Faculty of Management Sciences

Unit 3: Inventory Management

By: Ester Kalipi

Date: 05 March 2018
Table of contents

1. objectives of the Unit
2. Importance of Inventory Management
3. Purpose of inventory
4. Classification of Inventory
5. Inventory Management Concepts
6. Inventory Costs
7. Mathematics of Inventory Management
8. Inventory Replenishment System
9. Inventory Control through ABC Analysis
1. Objectives of the Lesson

By the end of this unit, students should be able to:

- Define inventory management;
- Explain the reasons for holding inventory;
- List the types of inventory and their classification;
- Explain the inventory management concepts;
- Evaluate the inventory management costs;
- Calculate the economic order quantity (EOQ) and Total inventory costs;
- Discuss inventory management control systems
What is Inventory?

- Inventories are:
  - stockpiles of raw materials,
  - supplies, components,
  - work in progress and finished goods
  - appear at numerous points throughout a firm’s production and logistics channel

Where can you find inventories?
Inventory Management

✓ helps the supply chain to improve customer service
✓ can meet high expectations for product availability when located in the proximity of the customer
✓ reduce costs in the supply chain
✓ Holding inventories may encourage economies of production
✓ Holding inventories fosters economies in purchasing and transportation.
2. Purpose of inventory Management

- Inventory management helps in maintaining a trade off between carrying costs and ordering costs which results into minimizing the total cost of inventory.
- Inventory management facilitates maintaining adequate inventory for smooth production and sales operations.
- Inventory management avoids the stock-out problem that a firm otherwise would face in the lack of proper inventory management.
- Inventory management suggests the proper inventory control system to be applied by a firm to avoid losses, damages and misuses.
3. Purpose of inventory

a) Decoupling: is the separation of manufacturing process from the selling process.

✓ Semi-finished products is held between different phases of the production process
✓ Decoupling allows the economies of production
✓ Transport economies are achieved in the case of large-volume shipments
✓ Inventory is held to reduce the cost of purchasing
  ✓ ordering goods frequently in small quantities involves:
    ✓ high delivery costs,
    ✓ handling costs, and
    ✓ administration costs.
b) Balancing supply and demand

Balancing supply and demand is more appealing in seasonal supply and/or demand.

✓ Seasonal production, but year-round consumption
  ✓ Canned fruits and frozen vegetables, fresh fruits and vegetables only harvested during their season, but consumption is throughout the year.

✓ Seasonal consumption, where supply must meet peak demand
  ✓ Seasonal variation in demand of some products.
  ✓ Demand for beverages during the festive season.
c) **Buffering against uncertainties in supply and demand**

Protecting the business or supply chain against three types of uncertainty:

- **Uncertainty of future demand**
- **Lead-time uncertainty**
  - A lead time is the elapsed time from order placement to order receipt.
- **Uncertainty in supply**
Geographical specialization

- Availability and cost of the factors of production influence the location of factories.
- Factors of production are not closer to the markets where the product is consumed.
- Inventory in the form of materials, semi-finished goods or components is kept across the supply chain.
- Each member of the supply chain requires a basic inventory, and in-transit inventories are necessary to link manufacturing and distribution.
e) Preventing the cost of stock out

There are three costs attached to stock-outs:

*The cost of back order*: additional costs of processing and expediting an order that cannot be met from inventory at hand.

*The cost of a lost sale*: incurs when the customer goes elsewhere for the purchase. These costs can be measured in terms of the contribution or profit that is lost on the particular sale.

*The cost of the lost customer*: unavailability may result into a customer permanently seeking another supplier.
4. Classification of inventories

a) Classification of inventory based on its position in the supply chain

Inventory can be classified in terms of where it is in the supply chain.

NB: The more inventory moves to the downstream from the factory towards the final consumer, the higher the value of the inventory.

- **Raw material**: E.g. iron ore, water, crude oil, sugar cane.
- **Work-in-progress**
- **Packaging material**: E.g. cold drinks cans; shrink-wrapping is used in various stages of the logistics process.
- **Finished goods inventory**
b) Classification of inventory based on its purpose

i. Cycle stock (base stock)
   ✓ Amount cycle stock depends mainly on the average demand and lead time under conditions of certainty.

ii. Transit inventory: inventory that is in the pipeline

iii. Safety (buffer) stock: make provision for the uncertainties in demand

iv. Speculative stock
   ✓ inventory held for reasons other than satisfying normal day-to-day demand.

v. Dead Stock: items which has deteriorated, becomes out-dated
Reasons for Speculative stock

An organization may purchase merchandise in volumes larger than necessary for the following reasons:

✓ To qualify for discounts
✓ When a price increase in goods is expected
✓ When a shortage of goods is expected
✓ To protect against strike
✓ To provide for the promotion of an item
✓ To provide for a seasonal sales.
CLASS ACTIVITY:
Contrast the following inventory based on its position in the SC and classification of inventory based on its purpose by completing the following table:

1. Vehicle on ship destined for export market
2. Fuel additive manufacturer bought additional 20,000 litres of oil in anticipation of oil increase
3. Beer brewing tank at NB
4. Iron ore extracted & on site at Aglo America
5. Iron ore on site at Mittal Steel
6. Cell phones released in 2000 in warehouse at Nokia
7. Floppy Disk drive at Dell computer manufacturers
8. Paper stock at printer in February preparing to print Christmas wrapping
9. Cool drinks in distribution centre of large retailer stocking up for heroes day
10. Foodstuff in distribution warehouse of large retail chain

<table>
<thead>
<tr>
<th>Position</th>
<th>Cycle stock</th>
<th>Transit stock</th>
<th>Safety stock</th>
<th>Speculative stock</th>
<th>Dead stock</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raw material</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Work in progress</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Packaging Material</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Finished Goods</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
CLASS ACTIVITY:
Contrast the following inventory based on its position in the SC and classification of inventory based on its purpose by completing the following table:

1. Vehicle on ship destined for export market
2. Fuel additive manufacturer bought additional 20,000 litres of oil in anticipation of oil increase
3. Beer brewing tank at NB
4. Iron ore extracted & on site at Aglo America
5. Iron ore on site at Mittal Steel
6. Cell phones released in 2000 in warehouse at Nokia
7. Floppy Disk drive at Dell computer manufacturers
8. Paper stock at printer in February preparing to print Christmas wrapping
9. Cool drinks in distribution centre of large retailer stocking up for heroes day
10. Foodstuff in distribution warehouse of large retail chain

<table>
<thead>
<tr>
<th>Position</th>
<th>Purpose</th>
<th>Cycle stock</th>
<th>Transit inventory</th>
<th>Safety stock</th>
<th>Speculative stock</th>
<th>Dead stock</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raw material</td>
<td>5</td>
<td>2</td>
<td>7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Work in progress</td>
<td>3</td>
<td>8</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Packaging Material</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Finished Goods</td>
<td>4</td>
<td>1,10</td>
<td>9</td>
<td>6</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
5. Inventory Management Concepts

a) **Inventory policy**: guidelines regarding what to purchase or manufacture, when to take action, and in what quantity.

b) **Availability**: the capacity of the business to have inventory when desired by the customer. Availability is measured in three ways:

- **Stock-out frequency**
- **Fill rate**: measures the magnitude or impacts of the stock-out over time.
  - Case fill rate: define the percentage of cases (units) ordered & supplied.
  - Line fill rate: the percentage of individual items (product lines) that could be supplied in totality.
- **Order shipped complete (order fill)**: measure the number of times the business can supply all the items ordered by a customer from the available stock.
- **Performance cycle time**: the elapsed time between the release of the purchase order by the buyer to the receipt of shipment.
c) Inventory turnover

- *It is also known as Stock Turnover*
- Measures how well stock is managed.
- It gives an indication of how many times during the year an average stock is used up.
- *Inventory turnover* = *Total Annual sales* ÷ *Average Inventory*
d) Average inventory: consists on the materials, WIP, components, and finished products that are typically held in inventory. Average inventory include cycle stock, safety stock and transit inventory components. Example: the target inventory levels must be planned for each facility. If a facility carries a maximum stock of N$50,000.00 during normal performance cycle and minimum of N$10,000.00. The difference between these two levels, N$40,000.00 (N$50,000.00 – N$10,000.00), is the order quantity, resulting in an cycle inventory of N$20,000.00 (N$40,000.00/2).
Figure 3.1. Inventory cycle for a typical product
Average inventory Across Multiple performance cycles

Assume that replenishment performance cycle is constant, 10 days; daily sales rate is 10 units per day and order quantity is 200 units. See figure 3.2 below

Figure 3.2 inventory relationship for constant sales and performance cycles
6. Inventory Costs

The total inventory cost is made up of purchasing costs, ordering costs and carrying costs.

a. Ordering costs: administration. Communication and handling costs linked to order placement, processing and receiving.

   **Ordering costs on products ordered from an external suppliers:**
   - Order preparation and submittal
   - Receiving the product
   - Placing products in storage
   - Processing invoice for payment

   **Ordering costs of internal supplies:**
   - Transmitting and processing inventory transfer
   - Handling the product if in stock or cost of setting up production and handling in not in stock
   - Receiving at distribution warehouse
   - Processing associated documentation
Inventory Costs (Cont’d..)

b. **Carrying costs**: associated with holding products in stock. Carrying cost is also known as **holding or maintenance costs**.

   Inventory carrying costs = Value of average inventory × carrying cost %

**Categories of inventory carrying costs**

- **Capital costs on inventory investment**: money used to purchase goods that are kept in inventory could have been for other types of investment. Capital is tied up in the stock, regardless of whether the money is borrowed or not.

- **Insurance**: inventory should be insured against theft and fire. Insurance risks is based on estimated risk or exposure over time, which depends on the nature of the product and the place of the warehouse.

- **Storage costs**: use of warehouse space for storing products in inventory.

- **Inventory risk costs**
  - **Obsolescence**: deterioration of products and it is not covered by insurance. This is the difference between original cost of the products and the salvage value.
  - **Damage**: damage incurred in the warehouse while inventory is stored. This could be the excess fee.
  - **Shrinkage**: loses that that are not easily identifiable and traced to a specific instance of theft. It cannot be claimed from insurance.
7. Mathematics of Inventory Management

Inventory Planning

- Requires setting optimum inventory levels in the supply chain, with due consideration for lowest total logistics costs and uncertainty in demand and supply.
- The starting point for proper inventory planning is reliable and accurate forecasts of independent demand.

How much to order?

- This question can be answered by calculating the economic order quantity (EOQ) for a specific item.
- EOQ is a trade-off or a balance between the inventory ordering costs and inventory carrying-costs.
EOQ

- EOQ calculates the inventory order volume which minimise the sum of the annual costs of holding inventory and the annual costs of ordering inventory.

\[ EOQ = \sqrt{\frac{2DS}{H}} \]

Where:
- \( C \) = total annual cycle-inventory cost
- \( Q \) = lot size
- \( H \) = holding cost per unit per year
- \( D \) = annual demand
- \( S \) = ordering or setup costs per lot
Five assumptions of EOQ

1. Demand rate is constant and known with certainty.
2. No limitations are placed on the size of each lot.
3. The only two relevant costs are the inventory holding cost and the fixed cost per lot for ordering or setup.
4. Decisions for one item can be made independently of decisions for other items.
5. The lead time is constant and known with certainty.
6. NB:THE ORDER QUANTITY AT WHICH THE ACQUISITION COSTS IS EQUAL HOLDING COSTS.
Economic Order Quantity

Figure 3.3: Annual Holding costs, Ordering and Total Costs
Calculating EOQ

- **Annual holding cost**
  \[
  \text{Annual holding cost} = (\text{Average cycle inventory}) \times (\text{Unit holding cost})
  \]

- **Annual ordering cost**
  \[
  \text{Annual ordering cost} = (\text{Number of orders/Year}) \times (\text{Ordering or setup costs})
  \]

- **Total annual cycle-inventory cost**
  \[
  \text{Total costs} = \text{Annual holding cost} + \text{Annual ordering or setup cost}
  \]
Calculating EOQ

- Total annual cycle-inventory and ordering cost

\[ C = \frac{Q}{2}(H) + \frac{D}{Q}(S) \]

where

- \( C \) = total annual cycle-inventory cost
- \( Q \) = lot size
- \( H \) = holding cost per unit per year
- \( D \) = annual demand
- \( S \) = ordering or setup costs per lot
EXAMPLE 1

- A museum of natural history opened a gift shop which operates 52 weeks per year.
- Managing inventories has become a problem.
- Top-selling SKU is a bird feeder.
- Sales are 18 units per week, the supplier charges $60 per unit.
- Ordering cost is $45.
- Annual holding cost is 25 percent of a feeder’s value.
- Management chose a 390-unit lot size.
- What is the annual cycle-inventory cost of the current policy of using a 390-unit lot size?
- Would a lot size of 468 be better?
We begin by computing the annual demand and holding cost as

\[ D = (18 \text{ units/week})(52 \text{ weeks/year}) = 936 \text{ units} \]
\[ H = 0.25(60/\text{unit}) = 15 \]

The total annual cycle-inventory cost for the current policy is

\[
C = \frac{Q}{2}H + \frac{D}{Q}S = \frac{390}{2}(15) + \frac{936}{390}(45) \\
\quad = 2,925 + 108 = 3,033
\]

The total annual cycle-inventory cost for the alternative lot size is

\[
C = \frac{468}{2}(15) + \frac{936}{468}(45) = 3,510 + 90 = 3,600
\]
Fig. 3.4: Total Annual Cycle-Inventory Cost Function for the Bird Feeder

Total cost = \[ \frac{Q}{2} (H) + \frac{D}{Q} (S) \]

Holding cost = \[ \frac{Q}{2} (H) \]

Ordering cost = \[ \frac{D}{Q} (S) \]

Current cost

Lowest cost

Annual cost (dollars)

0 1000 2000 3000

Best \( Q \) (EOQ)

Lot Size (\( Q \))

Current \( Q \)

50 100 150 200 250 300 350 400
EXAMPLE 1
For the bird feeders in Example 1, calculate the EOQ and its total annual cycle-inventory cost.

SOLUTION
Using the formulas for EOQ and annual cost, we get

\[
EOQ = \sqrt{\frac{2DS}{H}} = \sqrt{\frac{2(936)(45)}{15}} = 74.94 \text{ or } 75 \text{ units}
\]
Finding the EOQ, Total Cost,

Figure 3.5 shows that the total annual cost is much less than the $3,033 cost of the current policy of placing 390-unit orders.

<table>
<thead>
<tr>
<th>Parameters</th>
<th></th>
<th>Economic Order Quantity</th>
<th>75</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current Lot Size (Q)</td>
<td>390</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Demand (D)</td>
<td>936</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Order Cost (S)</td>
<td>$45</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unit Holding Cost (H)</td>
<td>$15</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Annual Costs</th>
<th></th>
<th>Annual Costs based on EOQ</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Orders per Year</td>
<td>2.4</td>
<td>Orders per Year</td>
<td>12.48</td>
</tr>
<tr>
<td>Annual Ordering Cost</td>
<td>$108.00</td>
<td>Annual Ordering Cost</td>
<td>$561.60</td>
</tr>
<tr>
<td>Annual Holding Cost</td>
<td>$2,925.00</td>
<td>Annual Holding Cost</td>
<td>$562.50</td>
</tr>
<tr>
<td>Annual Inventory Cost</td>
<td>$3,033.00</td>
<td>Annual Inventory Cost</td>
<td>$1,124.10</td>
</tr>
</tbody>
</table>

Figure 3.5 – Total Annual Cycle-Inventory Costs Based on EOQ
Class Exercise 1

• An annual demand of 2000 items, cost of replenishing an order is N$400.00, carrying cost is 25% and the purchase price per item is N$100.00.

Required: Calculate the EOQ

• If there are 50 units on the pallets, the order quantity would be established at 250 units.

• Required: calculate the Annual Total Inventory Cost
When to Order?

The reorder point defines when a replenishment should be initiated. Reorder point is stated in terms of units or days’ supply. 

ROP formula:  \( R = D \times T \)

Where: 
- \( R \) = Reorder points in units
- \( D \) = Average Daily demand in units
- \( T \) = Average Performance cycle length in days

e.g. assume demand of 20 units/day and a 10-day performance cycle

\[ R = R \times T \]

= 20 units/day \times 10 \text{ days} \quad = 200 \text{ units}

Alternatively, Reorder point is defined in terms of days of supply, which is 10 Days.
In terms of uncertainty in demand or performance cycle length, safety stock is required. The reorder point formula is then:

\[ R = D \times T + SS \]

Where:
- \( R \) = Reorder points in units
- \( D \) = Average daily demand in units
- \( T \) = Average Performance cycle length in days
- \( SS \) = Safety Stock in units
Target stock level system (TSL)

The level at which inventory is topped up when ordering cycle reach the level of ordering at fixed times. This procedure follows steps ROP=D*T:

Step 1: specify a day each week / month on which to place order

Step 2: Review the stock on a chosen day

Step 3: Calculate the order quantity, \( Q = TSL - \text{stock on hand} - \text{supply orders outstanding within the current lead times} \)

Therefore, \( TSL = D \times (T + P) + SS \)

Where: TSL= Target stock level

- \( D = \) Daily or weekly demand
- \( T = \) average lead time in days or weeks
- \( P = \) reviewed period in days or weeks
Target stock level system (TSL) (Cont’d..)

Example:
Assume deliveries take place *once a week* and the average demand is 20 units per week. The lead time is 5 weeks. There is no uncertainty in demand and lead time.

\[
TSL = D \times (T + P) + SS
\]

\[
TSL = 20(5+1) + 0
\]

= 120 units to be topped up after review have been done.

**Assuming** that there is 30 Units in stock at review time

Order quantity = 120 - 30 = 90
Class Exercise 2

PQR LTD has an annual demand of 104,000 with a replenishing order cost of N$ 1,200, a carrying cost percentage of 18% and a purchase price of N$30 per unit, you are required to:

- Calculate the EOQ
- Calculate the ROP if the safety stock level is set to 3,800 and the lead time is 4 weeks
- Calculate the TSL if the weekly demand is 2,000 units, the lead time is 6 weeks and the review is done once per week. There is no uncertainty in demand and lead time
8. Inventory Replenishment System

- **Collaborative Planning, Forecasting and Replenishment**: this process is initiated by the fast-moving consumer goods (FMCG) industries to achieve the such coordination.

- CPFR coordinates the requirements planning process between the supply chain partners for demand creation and demand fulfilments activities.

- CPRF shares information involving promotions, forecasts, item data and order using a system or internet.

- Information developed collaboratively is used by planners to generate demand, determine replenishment requirements and match production to demands.
Inventory Replenishment System (Cont’d..)

- Joint Business Planning: customers and suppliers share, discuss, coordinate & rationalize individual strategies to form a joint plan.

- Joint calendar is created to share information determining the product flow.

- A common sales forecast is created and shared between retailer & supplier based on knowledge of each supply chain partner’s plan.

- Forecast and requirements plan is exchange and refined by partners until consensus is reached.
Homework

*Home work: research on the following collaborative inventory replenishment!*

- Quick Response
- Vendor Managed Inventory
- Profile replenishment
Types of Collaborative Inventory Replenishment

- **Quick Response**: the sharing of retail sales information among supply chain participants.

- Continuous sharing of information as regards the availability and delivery reduces uncertainty in demand and supply across the total supply chain.

- It reduces the need for safety stock

- It increases the flexibility of the supply chain

- QR enable the company to react faster to market changes and run operations in cost-effective manner to satisfy the end consumers needs.
Principles of Quick Response

- Activities regarding the inventory flow must be driven by and harmonized with the demand and behaviour of end-consumers.
- QR may be considered as the application of JIT in a distribution environment.
- The focus should be on reducing lead times.
- Access to and sharing of information in the supply chain is important for the QR concept.
Inventory replenishment system (cont’d..)

- **Vendor inventory management (VMI):** similar to QR however it eliminates the need for the downstream customer to place a replenishment order.
  - Suppliers manages the customer’s stock and plans replenishment orders based on inventory balances and demand information.
  - Suppliers commits to maintaining appropriate inventory levels on the customer’s premises.
- **Profile replenishment:** an extension of QR and VMI, whereby the supplier anticipates future demand based on overall knowledge of the market for a specific product category.
- Categories provide details about the size, colours and products likely to sell in a retail store
- Suppliers can simplify retailer involvement
  - by eliminating the need for the retailer to keep records of sales and inventory levels.
9. Inventory Control system through ABC Analysis

a) The purpose of inventory control

- Superior customer service
  - Relate to availability from current inventory
- Relatively low inventory costs
  - Minimum possible amount of cash tied up in inventory and space.
- Lowest possible total operating costs
  - A trade-off among the costs of the major logistics activities.
  - Major operating costs are:
    - Warehousing operations
    - Inventory
    - Purchasing
    - Transport
Inventory Control system through ABC Analysis (Cont’d..)

b) ABC Analysis (Pareto analysis)
   - Economist Villefredo Pareto found that 20% of the people controlled 80% of wealth.
     - The minority has the greatest importance and majority has the little importance is broaden to include situations, referred to Pareto Principle.
   - Examples of Pareto Principles:
     20% of products account for 80% of the sales
     80% of the stock value is caused by 20% of the stock lines.
     80% of purchased items come from 20% of the suppliers.
     80% of the warehouse space is occupied by 20% of the stock lines.
     20% of the stock lines give 80% of the turnover.
Pareto analysis forms the basis of inventory control and is an important management tool that can be used to minimize effort and obtain the best results.

80/20 rule

Efforts and control should focus on high-costs and high-impacts areas.

20% of the stock lines that cause 80% of the cost should be subject to tight control to reduce costs.

Tight control on 20% of the lines that contribute to 80% of the turnover could result in excellent customer service.

Measures of ABC classification of inventory includes:

- Annual sales
- Profit contribution
- Inventory value
- Usage rate (demand) and nature of the item

Product value is the most determinant of inventory-carrying cost, hence a combination of annual sales and product value is an appropriate measure.

Annual turnover = annual demand × unit cost
Classification of product lines based on annual turnover:
- A class = 10% of lines contributing to 65% of turnover
- B class = 20% of lines contributing to 25% of turnover
- C class = 70% of lines contributing to 10 percent of turnover
Solved problem 1

Booker’s Book Bindery divides SKUs into three classes, according to their dollar usage. Calculate the usage values of the following SKUs and determine which is most likely to be classified as class A.

<table>
<thead>
<tr>
<th>SKU Number</th>
<th>Description</th>
<th>Quantity Used per Year</th>
<th>Unit Value ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Boxes</td>
<td>500</td>
<td>3.00</td>
</tr>
<tr>
<td>2</td>
<td>Cardboard (square feet)</td>
<td>18,000</td>
<td>0.02</td>
</tr>
<tr>
<td>3</td>
<td>Cover stock</td>
<td>10,000</td>
<td>0.75</td>
</tr>
<tr>
<td>4</td>
<td>Glue (gallons)</td>
<td>75</td>
<td>40.00</td>
</tr>
<tr>
<td>5</td>
<td>Inside covers</td>
<td>20,000</td>
<td>0.05</td>
</tr>
<tr>
<td>6</td>
<td>Reinforcing tape (meters)</td>
<td>3,000</td>
<td>0.15</td>
</tr>
<tr>
<td>7</td>
<td>Signatures</td>
<td>150,000</td>
<td>0.45</td>
</tr>
</tbody>
</table>
Solved Problem 1 (Cont’d..)

SOLUTION

The annual dollar usage for each item is determined by multiplying the annual usage quantity by the value per unit. As shown in Figure below, the SKUs are then sorted by annual dollar usage, in declining order. Finally, A–B and B–C class lines are drawn roughly, according to the guidelines presented in the text. Here, class A includes only one SKU (signatures), which represents only 1/7, or 14 percent, of the SKUs but accounts for 83 percent of annual dollar usage. Class B includes the next two SKUs, which taken together represent 28 percent of the SKUs and account for 13 percent of annual dollar usage. The final four SKUs, class C, represent over half the number of SKUs but only 4 percent of total annual dollar usage.
Solved problem 1

<table>
<thead>
<tr>
<th>SKU Number</th>
<th>Description</th>
<th>Quantity Used per Year</th>
<th>Unit Value ($)</th>
<th>Annual Dollar Usage ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Boxes</td>
<td>500</td>
<td>3.00</td>
<td>1,500</td>
</tr>
<tr>
<td>2</td>
<td>Cardboard (square feet)</td>
<td>18,000</td>
<td>0.02</td>
<td>360</td>
</tr>
<tr>
<td>3</td>
<td>Cover stock</td>
<td>10,000</td>
<td>0.75</td>
<td>7,500</td>
</tr>
<tr>
<td>4</td>
<td>Glue (gallons)</td>
<td>75</td>
<td>40.00</td>
<td>3,000</td>
</tr>
<tr>
<td>5</td>
<td>Inside covers</td>
<td>20,000</td>
<td>0.05</td>
<td>1,000</td>
</tr>
<tr>
<td>6</td>
<td>Reinforcing tape (meters)</td>
<td>3,000</td>
<td>0.15</td>
<td>450</td>
</tr>
<tr>
<td>7</td>
<td>Signatures</td>
<td>150,000</td>
<td>0.45</td>
<td>67,500</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>Total</strong> 81,310</td>
</tr>
</tbody>
</table>
### Solved Problem 1

#### Figure 3.7: Annual Dollar Usage for Class A, B and C SKUs

<table>
<thead>
<tr>
<th>SKU #</th>
<th>Description</th>
<th>Qty Used/Year</th>
<th>Value</th>
<th>Dollar Usage</th>
<th>Pct of Total</th>
<th>Cumulative % of Dollar Value</th>
<th>Cumulative % of SKU</th>
<th>Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>Signatures</td>
<td>150,000</td>
<td>$0.45</td>
<td>$67,500</td>
<td>83.0%</td>
<td>83.0%</td>
<td>14.3%</td>
<td>A</td>
</tr>
<tr>
<td>3</td>
<td>Cover stock</td>
<td>10,000</td>
<td>$0.75</td>
<td>$7,500</td>
<td>9.2%</td>
<td>92.2%</td>
<td>28.6%</td>
<td>B</td>
</tr>
<tr>
<td>4</td>
<td>Glue</td>
<td>75</td>
<td>$40.00</td>
<td>$3,000</td>
<td>3.7%</td>
<td>95.9%</td>
<td>42.9%</td>
<td>B</td>
</tr>
<tr>
<td>1</td>
<td>Boxes</td>
<td>500</td>
<td>$3.00</td>
<td>$1,500</td>
<td>1.8%</td>
<td>97.8%</td>
<td>57.1%</td>
<td>C</td>
</tr>
<tr>
<td>5</td>
<td>Inside covers</td>
<td>20,000</td>
<td>$0.05</td>
<td>$1,000</td>
<td>1.2%</td>
<td>99.0%</td>
<td>71.4%</td>
<td>C</td>
</tr>
<tr>
<td>6</td>
<td>Reinforcing tape</td>
<td>3,000</td>
<td>$0.15</td>
<td>$450</td>
<td>0.6%</td>
<td>99.6%</td>
<td>85.7%</td>
<td>C</td>
</tr>
<tr>
<td>2</td>
<td>Cardboard</td>
<td>18,000</td>
<td>$0.02</td>
<td>$360</td>
<td>0.4%</td>
<td>100.0%</td>
<td>100.0%</td>
<td>C</td>
</tr>
</tbody>
</table>

Total

$81,310
**ABC Classification Example:** Assume a firm has ten stock keeping units (SKU). Given the annual demand and the cost we can determine the turnover for the firm.

<table>
<thead>
<tr>
<th>SKU</th>
<th>Demand</th>
<th>Cost</th>
<th>Turnover</th>
<th>Turnover %</th>
</tr>
</thead>
<tbody>
<tr>
<td>101</td>
<td>55</td>
<td>18</td>
<td>990</td>
<td>2.2</td>
</tr>
<tr>
<td>102</td>
<td>265</td>
<td>28</td>
<td>7420</td>
<td>16.2</td>
</tr>
<tr>
<td>103</td>
<td>5</td>
<td>38</td>
<td>190</td>
<td>0.4</td>
</tr>
<tr>
<td>104</td>
<td>125</td>
<td>13</td>
<td>1625</td>
<td>3.5</td>
</tr>
<tr>
<td>105</td>
<td>25</td>
<td>35</td>
<td>875</td>
<td>1.9</td>
</tr>
<tr>
<td>106</td>
<td>990</td>
<td>30</td>
<td>29700</td>
<td>64.9</td>
</tr>
<tr>
<td>107</td>
<td>15</td>
<td>20</td>
<td>300</td>
<td>0.7</td>
</tr>
<tr>
<td>108</td>
<td>1250</td>
<td>3</td>
<td>3750</td>
<td>8.2</td>
</tr>
<tr>
<td>109</td>
<td>30</td>
<td>10</td>
<td>300</td>
<td>0.7</td>
</tr>
<tr>
<td>110</td>
<td>10</td>
<td>63</td>
<td>630</td>
<td>1.4</td>
</tr>
</tbody>
</table>

4578
Step 1: Ranking stock using ABC classification method-based on the turnover contribution and to assign the ABC class:

<table>
<thead>
<tr>
<th>SKU</th>
<th>Demand</th>
<th>Cost</th>
<th>Turnover%</th>
<th>Cumulative %</th>
<th>Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>106</td>
<td>990</td>
<td>29700</td>
<td>64.9</td>
<td>64.9</td>
<td>A</td>
</tr>
<tr>
<td>102</td>
<td>265</td>
<td>7420</td>
<td>16.2</td>
<td>81.1</td>
<td>B</td>
</tr>
<tr>
<td>108</td>
<td>1250</td>
<td>3750</td>
<td>8.2</td>
<td>89.3</td>
<td>B</td>
</tr>
<tr>
<td>104</td>
<td>125</td>
<td>1625</td>
<td>3.5</td>
<td>92.8</td>
<td>C</td>
</tr>
<tr>
<td>101</td>
<td>55</td>
<td>990</td>
<td>2.2</td>
<td>95.0</td>
<td>C</td>
</tr>
<tr>
<td>105</td>
<td>25</td>
<td>875</td>
<td>1.9</td>
<td>96.9</td>
<td>C</td>
</tr>
<tr>
<td>110</td>
<td>10</td>
<td>630</td>
<td>1.4</td>
<td>98.3</td>
<td>C</td>
</tr>
<tr>
<td>107</td>
<td>15</td>
<td>300</td>
<td>0.7</td>
<td>98.9</td>
<td>C</td>
</tr>
<tr>
<td>109</td>
<td>30</td>
<td>300</td>
<td>0.7</td>
<td>99.6</td>
<td>C</td>
</tr>
<tr>
<td>103</td>
<td>5</td>
<td>190</td>
<td>0.4</td>
<td>100</td>
<td>C</td>
</tr>
</tbody>
</table>
## Policy and control based on ABC classification

<table>
<thead>
<tr>
<th>Class</th>
<th>Characteristics</th>
<th>Policy</th>
<th>Methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Few items</td>
<td>Tight control</td>
<td>Frequent monitoring- daily</td>
</tr>
<tr>
<td></td>
<td>Most of turnover</td>
<td>Personal supervision</td>
<td>Accurate records</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Communication</td>
<td>Sophisticated forecasting</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Balanced safety stock</td>
<td>High service policy</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>Important Items</td>
<td>Lean stock policy</td>
<td>Less frequent monitoring-weekly</td>
</tr>
<tr>
<td></td>
<td>Significant turnover</td>
<td>Typical stock control</td>
<td>Calculated safety stocks</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fast appraisal methods</td>
<td>Limited order value</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Managed by exception</td>
<td>Computerised</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Exception reporting</td>
</tr>
<tr>
<td>C</td>
<td>Many items</td>
<td>Minimum supervision</td>
<td>Simple system</td>
</tr>
<tr>
<td></td>
<td>Low turnover value</td>
<td>Supply of order where possible-</td>
<td>Avoid stock shortages or excess</td>
</tr>
<tr>
<td></td>
<td>Few movement of low-value items</td>
<td>keep stock centrally</td>
<td>Infrequent ordering</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Large order quantities</td>
<td>Automatic system</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Zero or high safety stock policy</td>
<td></td>
</tr>
</tbody>
</table>
Stock Cover

- Inventory control aims to drive stock towards appropriate levels determined by supply and demand.
- Inventory performance of each item is monitored using a measurement stock balance.
- Stock cover (is an appropriate measure): defined as the time in which inventory will be depleted at an average demand.

\[
\text{Stock cover} = \text{current stock} \times 52 \div \text{annual demand}
\]

- Stock cover results into a number of weeks that the current inventory will last.
- Stock cover indicates whether the stock is in right ballpark & gives an insight into the priority for action.
- Stock turnover is the same as stock cover, and it measure the effectiveness of inventory management.

**Stock targets based on ABC**

- An allowable stock cover range can be set for ABC inventory categories in a ratio which 1:3:7.
  - A class: between one and four weeks
  - B class: between two and eight weeks
  - C class: between three and twenty weeks
References


Next Chapter

Warehousing Procedures

Thank you!