Innovation in stock optimization

BECOME AN INDUSTRY LEADER BY REDUCING YOUR INVENTORY WITH 50%

Breda, 18 June 2015

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The recommendations, advice and conclusions, mentioned in this report, are based on the information and data provided by client. Savings, operational costs and investment estimates are depending on the assumptions and preconditions stated in this report. All orders are accepted and carried-out according to the Groenewout Terms and Conditions 2012.
WHY INVENTORY?
5 REASONS FOR KEEPING INVENTORY

Supply chain: from raw materials till consumer

- **Strategic**: trading & speculation
- **Capacity**: limited capacity requires stockbuild (e.g. seasonality)
- **Order quantity**: economic to order more than 1 pcs.
- **Uncertainty**: demand-, supply quantity and lead times
- **Lead time**: Coverage of lead time demand
The impact of inventory on Return On Investment

INVENTORY IMPACTS THE ASSET TURNOVER AND NET PROFIT MARGIN

DuPont chart: Inventory affects asset efficiency and net profit

Inventory reduction results in an increase of asset turnover and net profit margin. Meaning that the ROI is leveraged from both sides. A lean inventory is a key issue to become an industry leader.

*source: working capital benchmark PwC July 2014
Decision making process portfolio and stock mgmt.

STOCK POLICY DECISIONS AND VARIABLES

<table>
<thead>
<tr>
<th>Decisions</th>
<th>Variables</th>
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<tbody>
<tr>
<td>Item in portfolio (yes/no)</td>
<td>Customer needs, profitability, supplementary, etc.</td>
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<tr>
<td>Make-To-Stock vs. Make-To-Order</td>
<td>Production lead time vs. customer requirements</td>
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<td>Where to stock (central vs. local)</td>
<td>Customer demand, volatility demand, transport costs</td>
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<td>Supplier lead time, demand characteristics</td>
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<td>Safety Stock</td>
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Make-To-Stock vs. Make-To-Order (FMCG case)

QUADRANT ANALYSIS

MTS

Predictable high demand
2% SKUs, 47% sales

Unpredictable high demand
<1% SKUs, 1% sales

Calc.

Predictable low demand
42% SKUs, 41% sales

Unpredictable low demand
55% SKUs, 10% sales

MTO

Demand per week (pieces)

Volatility % per week
Where to stock (central vs. local)

INVENTORY & TRANSPORT COSTS

Number of lines per year vs. Purchase price (€)

- Central
- Local
## Inventory management scale

### ASSES YOUR COMPANY INVENTORY MANAGEMENT MATURITY

#### Level of professionalism in inventory management

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Safety stock based on service levels and charges

SAFETY STOCK DECISION RULES

• **Safety stock based on service levels:**
  
  • Specified Probability (**P1**) of No Stockout per Replenishment Cycle – Cycle Service Level.
  • Specified Fraction (**P2**) of Demand to Be Satisfied Routinely from the Shelf – Fill Rate
  • Specified Fraction of Time (**P3**) During Which Net Stock is Positive – Ready Rate
  • Specified Average Time (**TBS**) Between Stockout Occasions

• **Safety stock based on charge per unit short:**
  
  • Specified Fractional Cost (**B1**) per Stockout Occasion
  • Specified Fractional Charge (**B2**) per Unit Short
  • Specified Fractional Charge (**B3**) per Unit Short per Unit Time
Decision rules for (s,Q) control system (1/3)

ASSUMPTIONS AND NOTATION

Assumptions

1. Demand is probabilistic but average demand is stable
2. A replenishment order Q is placed exactly at the order point s
3. Orders must be received in the same order as ordered
4. Forecast errors have a normal distribution with no bias
5. Q has been predetermined
6. The costs of the control system are independent of s

Notation

\( k \) safety factor
\( p_{u \geq k}(k) \) probability that a unit normal (mean 0, standard deviation 1) variable takes on a value of \( k \) or larger.
\( SS \) safety stock, in units
\( X_l \) forecast (or expected) demand over a replenishment lead time, in units
\( \sigma_l \) standard deviation of errors of forecasts over a replenishment lead time, in units
Decision rules for \((s,Q)\) control system (2/3)

NORMALLY DISTRIBUTED FORECAST ERRORS

\[ \text{Area} = \text{prob. Demand in } L \text{ exceeds } X_l + k\sigma_l \]
Decision rules for (s,Q) control system (3/3)

THE RULE

• **Step 1**: Select the safety factor $k$ to satisfy

\[ p_{u \geq k}(k) = 1 - P_1 \]

• **Step 2**: Calculate Safety stock

\[ SS = k \sigma_1 \]

• **Step 3**: Calculate reorder point

\[ S = X_l + SS \text{ (increased to the next higher integer if not already exactly an integer)} \]
Quick win of 20-30% inventory reduction

STATISTICAL BASIC INVENTORY OPTIMIZATION

• **Four steps**
  1. Historic demand data
  2. Distribution fitting to lead time demand
  3. Implementation of basic safety stock calculations
  4. Calculate (and simulate)

• **Frequent mistakes**
  • Incorrect formulas
  • Excluding uncertainty in supply
  • Misunderstanding of inventory position

• **Best practices**
  • One year historic demand
  • Weekly time buckets
  • Frequency: twice per year

\[ SS = k \times \sigma_L \]
Customer Service Level: P1 vs. P2
DIFFERENCE BETWEEN P1 AND P2 EXPLAINED

**P1**: Probability of no stockout during replenishment cycle

**P2**: Fill Rate
Potential of 30-50% by using P2

BESIDES DEMAND AND FORECASTING PLANNING CAN REDUCE VARIANCE IN LEAD TIME

• **Approach**
  • The approach of P1 is similar to P2
  • Only a more complex distribution for the lead time demand is used
  • P2 can be implemented in Excel, but its more difficult

• **Frequent mistakes**
  • Using P1 in case of high order quantities leads to dead stock
  • Forecast error which is higher than the variance in demand

• **Best practices**
  • In case of high order quantities use P2
  • Demand and forecast planning is key in lowering safety stocks
Multi-Echelon Inventory optimization

COMPLEX SUPPLY CHAINS WITH BILL OF MATERIALS
Bullwhip effect

FASHION EXAMPLE
Vendor Managed Inventory & Collaborative Planning Concepts
Echelon Inventory Position

MULTI ECHELON CONCEPT
Synchronized Base Stock Policy

AN EVOLUTION IN MATERIAL PLANNING
How it worked out for Philips

ELIMINATION OF THE BULLWHIP EFFECT

Figure 3: In a successful ramp-down at the end of the life cycle of a product, as a consequence of the new planning process, the gap between demand and supply decreased (first half of the graph), and then supply started following demand closely (second part of the graph) with almost no obsolescence at the end of the life cycle.
L-Pad Game
CHALLENGE AND TRIGGER YOUR SUPPLY CHAIN TEAM!
Where are you now and next year?

PLAY THE L-PAD GAME

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Play the L-Pad game to create awareness
DRIVEN BY KNOWLEDGE