock

- Cost-efficient inventory management

- Profit-optimized operations

- Executive-level decision support

Tech Stack

Python, Pandas, NumPy, Prophet, PuLP, Matplotlib, Tableau

Conclusion

The project showcases how AI and operations research can be combined to build an integrated decision intelligence system, mirroring real-world business planning processes. It highlights the ability to translate analytics into strategic operational and financial decisions.