Inventory Management Concepts

ABC Stratification

Ken Homa
To reduce inventory, reduce safety stock …

• **Shorten lead times**
  …Less Lead Time Demand
  …More predictable (shorter-term forecast)

• **Reduce forecasting error**
  …Better mechanics
  …Aggregation benefits

• **Change service level policy**
  …Prudent stockout goals
  …Differentiated service levels
A-B-C Inventory Stratification
Pareto Principle: 80% sales from 20% items

Real Life Illustration

<table>
<thead>
<tr>
<th>Strata</th>
<th>Q.R.</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
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<td>33%</td>
<td>80%</td>
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<td>B</td>
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Q.R. = quick response items ... customers require near-immediate delivery
A-B-C Inventory Stratification
Pareto Principle: 80% sales from 20% items

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Bottom 50% of items often generate less than 5% of sales

Q.R. = quick response items … customers require near-immediate delivery
## The ‘C’ Items Challenge

Disproportionately high standard errors

<table>
<thead>
<tr>
<th>% Items</th>
<th>% Sales</th>
<th>Sales per Item*</th>
<th>Typical Std. Error</th>
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<tbody>
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<td>80%</td>
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<tr>
<td>B</td>
<td>30%</td>
<td>15%</td>
<td>5</td>
</tr>
<tr>
<td>C</td>
<td>50%</td>
<td>5%</td>
<td>1</td>
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* Indexed to C = 1 unit per item
Amount of safety stock depends on standard error and service level objective ... which gets translated via a service level factor that is analogous to normal distribution z-factors.

**WARNING !**
Increasingly higher service levels require disproportionately more safety stock!

ROP = E(LTD) + SS
= E(LTD) + (k x SE)

E(LTD) = Expected LT Demand
SS = Safety Stock
k = Service level factor
SE = Std Error of LT Demand
The ‘C’ Items Challenge

Disproportionately high standard errors => disproportionately high safety stock

Safety Stock
Typical A-B-C

Safety Stk. % Sales

20% 50% 100%

29%
The ‘C’ Items Challenge

Disproportionate inventory is often tied up in items generating a small percentage of sales

Inventory Strata
Typical A-B-C

- Items: 20% (20%), 30% (30%), 50% (50%)
- Sales: 15% (5%), 20% (20%)
- Safety Stk.: 26% (26%), 18% (18%), 44% (44%)
Meeting the ‘C’ Items Challenge …

- Prune the items from the line
  ... Contingent on strategic need,
  e.g. filling out the product line

- Protect at lower service levels
  ... Lower services levels require
  disproportionately less safety stock

- Differentiate service levels by strata
  ... Example: achieve an overall SL = 95%
  by protecting A items at 98% and Cs at 90%

- Make C items to order
  ... If low volume, may be less time critical
  i.e. customers may be willing to wait
Meeting the ‘C’ Items Challenge …

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Make non-QR Cs to order…52% of items, >5% of sales…frees up inventory & capacity

Q.R. = quick response items … customers require near-immediate delivery
Inventory TakeAways …

- 1. If demand is perfectly predictable, reorder when the inventory level is just sufficient to meet demand over the lead time.

- 2. If demand is not perfectly predictable, safety stock is required to protect against stockouts.

- 3. Safety stocks depend on forecast accuracy (the flip side of standard error) and service level policy.

- 4. Higher service levels require disproportionately more safety stock … the safety factor function is exponential, not linear.

- 5. Pareto is alive and well … typically 20% items => 80% sales.

- 6. Low volume ‘C’ items have high forecast errors, and require disproportionately high safety stocks.

- 7. To cut inventory: forecast better, change service level policy (e.g. differentiate targets by strata), drop problem items.
Inventory Management Concepts

ABC Stratification

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