

Chapter Five

Inventory Management

The term inventory refers to **current assets, which will be used in production or sold in the future in the normal course of business operations.** Inventory is a necessary current asset that permits the production-sale process to operate with minimum of disturbance. Like accounts receivable, inventory represents a significant monetary investment on the part of most firms. Inventory management is concerned with keeping enough inventory on hand to avoid running out of stock while at the same time maintaining a small enough inventory balance to allow for a reasonable return on investment.

Types of Inventory

The three basic types of inventories are: **raw materials inventory, Work-in process inventory and finished goods inventory.**

Raw Materials Inventory- Raw materials inventory consists of items purchased by the firm for use in the manufacture of a finished product. If a firm manufactures complex products with numerous parts, its raw materials inventory may consist of manufactured items that have been purchased from another company or from another division of the same firm.

Work-In-Process Inventory -Work-in process inventory consists of all items that are currently in production process. These are normally partially finished goods at some intermediate stage of completion. An inventory of partially completed units allows the separation of different phases of the production process. The amount of work-in-process inventory is in part a function of the type of product, the measurement period, and the nature of the production process.

Finished Goods Inventory - Finished goods inventory consists of items that have been produced completely but not yet sold. An inventory of finished goods allows separation of production from selling. With a stock of finished merchandise on hand, a firm can fill orders as they are received rather than depend upon the completion of production to satisfy customer demands.

Inventory Management Costs

As it was clearly discussed, the twin goals of inventory management are (i) to ensure that the inventories needed to sustain operations are available, but (ii) to hold the costs of ordering and carrying inventories to the lowest level possible. Relevant inventory management costs are usually grouped into three categories:

- ♦ *Ordering costs*
- ♦ *Carrying costs*
- ♦ *Stock out costs*

Ordering Costs- Every time an order is placed for stock replenishment, certain costs are involved. The ordering cost may vary, dependent upon the type of item. However, an estimated ordering cost can be obtained for a

given range of items. Ordering costs are normally stated as Birr per order. Costs of ordering include:

- ♦ Paper work costs of typing and dispatching an order.
- ♦ Follow-up costs-includes the travel cost for purchase follow-up, telephone, telex and postal bills.
- ♦ Costs involved in receiving the order, inspection, checking, and handling to the stores.

Carrying Costs: Carrying costs constitute all the costs of holding items in inventory for a given period of time. They are expressed either in Birr per unit per period or as a percentage of the inventory value per period. Components of this cost include the following:

- ♦ Storage and handling costs.
- ♦ Obsolescence and deterioration costs.
- ♦ Insurance.
- ♦ Taxes.
- ♦ The cost of the funds invested in inventories.

Stock out Costs: Stock out costs are incurred whenever a business is unable to fill orders because the demand for an item is greater than the amount currently available in inventory. When inventory stock out in raw materials occurs, for example, stock out costs include the expenses of placing special orders (backordering) and expediting incoming orders, in addition to the costs of any resulting production delays. A stock out in work-in-progress inventory results in additional costs of rescheduling and speeding production within the plant, and it also may result in lost production costs if work stoppages occur. Finally, a stock out in finished goods inventory may result in the immediate loss of profits if customers decide to purchase the product from a competitor and in potential long-term losses if customers decide to order from other companies in the future.

Inventory Management Techniques

The ultimate goal of an inventory management program is to provide maximum customer service at a minimum cost. Effective inventory management requires effective techniques of inventory control. A proper inventory control not only helps in solving the acute problem of liquidity but also increases profits and causes substantial reduction in working capital requirement of a firm.

Techniques that are commonly used in managing inventory are:

- ♦ *Materials Requirement Planning (MRP) System*
- ♦ *ABC system*
- ♦ *Economic Order Quantity (EOQ) Model*
- ♦ *Just-In-Time (JIT) system*

Materials Requirement Planning (MRP) System

In many manufacturing organizations, production requirements are based directly on the sales forecast. In turn, for each of its products, the company prepares a **bill of materials**- a list of the parts (and their quantities) needed for various products in the production process. To determine overall

material requirements, each sub-assembly or part on the bill of materials is extended or multiplied by the planned number of finished products. This yields the total materials requirement for each product. This is called materials requirement planning (MRP) system. Many companies use a materials requirement planning (MRP) system to determine what to order, when to order, and in what quantity to order materials. The advantage of the MRP system is that it forces the firm to more thoroughly consider its inventory needs and plan accordingly. The objective is to lower the firm's inventory investment without impairing production.

ABC System

One of the most widely recognized concepts of inventory management is referred to as ABC inventory control system. It maintains appropriate control according to the potential savings associated with each category of inventory. For example an item having an inventory cost of Br. 10,000 has a much greater potential for saving of expenses related to maintaining inventories than an item with a cost of Br. 200.

The ABC system is a means of categorizing inventory items into three classes "A," "B" and "C" according to the potential amount of investment to be controlled. The "A" group inventory includes those items that require the largest birr investment. The "B" group inventory consists of the items accounting for the next largest investment. The "C" group typically consists of a large number of items accounting for relatively small birr investment.

Dividing its inventory into "A," "B" and "C" items allows the firm to determine the level and types of inventory control procedures needed. Control of the "A" items should be most intensive because of the high birr investment involved; the perpetual inventory record keeping that allows daily monitoring of these inventory levels is appropriate. "B" items are frequently controlled through periodic checking, possibly weekly, of their levels. "C" items could be controlled by using simple procedures. In general, the ABC inventory control system is an inventory technique, which controls expensive inventory items more closely than less expensive inventory items.

Just-In- Time (JIT) Inventory System

Just-in-time inventory management system is part of a manufacturing approach that seeks to reduce the company's operating cycle and associated costs by eliminating wasteful procedures. As its name implies, the idea is that all inventories are acquired and used in production at the exact time and at the right quantity they are needed. While raw materials inventory and work-in-process inventory can never be reduced to zero, the notion of JIT is one of extremely tight control so as to minimize inventory size as low as possible.

However, the use of JIT inventory system requires close coordination between a company and its suppliers, because any interruption in the flow of parts and raw materials from the supplier can result in costly production delays and lost sales. A JIT system requires extensive cooperation among all

parties involved in the process - suppliers, shipping companies, and the firm's employees. Because its objective is to minimize inventory investment, a JIT system uses no, or very little, safety stocks.

The Economic Order Quantity (EOQ) Model

Given the significance of the benefits and costs associated with holding inventories, it is important that the firm efficiently control the level of inventory investments. A number of inventory management or control models are available that can help in determining the optimal inventory level of each item. One of these models is economic order quantity (EOQ) model.

The EOQ model assumes the annual demand or usage for a particular inventory item is known with certainty. It also assumes that this demand is stationary or uniform throughout the year. In other words, seasonal fluctuations in the rate of demand are ruled out. Finally, the model assumes that orders to replenish the inventory item are filled instantaneously. That means the lead-time is zero. Lead-time is the time taken from ordering inventory to the supplier until the ordered inventory is received from the supplier.

Given a known and constant demand and a zero lead-time for replenishing inventories, there is no need for a company to maintain additional inventories, or safety stocks to protect itself against stock outs. Thus, this model eliminates the need to consider stock out costs since one can determine exactly when to order the required inventory to avoid stock outs. This model assumes that the costs of placing and receiving an order are the same for each order and independent of the number of units ordered. It also assumes that the annual cost of carrying 1 unit of the item in inventory is constant regardless of the inventory level. Total annual inventory costs, then, are the sum of ordering costs and carrying costs. The primary objective of the EOQ model is to find the order quantity, which minimizes total annual inventory costs, which can obtain algebraically.

Algebraic Form: In developing the algebraic form of the EOQ model, the following variables are used and defined as:

Q = the order quantity in units

D = the annual demand for the item, in units

S = the cost of placing and receiving one order

C = the annual cost of carrying 1 unit of the item in inventory

Total ordering costs are equal to the number of orders per year multiplied by the cost per order, **S**. The number of orders per year is equal to annual demand, **D**, divided by the Economic order quantity, **EOQ**. Total annual carrying costs are equal to average inventory, **EOQ/2**, multiplied by the annual carrying cost per unit, **C**. Therefore, total annual cost of ordering and carrying inventory is the sum of ordering costs and carrying costs:

$$\text{Total cost} = \text{Ordering costs} + \text{Carrying costs}$$

By substituting the variables just defined into the above equation, the following expression is obtained:

$$\text{Total cost} = (\text{Number of orders per year} \times \text{cost per order}) + (\text{Average inventory} \times \text{annual carrying cost per unit})$$

Or, in algebraic terms,

$$\text{Total cost} = (D/Q \times S) + (Q/2 \times C)$$

The EOQ is the value of Q that minimizes the total cost. EOQ is the economic order quantity, the amount that is most advantageous for the firm to order each time. It is calculated using the following equation:

$$\text{EOQ} = \sqrt{2SD/C}$$

The following example illustrates the use of the EOQ model.

Example

Nardos Company sells mattresses through its department stores located in Addis Ababa. All inventories are maintained at the firm's centrally located warehouse. Annual demand for the standard-sized mattress is 3,600 units and is spread uniformly throughout the year. The cost of placing and receiving an order is Br. 31.25. Nardos' annual carrying costs are 20 percent of the inventory value.

Required:

- Determine the EOQ
- Compute annual carrying costs
- Compute annual ordering costs
- Total cost of ordering and carrying costs

Solution

- Based on a wholesale cost of Br. 50 per mattress, the annual carrying cost per mattress, C, is $0.20 \times \text{Br. } 50 = \text{Br. } 10$.

$$\begin{aligned}\text{EOQ} &= \sqrt{2 \times \text{Br. } 31.25 \times 3,600 / \text{Br. } 10} \\ &= 150 \text{ mattresses}\end{aligned}$$

- Annual carrying costs $= (\text{EOQ}/2) \times C = (150/2) \times \text{Br. } 10 = \text{Br. } 750$
- Annual ordering costs $= (D/\text{EOQ}) \times S = (3600/150) \times \text{Br. } 31.25 = \text{Br. } 750$
- Total cost $= \text{ordering costs} + \text{carrying costs} = \text{Br. } 750 + \text{Br. } 750 = \text{Br. } 1,500$