

Inventory Management and Control

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Inventories occupy the most strategic position in the structure of working capital of most business enterprises. It constitutes the largest component of current asset in most business enterprises. In the sphere of working capital, the efficient control of inventory has passed the most serious problem to the cement mills because about two-third of the current assets of mills are blocked in inventories. The turnover of working capital is largely governed by the turnover of inventory. It is therefore quite natural that inventory which helps in maximize profit occupies the most significant place among current assets.

Meaning and Definition of Inventory

In dictionary meaning of inventory is a “detailed list of goods, furniture etc.” Many understand the word inventory, as a stock of goods, but the generally accepted meaning of the word ‘goods’ in the accounting language, is the stock of finished goods only. In a manufacturing organization, however, in addition to the stock of finished goods, there will be stock of partly finished goods, raw materials and stores. The collective name of these entire items is ‘inventory’.

The term ‘inventory’ refers to the stockpile of production a firm is offering for sale and the components that make up the production.

The inventory means aggregate of those items of tangible personal property which

- (i) are held for sale in ordinary course of business.
- (ii) are in process of production for such sales.
- (iii) they are to be currently consumed in the production of goods or services to be available for sale.

Inventories are expandable physical articles held for resale for use in manufacturing a production or for consumption in carrying on business activity such as merchandise, goods purchased by the business which are ready for sale.

It is the inventory of the trader who does not manufacture it.

Finished Goods:

Goods being manufactured for sale by the business which are ready for sale.

Materials:

Articles such as raw materials, semi-finished goods or finished parts, which the business plans to incorporate physically into the finished production.

Supplies:

“Article, which will be consumed by the business in its operation but will not physically as they are a part of the production.

The short inventory may be defined as the material, which are either saleable in the market or usable directly or indirectly in the manufacturing process. It also includes the

items which are ready for making finished goods in some other process or by comparing them either by the concern itself and/or by outside parties. In other words, the term inventory means the material having any one of the following characteristics. It may be

1. saleable in the market,
2. directly saleable in the manufacturing process of the business,
3. usable directly in the manufacturing process of the undertaking, and
4. ready to send to the outside parties for making usable and saleable productions out of it.

In the present study raw materials, stores and spare parts, finished goods and work-in-process have been included inventories. Firm also manufactures inventory to supplies.

Supplies included office and plant cleaning materials (soap, brooms etc. oil, fuel, light bulbs and the likes). These materials do not directly enter into the production process, but are necessary for production process. Inventory constitutes the most significant part of current assets of a large majority of companies in India. For example, on an average inventories are more than 57 per cent of current assets in public limited companies and about 60.5per cent in government companies in India. Therefore it is absolutely imperative to manage inventories efficiently and effectively in order to avoid unnecessary investment in them. An undertaking neglecting the management of inventories will be jeopardizing its long

run profitability and may fail ultimately. It is possible for a company to reduce its level of inventories to a considerable degree *e.g.* 10 to 20 per cent without any adverse effect on production and sales.

Management of Inventories

Inventories consist of raw materials, stores, spares, packing materials, coal, petroleum products, works-in-progress and finished products in stock either at the factory or deposits. It is most important component of current assets in the cement industry and was 42 per cent of total current assets for sample companies as on March 31, 2004. In other industries too it is very important component of total investment.

The maintenance of inventory means blocking of funds and so it involves the interest and opportunity cost to the firm. In many countries specially in Japan great emphasis is placed on inventory management. Efforts are made to minimize the stock of inputs and outputs by proper planning and forecasting of demand of various inputs and producing only that much quantity which can be sold in the market.

The inventory cost is not only interest on stocks but also cost of store building for storage, insurance and obsolesce and movement of inputs from place of storage to the factory where the materials have to be finally used to convert them into finished goods. In japan industries have adopted concept of JIT (Just in Time) and components, materials are received when required for which detailed instructions are given to suppliers. There are many engineering companies who receive

components directly at assembly point and that too only for 3-4 hours requirements at a time. Even in case of bulk materials like iron ore, which is imported from abroad, the minimum possible inventory is kept.

As against this by and large in India the inventory of coal, raw materials and packing materials is very high and many items become junk or obsolete causing heavy loss to the enterprise. Lack of inventory planning in India has been pointed out by various committees but due to uncertainties in supplies, problem of timely receipt of railway wagons, lack of planning and unreliable suppliers the investment in inventories is quit high. The fluctuation in demand affects inventory of finished product of which cement industry has been a victim many times.

The situation in cement industry has been analysed in this chapter after studying the principles of inventory control and relating it with cement industry.

In case of raw materials the first requirement is to study lead time between the date of order and receipt in the factory and same is applicable in case of coal.

In case of cement industry the basic raw material *i.e.* lime stone is not purchased from the market but form one's own queries which are within 10 to 15 Km distance from factory and only in few cases distance is more upto 50 Km. It is transported to cursing mills by trucks, rail or overhead ropeways to the factory. The only uncertainty is with regard to problem of quarrying in quarries, which may be affected due to labour

problem, problem in supplies of electricity or explosives. But in spite of these factors industry feels that 3-4 days of stock of raw material is enough. This, from any standard is on the high side when self-produced raw material is used. Actually for ideal situation there should be stock for a few hours, requirement and at the most for one day need. The industry is keeping larger stocks of limestone because of uncertainties in quarrying and transportation.

Objectives of Inventory Management

The primary objectives of inventory management are:

- (i) To minimize the possibility of disruption in the production schedule of a firm for want of raw material, stock and spares.
- (ii) To keep down capital investment in inventories.

So it is essential to have necessary inventories. Excessive inventory is an idle resource of a concern. The concern should always avoid this situation. The investment in inventories should be just sufficient in the optimum level. The major dangers of excessive inventories are:

- (i) the unnecessary tie up of the firm's funds and loss of profit.
- (ii) excessive carrying cost, and
- (iii) the risk of liquidity.

The excessive level of inventories consumes the funds of business, which cannot be used for any other purpose and thus involves an opportunity cost. The carrying cost, such as the cost of shortage, handling insurance, recording and inspection,

are also increased in proportion to the volume of inventories. This cost will impair the concern profitability further.

On the other hand, a low level of inventories may result in frequent interruptions in the production schedule resulting in under-utilization of capacity and lower sales. The aim of inventory management thus should be to avoid excessive inventory and inadequate inventory and to maintain adequate inventory for smooth running of the business operations. Efforts should be made to place orders at the right time with the right source to purchase the right quantity at the right price and quality. The effective inventory management should

- (i) maintain sufficient stock of raw material in the period of short supply and anticipate price changes.
- (ii) ensure a continuous supply of material to production department facilitating uninterrupted production.
- (iii) minimize the carrying cost and time.
- (iv) maintain sufficient stock of finished goods for smooth sales operations.
- (v) ensure that materials are available for use in production and production services as and when required.
- (vi) ensure that finished goods are available for delivery to customers to fulfil orders, smooth sales operation and efficient customer service.
- (vii) minimize investment in inventories and minimize the carrying cost and time.

- (viii) protect the inventory against deterioration, obsolescence and unauthorized use.
- (ix) maintain sufficient stock of raw material in period of short supply and anticipate price changes.
- (x) control investment in inventories and keep it at an optimum level.

Problems faced by management:

- (i) To maintain a large size inventories for efficient and smooth production and sales operation.
- (ii) To maintain only a minimum possible inventory because of inventory holding cost and opportunity cost of funds invested in inventory.
- (iii) Control investment in inventories and keep it at the optimum level.

Inventory management, therefore, should strike a balance between too much inventory and too little inventory. The efficient management and effective control of inventories help in achieving better operational results and reducing investment in working capital. It has a significant influence on the profitability of a concern.

Inventory Control

Inventory control is concerned with the acquisition, storage, handling and use of inventories so as to ensure the availability of inventory whenever needed, providing adequate provision for contingencies, deriving maximum economy and minimizing wastage and losses.

Hence Inventory control refers to a system, which ensures the supply of required quantity and quality of inventory at the required time and at the same time prevent unnecessary investment in inventories.

It is one of the most vital phase of material management. Reducing inventories without impairing operating efficiency frees working capital that can be effectively employed elsewhere. Inventory control can make or break a company. This explains the usual saying that “inventories” are the graveyard of a business.

Designing a sound inventory control system is in a large measure for balancing operations. It is the focal point of many seemingly conflicting interests and considerations both short range and long range.

The aim of a sound inventory control system is to secure the best balance between “too much and too little.” Too much inventory carries financial rises and too little reacts adversely on continuity of productions and competitive dynamics. The real problem is not the reduction of the size of the inventory as a whole but to secure a scientifically determined balance between several items that make up the inventory.

The efficiency of inventory control affects the flexibility of the firm. Insufficient procedures may result in an unbalanced inventory. Some items out of stock, other overstocked, necessitating excessive investment. These inefficiencies ultimately will have adverse effects upon profits. Turning the situation round, difference in the efficiency of the inventory

control for a given level of flexibility affects the level of investment required in inventory. The less efficient is the inventory control, the greater is the investment required. Excessive investment in inventories increase cost and reduce profits, thus, the effects of inventory control of flexibility and on level of investment required in inventories represent two sides of the same coin.

Control of inventory is exercised by introducing various measures of inventory control, such as ABC analysis fixation of norms of inventory holdings and reorder point and a close watch on the movements of inventories.

Inventories Control Techniques

ABC Analysis of Inventories

The ABC inventory control technique is based on the principle that a small portion of the items may typically represent the bulk of money value of the total inventory used in the production process, while a relatively large number of items may from a small part of the money value of stores. The money value is ascertained by multiplying the quantity of material of each item by its unit price.

According to this approach to inventory control high value items are more closely controlled than low value items. Each item of inventory is given A, B or C denomination depending upon the amount spent for that particular item. "A"

or the highest value items should be under the tight control and under responsibility of the most experienced personnel, while “C” or the lowest value may be under simple physical control.

It may also be clear with the help of the following examples:

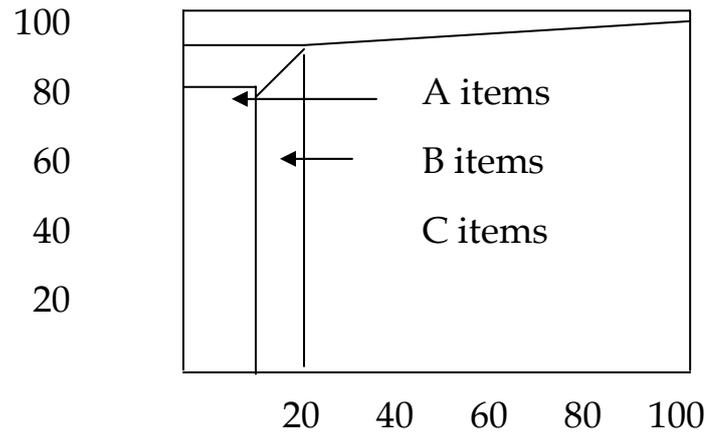
“A” Category - 5% to 10% of the items represent 70% to 75% of the money value.

“B” Category - 15% to 20% of the items represent 15% to 20% of the money.

“C” Category - The remaining number of the items represent 5% to 10% of the money value.

The relative position of these items show that items of category A should be under the maximum control, items of category B may not be given that much attention and item C may be under a loose control.

Particulars	A item	B item	C item
Control	Tight	Moderate	Loose
Requirement	Exact	Exact	Estimated
Check	Close	Some	Little
Expenditure	Regular	Some	No
Posting	Industrial	Individual	Group/none
Safety Stock	Low	Medium	Lare



After classification, the items are ranked by their value and then the cumulative percentage of total value against the percentage of item are noted. A detailed analysis of inventory may indicate above figure that only 10 per cent of item may account for 75 per cent of the value, another 10 per cent of item may account for 15 per cent of the value and remaining percentage items may account for 10 per cent of the value. The importance of this tool lies in the fact that it directs attention to the key items.

Advantages of ABC Analysis

1. It ensures a closer and a more strict control over such items, which are having a sizable investment in there.
2. It releases working capital, which would otherwise have been locked up for a more profitable channel of investment.
3. It reduces inventory-carrying cost.
4. It enables the relaxation of control for the 'C' items and thus makes it possible for a sufficient buffer stock to be created.

5. It enables the maintenance of high inventory turn over rate.

Fixation of Norms of Inventory Holdings

Either by the top management or by the materials department could set the norms for inventories. The top management usually sets monetary limits for investment in inventories. The materials department has to allocate this investment to the various items and ensure the smooth operation of the concern. It would be worthwhile if norms of inventories were set by the management by objectives, concept. This concept expects the top management to set the inventory norms (limit) after consultation with the materials department. A number of factors enter into consideration in the determination of stock levels for individual items for the purpose of control and economy. Some of them are:

1. Lead time for deliveries.
2. The rate of consumption.
3. Requirements of funds.
4. Keeping qualities, deterioration, evaporation etc.
5. Storage cost.
6. Availability of space.
7. Price fluctuations.
8. Insurance cost.
9. Obsolescence price.
10. Seasonal consideration of price and availability.
11. EOQ (Economic Order Quantity), and
12. Government and other statutory restriction

Any decision involving procurement storage and uses of item will have to be based on an overall appreciation of the influence of the critical ones among them. Material control necessitates the maintenance of inventory of every item of material as low as possible ensuring at the same time, its availability as and when required for production. These twin objectives are achieved only by a proper planning of inventory levels. If the level of inventory is not properly planned, the results may either be overstocking or understocking. If a large stock of any item is carried it will unnecessarily lock up a huge amount of working capital and consequently there is a loss of interest. Further, a higher quantity than what is legitimate would also result in deterioration. Besides there is also the risk of obsolescence if the end product for which the inventory is required goes out of fashion. Again, a large stock necessarily involves an increased cost of carrying such as insurance, rent handling charges. Under stocking which is other extreme, is equally undesirable as it results in stock outs and the consequent production holds ups. Stoppage of production in turn, cause idle facility cost. Further, failure to keep up delivery schedules results in the loss of customers and goodwill. These two extreme can be avoided by a proper fixation of two important inventory level *viz*, the maximum level and the minimum level. The fixation of inventory levels is also known as the demand and supply method of inventory control.

Carrying too much or too little of the inventories is detrimental to the company. If too little inventories are maintained, company will have to encounter frequent stock outs and incur heavy ordering costs. Very large inventories subjects the company to heavy inventory carrying cost in addition to unnecessary tie up of capital.

An efficient inventory management, therefore, requires the company to maintain inventories at an optimum level where inventory costs are minimum and at the same time there is no stock out which may result in loss of sale or stoppage of production. This necessitates the determination of the minimum and maximum level of inventories.

Minimum Level

The minimum level of inventories of their reorder point may be determined on the following bases:

- 1 Consumption during lead-time.
- 2 Consumption during lead-time plus safety stock.
- 3 Stock out costs.
- 4 Customers irritation and loss of goodwill and production hold costs.

To continue production during Lead Time it is essential to maintain some inventories. Lead Time has been defined as the interval between the placing of an order (with a supplier) and the time at which the goods are available to meet the consumer needs.

There are sometimes fluctuations in the lead-time and/ or in the consumption rate. If no provision is made for these

variations, stock out may take place-causing disruption in the production schedule of the company. The stock, which takes care to the fluctuation in demand, varies in lead-time and consumption rate is known as safety stock. Safety stock may be defined as the minimum additional inventory, which serves as a safety margin or buffer or cushion to meet an unanticipated increase in usage resulting from an unusually high demand and or an uncontrollable late receipt of incoming inventory. It can be determined on the basis of the consumption rate, plus other relevant factor such as transport bottleneck, strikes or shutdowns.

In the case of uncertainly, the probabilistic approach may be applied to determine the safety margin. To avoid stock out arising out of such eventualities, companies always carry some minimum level of inventories including safety stock. Safety stock may not be static for all the times. A change in the circumstances and in the nature of industry demand, necessitates are adjusted in its level. In this study an effort has been made to examine how the current companies determine their minimum level for re-order inventories, safety stock, whether a level of study is maintained throughout the year or not.

For each type of inventory a maximum level is set that demand presumably will not exceed as well as a minimum level representative a margin of safety required to prevent out of stock condition. The minimum level also governs the ordering point. An order to sufficient size is placed to bring

inventory to the maximum point when the minimum level is reached.

Maximum Level

The upper limit beyond which the quantity of any item is not normally allowed to rise is known as the “Maximum Level”. It is the sum total of the minimum quantity, and ECQ. The fixation of the maximum level depends upon a number of factors, such as, the storage space available, the nature of the material *i.e.* chances of deterioration and obsolescence, capital outlay, the time necessary to obtain fresh supplies, the ECQ, the cost of storage and government restriction.

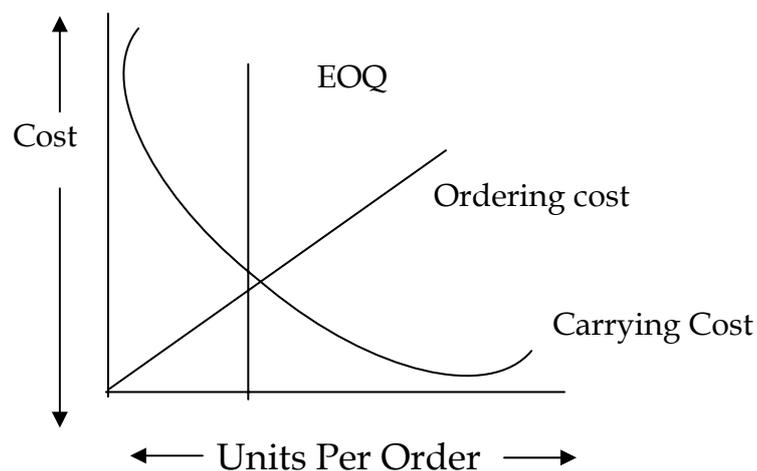
Re-Order Level

Also known as the ‘ordering level’ the reorder level is that level of stock at which a purchase requisition is initiated by the storekeeper for replenishing the stock. This level is set between the maximum and the minimum level in such a way that before the material ordered for are received into the stores, there is sufficient quantity on hand to cover both normal and abnormal circumstances. The fixation of ordering level depends upon two important factors *viz*, the maximum delivery period and the maximum rate of consumption.

Re-Order Quantity

The quantity, which is ordered when the stock of an item falls to the reorder level, is known as the reorder quantity or the EOQ or the economic lot size. Although it is not a stock level as such, the reorder quantity has a direct bearing upon the stock level in as much as it is necessary to consider the maximum

and minimum stock level in determining the quantity to be ordered. The re-order quantity should be such that, when it is added to the minimum quantity, the maximum level is not exceeded. The re-order quantity depends upon two important factors *viz*, order costs and inventory carrying costs. It is, however, necessary to remember that the ordering cost and inventory carrying cost are opposed to each other. Frequent purchases in small quantities, no doubt reduce carrying cost, but the ordering costs such as the cost of inviting tenders of placing order and of receiving and inspection, goes up. If on the other hand purchases are made in large quantities, carrying costs, such as, the interest on capital, rent, insurance, handling charges and losses and wastage, will be more than the ordering costs. The EOQ is therefore determined by balancing these opposing costs.



Economy Order Quantity

The EOQ refers to the order size that will result in the lowest total of order and carrying costs for an item of

inventory. If a firm place unnecessary orders it will incur unneeded order costs. If a firm places too few order, it must maintain large stocks of goods and will have excessive carrying cost. By calculating an economic order quantity, the firm identifies the number of units to order that result in the lowest total of these two costs.

The constraints and assumption followed:

1. **Demand is known--** Using past data and future plans a reasonably accurate prediction of demand can often be made. This is expressed in unit sold in a year.

2. **Sales occur at a constant rate--** This model may be used for goods that are sold in relatively constant amount throughout the year. A more complicated model is needed for firms whose sales fluctuate in response to there seasonal cyclical factors.

3. **Cost of running of goods are ignored--** Cost associated with storage, delays or lost sales are not considered. These costs are considered in the determination of safety level in the re-order point subsystem.

4. **Safety stock level is not considered--** The safety stock level is the minimum level of inventory that the firm wishes to hold as a protection against running out. Since the firm must always be above this level the EOQ need not be considered the safety stock level.

$$\text{Total Ordering Cost (TOC)}=(A/Q)*O$$

$$\text{Average Inventory}=Q/2$$

$$\text{Total Carrying Cost (TCC)}=(Q/2)*C$$

Total Inventory Cost=TOC+TCC

Total Cost=(AO/2)+(QC/2)

Where A=total annual demand

Q=Quantity order in units

O=Order cost per order

C=Carrying cost per unit

The basic formula is $EOQ = \frac{2(U)(OC)}{CC\%PP}$

Where 2=mathematical factor that occurs during the deriving of the formula, U-Units sold per year, a forecast provided by the marketing department. OC=Cost of placing each order for more inventory provided by cost accounting. CC% = Inventory carrying cost expressed as a percentage of the average value of the inventory, an estimate usually provided by cost accounting. PP = Purchase price per each unit of inventory supplied by the purchasing department.

Trial and error approach

Select a number of possible lot (Order) sizes to purchase, then determine the total cost for each lot size chosen, now select the ordering quantity that minimizes the total cost.

Quantity Discount and Order Quantity

The standard EOQ analysis is based on the assumption that the price per unit remains constant irrespective of the order size. When quantity discount are available which is often the case, price per unit is influenced by the ordered quantity. This violates the applicability of the EOQ formulas. However

the EOQ framework can still be used as a starting point for analyzing the problem.

To determine the optimal order size when quantity discount is available, the following procedures may be followed:

1. Determine the order quantity using the standard EOQ formula assuming no quantity discount.
2. If Q enable the firm to get quantity discount then it represents the optimal order size.
3. If Q is less then the minimum order size required for quantity discount (call it- Q^2) compute to change in profit as a result of increasing the order quantity from O^1 to O^2 as follows.

$$=AD+[A/Q^1-A/Q^2] O-[Q^2((P-D)/2)-(Q^1PC/2)$$

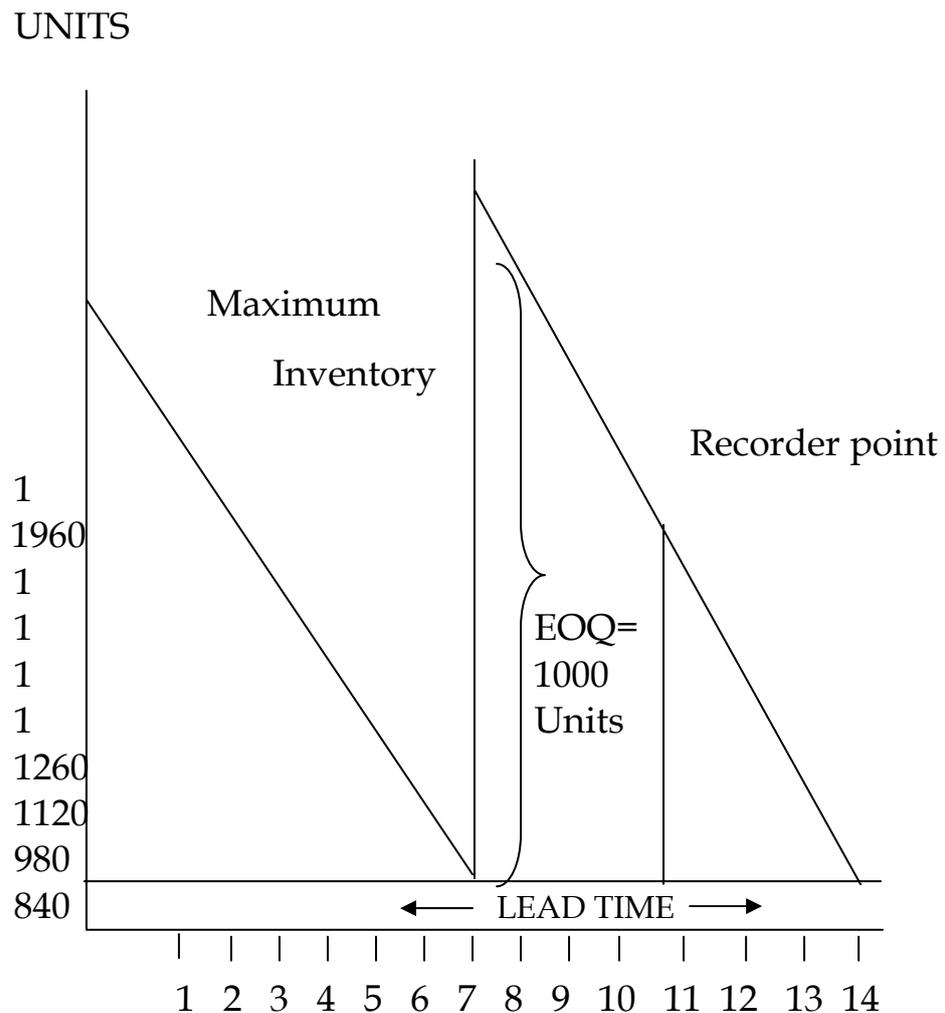
= Change in profit, A = total demand, D = discount per unit when quantity discount is available, Q^1 = EOR assuming no discount, Q^2 = minimum order size required for quantity discount, O = order cost, P = Purchase price without discount, C = carrying cost

4. If change in profit is positive = Q^2
If change in profit is positive = Q^1

Stock Level Sub-system

This system keeps track of the goods held by the firm, the insurance of goods, and the arrival of order. It is made up of the records accounting for the goods in stock. Thus the stock level subsystems maintain record of the current level of inventory for any period of time, the current level is calculated

by taking the beginning inventory, adding the inventory received and subtracting the cost of goods sold. When ever those subsystems reports that an item is at a below the recorder pt level, the firm will begin to place an order for the item.



Uncertainty and Safety Stock

In practice, the demand or usage of inventory is not generally known with certainty. Usually it fluctuates at a given period of time. In this case formula is (Maximum daily usage rate x Maximum lead time) - (Average daily usage rate x Average lead time).

Reorder Point

The reorder point is the level of inventory at which the firm places an order in the amount of EOQ. If the firm places the order when the inventory reaches the reorder point, the new goods will arrive before the firm runs out of goods to sell.

In designing reorder point subsystem, three items of information are needed as inputs to the subsystem.

1. **Usage rate--** This is the rate per day at which the item is consumed in production or sold to customers. It is expressed in units. It may be calculated by dividing annual sales by 365 days. If the sales are 50,000 units the usage rate is $50,000/365 = 137$ Units per day.
2. **Lead time--** This is the amount of time between placing an order and receiving goods. This information is usually provided by the purchasing department. The time to allow for an order to arrive may be estimated from a check of the company's record and the time taken in the past for different suppliers to fill orders.
3. **Safety stock--** The minimum level of inventory may be expressed in terms of several days' sales. The level can be calculated by multiplying the usage rate and time in the number of days that the firm wants to hold as a protection against shortages.

$$\begin{aligned} \text{Re-order point} &= (\text{Usage rate})(\text{Lead time} + \text{Days of safety}) \\ &= (\text{Lead Time} \times \text{Consumption rate}) + \text{Safety stock.} \end{aligned}$$

The probabilistic approach is found to be cumbersome and unfeasible for a multi period problem. It is proposed an order point whereby an order is placed. When inventory reaches so many units (See Arthur Snyder, "Principle of inventory management," *Financial Executive*, 32 (April 64 (13-21));

Re-order point $S(L) + F\sqrt{SR(L)}$

L = Lead Time

R = Average number of units per order

F = Stock out acceptance factor.

The foregoing analysis is based on certain simplifying assumption. In the real worked some additional consideration ought to be taken into account:

- (i) Anticipated scarcity of raw material
- (ii) Expected price charge
- (iii) Obsolescence risk
- (iv) Government restriction on inventory
- (v) Competitive market.

Pricing of Raw Materials

When issues are made out of various lots purchased at varying prices, the problem arises as to which of the receipt price should be adopted for valuing the materials requisitions.

1. First in first out

Materials received first will be issued first. The price of the earliest consignment is taken first and when that consignment is exhausted the price of the next consignment is adopted and so on. This method is suitable in times of falling

prices, because the material charge to production will be high while the replacement cost of materials will be low.

2. Last in first out

Materials received last will be issued first. The price of the last consignment is taken first and when that consignment is exhausted the price of the second last consignment is adopted and so on. In timing of rising prices this method will show a charge to production, which is closely related to current price levels provided that the last purchase is made recently.

3. Weighted average cost method

Under this method, material issued is priced at the weighted average cost of material in stock:

$$\text{WAC} = \text{Value of material in stock} / \text{Quantity in stock.}$$

4. Standard price method

Under this method a standard price is predetermined. The price of issues predetermined for a stated period taken into account all the factors affecting price such as anticipated market trends, transportation charges, and normal quantity of purchase. Standard prices are determined for each material and material requisition are priced at standards irrespective of the actual purchase price. Any difference between the standard and actual price results in materials price variance.

5. Current price

According to this method, material issued is priced at their replacement or realizable price at the time of issue. So the cost at which identical material could be purchased from the

market should be ascertained and used for valuing material issues.

Perpetual Inventory System

Another method of inventory control is the maintenance of inventory control on a continuous basis. After the material are received into the stores, the storekeeper will arrange for the storing of each item in the allotted rack, bin, shelf or other receptacles and attach a card to each bin for the purpose of making entries there-in, relating to the receipts, issues and balance. The bin card or the locker card, this becomes a perpetual inventory record for each item of stores. If the stores balance is recorded on continuous basis after every receipt and issue, the record is said to be one of perpetual inventory and the method of recording is called the perpetual inventory system. Thus the perpetual inventory is a method of recording store balance after every receipt and issue to facilitate regular checking and to obviate closing down for stock locking

As a perpetual inventory record, the bin card records the receipt, issues and the balance of every item of stores only in physical quantities, and not in value. This feature of the bin card is in accordance with the accepted principle that the storekeeper true to his designation, should be responsible for the safe keeping of the items of stores entrusted to him, and his accounting for stores should always be in physical quantities and not in value. The perpetual inventory system includes continues stock taking also.

Stocktaking or stock verification is done mainly with a view to finding out whether the book balances as revealed by the stock records agree with the physical or the ground balance. Although, therefore, stock verification is one of the tools of inventory control, and is done for exercising control over the stock of every item, is an integral part of material control for the purpose of preparing the B/S, the physical verification of stock must be done at the end of year.

Such verification at the end of the year is known as the periodical stock taking as against the continuous stocktaking, which is done throughout the year. The periodic stock taking method usually adopted by concerns which cannot maintain perpetual inventory records due to the nature of the items which are usually stored in open yards and not in bins and as a such, bin cards cannot be employed for them, or do not want to maintain such records and employ stock verification staff to do the work of stock checking throughout the year. Under this method of stocktaking, the verification of the whole of the stock and its valuation are accomplished only once at the close of the financial year and difference in stock is adjusted only once. As such, the stock in hand would tend to be accurate for the balance sheet purposes. It is also possible to find out slow moving items. Nevertheless, the periodic inventory has its own disadvantage. In the first place, it becomes necessary to close down the factory on the day of stock taking. Secondly, discrepancies in stock cannot be corrected by an executive action immediately as and when they occur. Thirdly, since all

the items are checked only once in a particular day, a surprise verification will not be possible. Lastly, reason for the discrepancies cannot be found out because of the long interval between two consecutive verifications.

These disadvantages of the periodical inventory system are overcome in the case of the perpetual inventory system. Under this method of continuous stock verification the purpose of verification is carried on throughout the year by a specially trained staff. This duty is to verify a few selected items in details so that each item is checked up a number of times during the year. The day and time of checking not being known to the staff, they are taken by a surprise. As such, not only secrecy of the items to be verified cannot be maintained, a manipulation of every type can be prevented. Discrepancies are located, reasons are ascertained, the necessary adjustments are made in the accounting records, and correlative action is taken then and there to prevent their recurrence. The advantages of a continuous stocktaking where perpetual inventory records are maintained may thus be summarized as follows:

- (i) The elaborate and costly work involved in periodic stock taking can be avoided.
- (ii) The stock verification can be done without the necessity of closing down the factory.
- (iii) The preparation of interim financial statements becomes possible.

- (iv) Discrepancies are easily located, and corrected immediately.
- (v) It ensure a reliable check on the stores.
- (vi) It exercises a moral influence on the stores staff.
- (vii) Fast and slow moving items can be distinguished and the fixation of proper stock levels prevents not only over-stocking, but under-stocking also.
- (viii) A perpetual inventory record of the nature of the bin cards enables the storekeeper to keep an eye on the stock levels, and replenish the stock of every item whenever the limit falls to the reorder level.
- (ix) It provides a reliable information to the management of the number of units, and the value of every item of stores.
- (x) It ensures secrecy of the items that are verified.

Factors Influences the Level of each Component of Inventory

Raw Material Inventory:

1. The volume of safety stock against material shortages that interrupt production.
2. Considerations of economy in purchase.
3. The outlook for future movements in the price of materials.
4. Anticipated volume of usage and consumption.
5. The efficiency of procurement and inventory control function.
6. The operating costs of carrying the stocks.

7. The costs and availability of funds for investment in inventory.
8. Storage capacity.
9. Re-component cycle.
10. Indigenous or foreign.
11. The lead-time of supply.
12. Formalities for importing.

Work-in-process Inventory:

1. The length of the complete production process.
2. Management policies affecting length of process time.
3. Length of process in runs.
4. Action that speed up the production process, *e.g.* adding second or third production shifts.
5. Management's skills in production scheduling and control.
6. Volume of production.
7. Sales expectations.
8. Level of sales and new orders.
9. Price level of raw materials used, wages and other items that enter production cost and the value added in production.
10. Customer requirements.
11. Usual period of aging.

Finished Goods Inventory:

1. The policy of the management to gear the production to meet the firm order in hand.

2. The policy to produce for anticipated orders and stock keeping.
3. Goods required or the purpose of minimum and safety stocks.
4. Sales policies of the firm.
5. Need for maintaining stability in production.
6. Price fluctuations for the product.
7. Durability, spoilage and obsolescence.
8. Distribution system.
9. Ability to fill orders immediately.
10. Availability of raw material on seasonal basis while customer's demand spread throughout the year.
11. Storage capacity.

Stores and Spares Inventory:

1. Nature of the product to be manufactured and its lead-time of manufacture.
2. State of technology involved.
3. Consumption's patterns.
4. Lead time of supply.
5. Indigenous or foreign.
6. Minimum and safety stock and ordering quantities.
7. Capacity utilization.
8. Importing formalities.

Some of the important inventory policies relates to :

1. minimum, maximum and optimum stocks;
2. safety stocks, order quantities, order levels and anticipated stocks;

3. waste, scrap spoilage and defective;
4. policies relating to alternative use;
5. policies relating to order filling;

Measure of Effectiveness of Inventory Management

1. Size of Inventory = Total inventory/Total Current assets
2. Size of Raw material Inventory = Raw material inventory/Total inventory
3. Size of Work in Process Inventory = Work in process Inventory/Total Inventory
4. Size of Stores and Spares parts Inventory = Stores and Spares parts inventory/Total Inventory
5. Size of Finished Goods Inventory = Finished goods inventory/Total inventory
6. Overall inventory turn over ratio = Cost of goods sold/average total inventories at cost
7. Raw material inventory turnover ratio = Annual consumption of Raw material / Average Raw material inventory
8. Work-in-process inventory turnover ratio = Cost of manufacture/average work-in-process inventory at cost
9. Finished Goods inventory turnover ratio = Cost of goods sold / Average finished stock
10. Stores and spare parts inventory turnover ratio = Stores and Spares consumed/Average stock of stores and spares
11. Age of Finished Goods inventory = 365/Finished Goods inventory turnover ratio

12. Average age of raw material inventory = $365/\text{Raw material inventory turnover ratio}$
13. Average age of Work-in-Process inventory = $365/\text{Work-in-Process inventory turnover ratio}$
14. Age of Stores and spare parts inventory = $365/\text{Stores and spare parts inventory turnover ratio}$
15. Inventory holding period = $365/\text{Inventory turn over ratio}$

Control and Review

The efficiency of inventory control affects the flexibility of the firm. There are several tools of inventory control. Some of these are:

- (1) The economic order quantity which enables determination of optimal size of order to place on the basis of demand or usage of the inventory.
- (2) The technique of safety stocks to overcome problems of uncertainty.
- (3) The order point formula, which tells us, the optimal point at which to reorder a particular item of inventory.

Together, these tools provide the means for determining an optimal average level of inventory for the firm.

Ratio analysis has a wider application as a measure of inventory control among most manufacturing firms. Some of the important ratios are explained below:

- (1) Inventory to Sales (Total Inventory/Sales for the Period)

The ratio explains variations in the level of investment. An increase in inventory levels, substantially beyond that

which might be expected from an increase in sales, may reflect such phenomena as the result of a conscious policy shift to higher stock levels, of unintended accumulation of unsold stocks, and of inventory speculation, or simply stocking in anticipation of an almost certain surge of orders.

(2) Inventory Turnover (Cost of Goods Sold/Average Inventory)

The ratio tells us the rapidity with which the inventory is turned over into receivables through sales. Generally, the higher the inventory turnover, the more efficient the management of a firm is. However, a relatively high inventory turnover ratio may be the result of too low a level of inventory and frequent stock outs. Therefore, the ratio must be judged in relation to the past and expected future ratios of the firm and in relations of similar firms or the industry average or both.

(3) Sales to Inventory (Annual Net Sales/Inventory at the End of Fiscal Period)

The ratio indicates the volume of sales in relation to the amount of capital invested in inventories. When inventory for a firm is larger in relation to sales (the condition which causes it to have a lower net sales to inventory ratio than other firms) the firm's rate of return is less since it has more working capital tied up in inventories than has the firm with a higher ratio.

(4) Inventory to Current Assets (Total Inventory/Total Current Assets)

The ratio indicates the amount of investment in inventory per rupee of current assets investment. Generally an increasing

proportion of inventory is indicative of inefficient inventory management. The ratio may also indicate the state of liquidity position of concern. The lower the inventory to current assets lowers the liquidity as compared to other current assets, *viz.*, receivables, cash and marketable securities.

(5) Inventories Expressed in Terms of Number of Days Sales
(Inventory/Sales x 365)

The ratio indicates the size of inventory in terms of number of days sales. For this purpose first the sales per day are calculated and inventory is divided by the amount of sales per day. The increasing inventory in terms of number of days sales may indicate either accumulation of inventory or decline in sales. Inventory for this purpose is assumed to include finished goods only. While the former situation signifies poor inventory management, the later indicates the poor performance of the marketing department.

(6) Sundry Creditors to Inventory (Sundry Creditors/Inventory)

The ratio reveals the extent to which inventories are procured through credit purchases. Inventories for this purpose are assumed to include raw materials and stores and spares only. If the ratio is less than unity, it reveals that the credit available is lower than the total inventory required. It also explains the extent of inventory procured through cash purchases. Indirectly it emphasizes the inventory financing policy of the firm. If the ratio is more than one, it explains that the entire inventory is purchased on credit.

(7) Inventory to Net Working Capital (Inventory/Net Working Capital)

The ratio explains the amount of inventory per rupee of equity/long-term financed portion of current assets. A higher ratio may mean greater amount of net working capital investment in inventory. In order to control each category of inventory, the following ratios can be calculated.

The size of inventory of selected cement companies has been presented in table 6.1.

Table 6.1

**Size of Inventory of Selected Cement Companies
for the years from 2003-04 to 2007-08**

Year	ACC	Mangalam	Gujarat Ambuja	Shree Cement	India Cement	Industry Average
2003-04	0.27	0.37	0.51	0.40	0.37	0.38
2004-05	0.31	0.41	0.35	0.38	0.26	0.34
2005-06	0.27	0.40	0.31	0.29	0.19	0.29
2006-07	0.32	0.47	0.36	0.33	0.14	0.33
2007-08	0.34	0.51	0.41	0.22	0.12	0.32
Company Average	0.31	0.43	0.39	0.32	0.22	0.33

Source: Based on data provided in Appendix

Five cement companies under study have kept at different levels of inventory during the study period from 2003-04 to 2007-08. Table 6.1 gives a clear picture of inventory kept by the five companies. The size of inventory of all the cement companies shows fluctuating trend throughout the study period except India Cement that shows decreasing trend. The minimum size of inventory in ACC is 0.27 (2003-04). Mangalam is 0.37 (2003-04), Gujarat Ambuja is 0.31 (2005-06),

Shree Cement is 0.22 (2007-08) and in India Cement is 0.12 (2007-08). The maximum size of inventory in ACC is 0.34 (2007-08), Mangalam is 0.51 (2007-08), Gujarat Ambuja is 0.51 (2003-04), and Shree Cement is 0.40 (2003-04) and in India Cement is 0.37 (2003-04).

The size of Raw Material Inventory of selected companies has been given in table 6.2.

Table 6.2

Size of Raw Material Inventory of Selected Cement Companies for the years from 2003-04 to 2007-08

Year	ACC	Mangalam	Gujarat Ambuja	Shree Cement	India Cement	Industry Average
2003-04	0.14	0.11	0.04	0.15	0.07	0.10
2004-05	0.12	0.07	0.04	0.23	0.08	0.11
2005-06	0.15	0.08	0.04	0.30	0.08	0.13
2006-07	0.15	0.05	0.04	0.25	0.10	0.12
2007-08	0.13	0.03	0.05	0.13	0.11	0.09
Company Average	0.14	0.07	0.04	0.21	0.09	0.11

Source: Based on data provided in Appendix

Five cement companies under study have kept at different levels of raw material inventory during the study period from 2003-04 to 2007-08. Table 6.2 gives a clear picture of raw material inventory kept by the five companies. The size of raw material inventory of all the cement companies shows fluctuating trend throughout the study period except Gujarat Ambuja and India Cement which shows decreasing trend. The minimum size of raw material inventory in ACC is 0.12 ((2004-05), Mangalam is 0.03 (2007-08), Gujarat Ambuja is 0.04 (2003-04 to 2006-07), Shree Cement is 0.13 (2007-08) and in India Cement is 0.07 (2003-04). The maximum size of raw material

inventory in ACC is 0.15 (2005-06 and 2006-07). Mangalam is 0.11 (2003-04), Gujarat Ambuja is 0.05 (2007-08), and Shree Cement is 0.30 (2005-06) and in India Cement is 0.11 (2007-08).

The size of Stores and Spares Inventory of selected companies have been presented in Table 6.3

Table 6.3

**Size of Stores and Spares Inventory of Selected Cement Companies
for the years from 2003-04 to 2007-08**

Year	ACC	Mangalam	Gujarat Ambuja	Shree Cement	India Cement	Industry Average
2003-04	0.51	0.56	0.68	0.52	0.60	0.57
2004-05	0.48	0.60	0.64	0.36	0.49	0.52
2005-06	0.51	0.52	0.68	0.45	0.48	0.53
2006-07	0.40	0.56	0.66	0.45	0.39	0.49
2007-08	0.42	0.49	0.61	0.67	0.39	0.51
Company Average	0.46	0.54	0.65	0.49	0.47	0.53

Source: Based on data provided in Appendix

Five cement companies under study have kept at different levels of stores and spare parts inventory during the study period from 2003-04 to 2007-08. Table 6.3 gives a clear picture of stores and spare parts inventory kept by the five companies. The size of stores and spare parts inventory of all the cement companies shows fluctuating trend throughout the study period except India Cement which shows decreasing trend. The minimum size of stores and spare parts inventory in ACC is 0.40 (2006-07), Mangalam is 0.49 (2007-08), Gujarat Ambuja is 0.61 (2007-08), Shree Cement is 0.36 (2004-05) and in India Cement is 0.39 (2006-07 and 2007-08). The maximum size of stores and spare parts inventory in ACC is 0.5 (2003-04 and

2005-06), Mangalam is 0.60 (2004-05), Gujarat Ambuja is 0.68 (2003-04 and 2005-06) and Shree Cement is 0.67 (2007-08) and in India Cement is 0.60 (2003-04).

The Size of Works of Process Inventory of Selected Companies has been given in Table 6.4.

Table 6.4
Size of Work of Process Inventory of Selected Cement Companies
for the years from 2003-04 to 2007-08

Year	ACC	Mangalam	Gujarat Ambuja	Shree Cement	India Cement	Industry Average
2003-04	0.12	0.23	0.19	0.23	0.23	0.20
2004-05	0.17	0.26	0.22	0.15	0.31	0.22
2005-06	0.16	0.33	0.06	0.09	0.31	0.19
2006-07	0.22	0.21	0.18	0.20	0.26	0.21
2007-08	0.25	0.29	0.22	0.03	0.31	0.22
Company Average	0.18	0.26	0.17	0.14	0.28	0.21

Source: Based on data provided in Appendix

Five cement companies under study have kept at different levels of Work-in-Process inventory during the study period from 2003-04 to 2007-08. Table 6.4 gives a clear picture of Work in Process inventory kept by the five companies. The Work in Process inventory of all the cement companies shows fluctuating trend throughout the study period. The minimum Work-in-Process inventory in ACC is 0.12 (2003-04). Mangalam is 0.21 (2006-07), Gujarat Ambuja is 0.06 (2005-06), Shree Cement is 0.03 (2007-08) and in India Cement is 0.23 (2003-04). The maximum Work-in-Process inventory in ACC is 0.25 (2007-08), Mangalam is 0.33 (2005-06), Gujarat Ambuja is 0.22 (2004-05 and 2007-08), and Shree Cement is 0.23 (2003-04) and in India Cement is 0.31 (2004-05, 2005-06, and 2007-08).

Five cement companies under study have kept at different levels of finished goods inventory during the study period from 2003-04 to 2007-08 has been presented in Table 6.5.

Table 6.5

**Size of Finished Goods Inventory of Selected Cement Companies
for the years from 2003-04 to 2007-08**

Year	ACC	Mangalam	Gujarat Ambuja	Shree Cement	India Cement	Industry Average
2003-04	0.23	0.10	0.09	0.10	0.09	0.12
2004-05	0.23	0.07	0.09	0.26	0.12	0.15
2005-06	0.19	0.07	0.22	0.16	0.12	0.15
2006-07	0.24	0.18	0.12	0.11	0.24	0.18
2007-08	0.21	0.20	0.12	0.17	0.19	0.17
Company Average	0.22	0.12	0.13	0.16	0.15	0.16

Source: Based on data provided in Appendix

Table 6.5 gives a clear picture of finished goods inventory kept by the five companies. The size of finished goods inventory of all the cement companies shows fluctuating trend throughout the study period. The minimum size of finished goods inventory in ACC is 0.19 (2005-06), Mangalam is 0.07 (2004-05 and 2005-06), Gujarat Ambuja is 0.09 (2003-04 and 2004-05), Shree Cement is 0.10 (2003-04) and in India Cement is 0.09 (2003-04). The maximum size of finished goods inventory in ACC is 0.24 (2006-07), Mangalam is 0.20 (2007-08).

Five cement companies under study have kept at different levels of inventory holding period during the study period from 2003-04 to 2007-08 has been given in Table 6.6.

Table 6.6
Inventory holding period of Selected Cement Companies
for the years from 2003-04 to 2007-08

Year	ACC	Mangalam	Gujarat Ambuja	Shree Cement	India Cement	Industry Average
2003-04	84	52	153	136	125	110
2004-05	87	49	135	135	157	113
2005-06	75	49	113	99	119	91
2006-07	71	43	102	97	113	85
2007-08	79	62	106	78	121	89
Company Average	79	51	122	109	127	98

Source: Based on data provided in Appendix

Table 6.6 gives a clear picture of inventory holding period kept by the five companies. The inventory-holding period of all the cement companies shows fluctuating trend throughout the study period except Shree Cement that shows decreasing trend. The minimum inventory holding period in ACC is 71 (2006-07), Mangalam is 43 (2006-07), Gujarat Ambuja is 102 (2006-07), Shree Cement is 78 (2007-08) and in India Cement is 85 (2006-07). The maximum inventory-holding period in ACC is 87 (2004-05), Mangalam is 62 (2007-08), Gujarat Ambuja is 106 (2007-08), and Shree Cement is 97 (2003-04) and in India Cement is 113 (2004-05).

Inventory Turnover (Cost of Goods Sold/Average Inventory)

The ratio tells us the rapidity with which the inventory is turned over into receivables through sales. Generally, the higher the inventory turnover, the more efficient the management of a firm is. However, a relatively high inventory turnover ratio may be the result of too low a level of inventory

and frequent stock outs. Therefore, the ratio must be judged in relation to the past and expected future ratios of the firm and in relations of similar firms or the industry average or both.

Five cement companies under study have kept at different levels of inventory turnover during the study period from 2003-04 to 2007-08 has been given in Table 6.7.

Table 6.7
Inventory Turnover of Selected Cement Companies
for the years from 2003-04 to 2007-08

Year	ACC	Mangalam	Gujarat Ambuja	Shree Cement	India Cement	Industry Average
2003-04	4.34	7.03	2.39	2.69	2.92	3.87
2004-05	4.20	7.50	2.69	2.70	2.33	3.88
2005-06	4.86	7.46	3.22	3.70	3.08	4.46
2006-07	5.11	8.55	3.59	3.75	3.24	4.85
2007-08	4.63	5.93	3.44	4.67	3.01	4.34
Company Average	4.63	7.29	3.07	3.50	2.92	4.28

Source: Based on data provided in Appendix

Table 6.7 gives a clear picture of inventory kept by the five companies. The inventory turnover of all the cement companies shows fluctuating trend throughout the study period expect Shree Cement that shows increasing trend. The minimum inventory turnover in ACC is 4.20 (2004-05), Mangalam is 5.93 (2007-08), Gujarat Ambuja is 2.39 (2003-04), Shree Cement is 2.69 (2003-04) and in India Cement is 2.33 (2004-05). The maximum inventory turnover in ACC is 5.11(2006-07), Mangalam is 8.55 (2006-07), Gujarat Ambuja is 3.59 (2006-07), and Shree Cement is 4.67 (2007-08) and in India Cement is 4.67 (2006-07).

Sales to Inventory (Annual Net Sales/Inventory at the End of Fiscal Period)

The ratio indicates the volume of sales in relation to the amount of capital invested in inventories. When inventory for a firm is larger in relation to sales (the condition which causes it to have a lower net sales to inventory ratio than other firms) the firm's rate of return is less since it has more working capital tied up in inventories than has the firm with a higher ratio.

Five cement companies under study have kept at different levels of Sales to total inventory during the study period from 2003-04 to 2007-08 has been shown in Table 6.8.

Table 6.8

Sales to Total Inventory of Selected Cement Companies for the years from 2003-04 to 2007-08

Year	ACC	Mangalam	Gujarat Ambuja	Shree Cement	India Cement	Industry Average
2003-04	7.63	9.85	4.57	4.19	5.65	6.39
2004-05	7.37	8.58	6.57	5.41	4.90	6.57
2005-06	9.55	9.14	9.14	8.12	7.53	8.70
2006-07	8.10	9.49	7.57	6.12	7.36	7.73
2007-08	8.24	6.91	7.86	13.80	7.35	8.83
Company Average	8.18	8.79	7.14	7.53	6.56	7.64

Source: Based on data provided in Appendix

Table 6.8 gives a clear picture of Sales to Total inventory kept by the five companies. The Sales to Total inventory of all the cement companies shows fluctuating trend throughout the study period. The minimum Sales to Total Inventory in ACC is 7.37 (2004-05). Mangalam is 6.91 (2007-08), Gujarat Ambuja is 4.57 (2003-04), Shree Cement is 4.19 (2003-04) and in India Cement is 4.90 (2004-05). The maximum Sales to Total

Inventory in ACC is 9.55 (2005-06), Mangalam is 9.85 (2003-04), Gujarat Ambuja is 9.14 (2005-06), and Shree Cement is 13.80 (2007-08) and in India Cement is 7.53 (2005-06).

Inventory to Net Working Capital (Inventory/Net Working Capital)

The ratio explains the amount of inventory per rupee of equity/long-term financed portion of current assets. A higher ratio may mean greater amount of net working capital investment in inventory.

The Inventory of net Working Capital of selected cement companies has been given in table 6.9.

Table 6.9
Inventory to net Working Capital of Selected Cement Companies
for the years from 2003-04 to 2007-08

Year	ACC	Mangalam	Gujarat Ambuja	Shree Cement	India Cement	Industry Average
2003-04	0.85	0.55	0.74	0.69	0.66	0.70
2004-05	0.66	0.70	0.47	0.64	0.35	0.56
2005-06	0.63	0.71	0.54	0.46	0.28	0.52
2006-07	0.91	1.13	0.66	0.48	0.20	0.71
2007-08	0.97	-2.09	0.86	0.35	0.16	0.25
Company Average	0.80	0.24	0.86	0.52	0.33	0.55

Source: Based on data provided in Appendix

The inventory of net working capital of all the cement companies shows fluctuating trend throughout the study period except India Cement, which shows decreasing trend. The minimum value of inventory in net working capital in ACC is 0.63 (2005-06), Mangalam is -2.09 (2007-08), Gujarat Ambuja is 0.47 (2004-05), Shree Cement is 0.35 (2007-08) and in India Cement is 0.16 (2007-08). The maximum value of

inventory to net working capital in ACC is 0.97 (2007-08), Mangalam is 1.13 (2006-07), Gujarat Ambuja is 1.86 (2007-08), and Shree Cement is 0.69 (2003-04) and in India Cement is 0.66 (2003-04).

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