

Short Report: Inventory Forecasting and Recommendation System for Hotel Bars

1. What is the core business problem and why does it matter?

The core business problem is optimizing inventory management for bar items across hotel chains by forecasting demand and generating data-driven restocking recommendations. Poor inventory management can lead to frequent stockouts, overstocking, wastage, and revenue loss. A predictive, intelligent system can improve service levels, reduce costs, and support strategic purchasing decisions.

2. What assumptions did you make? Why?

- Historical consumption patterns are predictive of future demand.
- Inventory is restocked instantly when reorder conditions are met (no lead time delay).
- Alcohol demand variability can be modeled using a Gaussian noise component.
- No spoilage, spillage, or theft is considered.

These assumptions simplify modeling and align with data constraints, while still enabling practical simulation and decision-making.

3. What model did you use and why did you choose it? Why not others?

We used SARIMA for time series demand forecasting for each item. SARIMA is well-suited for seasonal patterns and provides interpretable forecasts. Given the dataset's size and granularity, SARIMA balances accuracy and efficiency. Alternatives like Prophet, LSTM, or XGBoost were considered but deemed overkill for this structured time series data.

4. How does your system perform? What would you improve?

The system achieves high service levels (>95%) in simulation for most items, with minimal stockouts and actionable recommendations. It effectively balances reorder frequency and inventory levels.

Improvements could include:

- Incorporating delivery lead time.
- Adding spoilage/expiry factors.
- Using ensemble forecasting models.
- Developing a real-time dashboard with alerts.

5. How would this solution work in a real hotel?

Each hotel bar's inventory system can connect to this forecasting engine. Daily closing balances and sales data feed the model, which forecasts demand, simulates inventory, and recommends purchase decisions. Managers receive dashboards and alerts for proactive ordering. It scales well across chains if centralized.

(Optionally) What would break at scale? What would you track in production?

At scale:

- Performance bottlenecks from too many models per item-bar combo.
- Data inconsistencies across outlets.
- Real-time ingestion and retraining challenges.

In production:

- Forecast vs actual tracking.
- Stockout occurrences.
- Purchase frequency and wastage.
- Alert responsiveness by staff.