CASE STUDY: OPTIMIZING LIQUIDITY VS. SUPPLY CHAIN RISK

Project: Operational Value-at-Risk (OpVaR) Modeling

Role: Technical Lead (Python/Stochastic Simulation)

Date: February 2026

1. THE BUSINESS CHALLENGE

Context: A major Nairobi distributor (FMCG) faced rising working capital costs due to high interest rates. The CFO targeted a **$2M reduction in inventory holding** to unlock liquidity.

The Conflict: The Supply Chain Director refused to cut safety stock, citing volatile lead times from the Port of Mombasa and fear of stockouts (lost revenue).

The Core Question: *"If we cut inventory by 20% to save cash, what is the exact statistical probability that we will fail to deliver to customers?"*

2. THE METHODOLOGY

Standard Excel analysis uses "average lead times," which fails to account for supply chain shocks (e.g., port delays). I built a **Monte Carlo Simulation** in Python to model this uncertainty.

- **Engine:** Modeled 10,000 discrete scenarios using NumPy and Pandas.
- **Variables:** Correlated demand volatility against lead-time variance (Log-Normal distribution).
- **Output:** Generated a "Risk Curve" to visualize the trade-off between **Cash Released** and **Stockout Probability**.

3. THE ANALYTICAL EVIDENCE

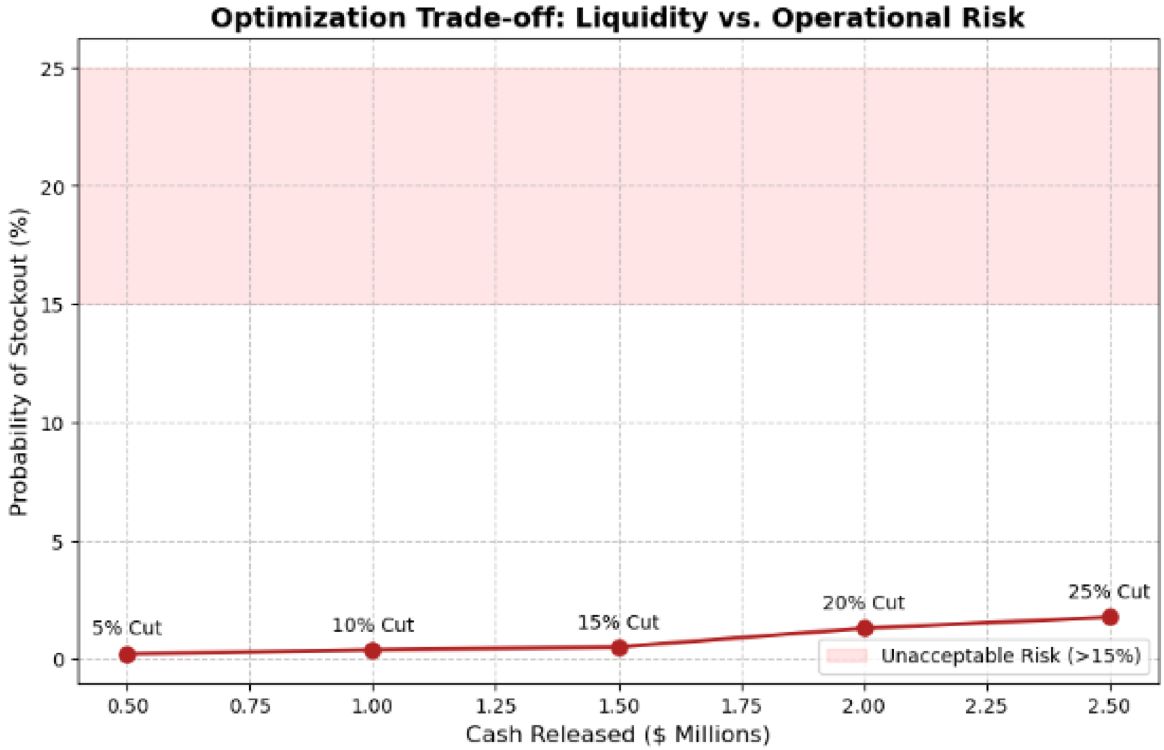

Figure 1: The Efficiency Frontier. The curve shows that risk remains negligible (<2%) even with significant inventory reductions.

4. STRATEGIC RECOMMENDATION

The simulation revealed that the company was severely over-stocked.

- **The Findings:** We can reduce safety stock by **15%** (releasing **$1.5M in Cash**) while maintaining a Service Level of **98.5%**.
- **The Fix:** Implement a dynamic tiered stocking policy.
    - **Tier A (High Volatility SKUs):** Maintain current coverage.
    - **Tier B (Stable SKUs):** Aggressively cut buffers by 20%.
- **Impact: $1.5M in working capital unlocked** within 30 days with zero operational disruption.