Feature Review

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Current State: Manual Chaos → Intelligent Automation

PAIN POINTS

📊 15% Stockout Rate
Lost sales & customer satisfaction

💰 $8M Excess Inventory
Tied-up working capital

⏱️ 4+ Hours Weekly
Manual Excel planning

🔄 Reactive Ordering
No demand visibility

SOLUTION

🎯 AI-Powered Planning
Real-time recommendations

🔍 Exception Management
Focus on what matters

🌐 Multi-Location Optimization
Unified global view

📈 Predictive Intelligence
ML-driven forecasts & Periodic review system

TARGET USER: Supply Chain Analysts & Inventory Managers

BUSINESS IMPACT: **50% ↓ Stockouts | 20% ↓ Inventory | 80% ↓ Time**

Key Concepts

Core Components

Intelligent Forecast Engine

- ML ensemble: Prophet, LightGBM, N-HiTS
- Dynamic model weighting
- External signals integration

Multi-Echelon Optimization

- Unified planning: US, UK, Germany
- Currency-aware calculations
- Network transfer opportunities

Exception-Driven Workflow

- Proactive alerts for issues
- Prioritized action queue
- One-click resolution

Conversational AI Assistant

- Natural language queries
- Transparent calculations
- In-context actions

Guiding Principles

Automation First
Minimize manual intervention

Transparency
Show calculation logic

Flexibility
Support planner overrides

Scalability
Handle 1000+ SKUs efficiently

Business Scenario: Premium Laptop Stand

💻 SKU: PLS-001 | Lead Time: 21 days | MOQ: 500

📦 Inventory	📊 Weekly Demand	⏱ Days
US: 850 🟡	US: 180 (σ=35)	4.7 ⚠️
UK: 120 🔴	UK: 45 (σ=12)	2.7 🚨
DE: 75 🔴	DE: 30 (σ=8)	2.5 🚨
Transit: 500	**Total: 255/week**	—

📐 Safety Stock Formula

$$SS = z \times \sigma \times \sqrt{(P+L)}$$

Where: z = 1.65 (95% service level)
σ = demand std deviation
P = review period (1 week)
L = lead time (3 weeks)

Business Scenario: Premium Laptop Stand-cont.

💻 SKU: PLS-001 | Lead Time: 21 days | MOQ: 500

RECOMMENDED ACTIONS

✓ US: Order 1,000 units
- Prevents stockout in 15 days
- Order value: $25,00

✓ UK: Transfer 200 units from US
- Immediate availability
- Utilizes US excess capacity

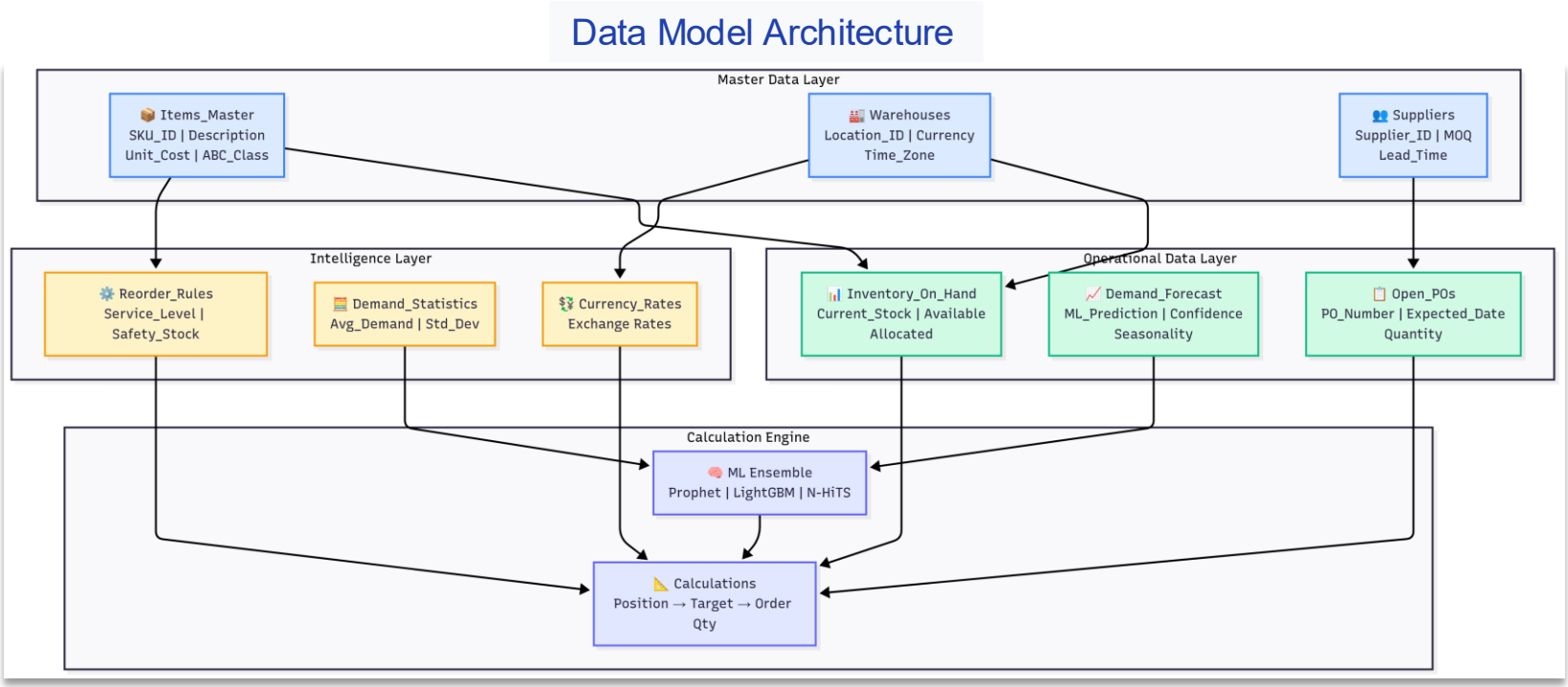
✓ DE: No action required
- Coverage sufficient after UK transfer

CALCULATION DETAILS

```
US Safety Stock = 1.65 × 35 × √4 = 115 units
Target Level = (180 × 4) + 115 = 835 units
Current Position = 850 + 500 = 1,350 units
Days to Reorder = (1,350-835)/25.7 = 20 days
```

- Prevented Revenue Loss: **$45,000**
- Working Capital Saved: **$20,000**
- Weekly Time Saved: **2 hours**
- ROI: **180% immediate return**

Data Model Architecture



🔄 Data Flow: Real-time inventory → ML forecasts → Smart recommendations

Implementation Approach & Timeline

Week 1-4 FOUNDATION → Week 5-8 INTELLIGENCE → Week 9-12 OPTIMIZATION

FOUNDATION	INTELLIGENCE	OPTIMIZATION
Activities: • Deploy calculation engine • Connect data sources • Basic dashboard launch • Train core users	Activities: • Activate ML forecasting • Enable exception detection • Multi-location optimization • Expand user base	Activities: • Launch AI assistant • Advanced analytics • Mobile deployment • Full rollout
Deliverables: ✓ Automated calculations ✓ Real-time inventory view ✓ Manual override capability	Deliverables: ✓ AI-powered predictions ✓ Proactive alerts ✓ Network visibility	Deliverables: ✓ Natural language interface ✓ Transfer recommendations ✓ Complete automation
Outcome: **3 hours/week saved**	Outcome: **50% stockout reduction**	Outcome: **Full ROI realization**

Implementation Approach & Timeline-cont.

Success Metrics

Metric	Current	Phase 2	Phase 3
Planning	4 hrs/wk	2 hrs/wk	45 min/wk
Stockouts	15%	10%	7.5%
Inventory	$8M	$7.2M	$6.4M
Accuracy	70%	80%	85%

Low-Risk Approach: Each phase delivers immediate value while building toward full automation

Technical Architecture

INBOUND	PROCESSING	OUTBOUND
Data Sources: - ERP Systems └── Item master, costs - WMS Real-time └── Inventory positions - Sales CRM └── Pipeline, forecasts - External APIs └── Weather, trends	Core Components: - ML Engine └── Prophet, LightGBM - Rules Engine └── Business logic - Optimizer └── Network balancing - AI Assistant └── GPT-3.5 powered	Integrations: - PO Generation └── Direct to procurement - Notifications └── Email, Slack alerts - BI/Analytics └── Tableau, PowerBI - Finance Systems └── Inventory projections
🔄 Update Frequency: Real-time & Batch	⚡ Performance: <100ms response time	✅ Actions: Automated & tracked

Frontend: React + Embedded Chat
Backend: Python ML + Kafka Streaming
Deploy: Kubernetes + Auto-scaling

💡 Modern, scalable architecture integrates with your existing systems

Business Value & ROI

INVESTMENT

One-Time Cost

- Development & Implementation
  $120,000
- Training & Change Management
  $20,000
- ML Model Training
  $10,000

Total Investment: $150,000

ANNUAL RETURNS

Recurring Benefits

- Stockout Reduction (50%)
  $300,000
- Inventory Reduction (20%)
  $200,000
- Labor Savings (3+ hrs/week)
  $100,000

Total Annual Benefit: $600,000

ROI SUMMARY

Payback Period: 3 months

5-Year NPV: $2.1M

IRR: 400%

Competitive Advantage

Planning Speed	Forecast Accuracy	Exception Response	Scalability
80% faster	+15-20%	Proactive	10K+ SKUs
4hr → 45min	improvement	vs Reactive	supported

Open Questions

1. ML Model Strategy

Should we include external signals (weather, events) from day one, or phase them in after establishing baseline accuracy?

2. User Experience

How aggressive should auto-approval thresholds be initially? Start conservative or trust the AI?

3. Rollout Approach

Pilot with one geography or all three simultaneously?
High-value SKUs first or full catalog?

4. Integration Priorities

Which downstream systems need real-time vs batch updates?
Build APIs for third-party tools immediately?

5. Change Management

How long should we run Excel processes in parallel?
What KPIs trigger full automation?

Appendix 1 – News Vendor Model

Basic Cost Equations:

$$Expected\ cost\ of\ overstocking\ =\ Prob(Demand\ <\ Q*)\ \times\ Co\ =\ F(Q*)\ \times\ Co$$

$$Expected\ cost\ of\ understocking\ =\ Prob(Demand\ >\ Q*)\ \times\ Cu\ =\ [1\ -\ F(Q*)]\ \times\ Cu$$

Newsvendor Critical Ratio:

$$F(Q*)\ =\ Cu\ /\ (Cu\ +\ Co)$$

Where:

$F(Q*)\ =\ Cumulative\ probability\ function\ (probability\ that\ demand\ <\ Q*) Cu\ =\ Understocking\ cost\ (loss\ of\ ma$

Appendix 2 – Periodic Review System and Safety Stock

Inventory Position:

$$IP = On-hand\ inventory + On-order\ quantities - Backorders$$

Target Level:

$$T = Forecast\ of\ demand\ (during\ P + L\ time\ periods) + Safety\ Stock$$

Order Quantity:

$$Q = T - IP$$

Demand Statistics for Planning Interval:

$$Average\ demand\ over\ P + L\ periods\text{: } DAVG = (P + L) \times \mu d$$

$$Standard\ Deviation\ over\ P + L\ periods\text{: } \sigma P + L = \sqrt{(P + L)} \times \sigma d$$

Safety Stock:

$$Safety\ Stock\ (SS) = z \times \sigma P + L$$

Annual Cost Equation:

$$Annual\ Cost = (52/P)S + CR + KC(Qavg/2) + KC(SS)$$

Variable Definitions:

- IP = Inventory position
- T = Target inventory level
- Q = Order quantity
- P = Review period (in weeks)
- L = Lead time
- μd = Mean demand per period
- σd = Standard deviation of demand per period
- σP+L = Standard deviation over planning interval
- z = Service factor constant (based on desired service level)
- S = Cost of ordering (fixed)
- C = Cost per unit
- R = Annual demand
- K = Fraction of unit cost for carrying inventory annually
- Qavg = Average order size = (R/52) × P
- SS = Safety stock

Appendix 2 – Cont.

Figure 1. Periodic review system.