Chapter–3
Inventory Management
Chapter–III

Inventory Management

3.1 Introduction:

Management of working capital is similar with controlling inventories as a result of within the sphere of working capital, economical and effective management of inventory poses a difficult drawback. Sensible Inventory Management could be a sensible finance management as inventories occupy the foremost strategic position in maximization of financial gain. A study of company Balance sheets shows that a firm's inventory usually constitutes fifteen to thirty percent of it’s invested with capital. Profits primarily rely upon the turnover of working capital that is generally determined, by the turnover of inventories. the right management and management of inventory not solely solves the acute drawback of liquidity however additionally will increase annual profits and causes substantial reduction within the working capital of a firm. Inventories form a link between production and sale of product. Therefore, it's essential to possess a adequate level of investment in inventories. Managing the amount of investment in inventory is like maintaining the amount of water associate degree exceedingly in a very bath-tub with an open drain. The water is flowing out unendingly. If water is let into slowly, the bathtub is shortly empty. If water is let in too quickly, the bathtub overflows. Just like the water within the tub, the actual things of inventories keep dynamical; however the amount could keep constant. The fundamental monetary issues square measure to work out the right level of investment in inventories and to determine what proportion inventory should be no inheritable throughout every period to take care of that level.

3.1.1 Nature of Inventories:

Inventories square measure stock of the merchandise an organization is producing available and parts that compose the merchandise. The assorted forms during which inventories exist in a very producing company are: raw materials, work-in-process and finished product.

- Raw Materials square measure those basic inputs that square measure reborn into finished product through the producing method. Raw
Materials inventories square measure those units that are purchased and keep for future productions.

- Work-in-process inventories square measure semi-manufactured merchandise. They represent merchandise that requires additional work before they become finished merchandise available.

- Finished product inventories square measure that fully factory-made merchandise that square measure prepared available. Stock of raw materials and work-in-process facilitate production, whereas stock of finished product is needed for sleek promoting operations; therefore, inventories serve a link between the merchandise particle and consumption of products.

The level of 3 varieties of inventories for a firm depends on the character of its business. A producing firm can have considerably high levels of all 3 varieties of inventories, whereas a retail or wholesale firm can have an awfully high level of finished product inventories and no staple and work-in-process inventories. At intervals producing corporations, there'll be variations. Giant serious engineering corporations turn out long production cycle products; so, they carry giant inventories. On the opposite hand, inventories of a client product company won't be giant thanks to short production cycle and quick turnover.

Stores and Spares, a fourth reasonably inventory, is additionally maintained by corporations. Provides embody workplace and plant cleanup materials like soap, brooms, oil, fuel, lightweight bulbs etc. These materials don't directly enter production; however square measure necessary for production method. Usually, these provides square measure little a part of the full inventory and don't involve vital investment. Therefore, a classy system of internal control might not be maintained for them.

### 3.1.2 Need for Inventories:

The Management of inventories is important only if the corporate holds inventories. Maintaining inventories involves attempting of the company's funds and commitment of storage and handling prices. If it's big-ticket to take care of inventories, the question of holding inventories by the corporations arises. There square measure 3 general motives for holding inventories:

- Transaction Motive emphasizes the necessity to take care of inventories to facilitate sleek production and sales operations.
o Precautionary Motive necessitates holding of inventories to protect against the danger of unpredictable changes in demand and provide for forces and different factors.

o Speculative Motive influences the choice to extend or cut back inventory levels to require advantage of worth fluctuations.

A company ought to maintain adequate stock of materials for continuous offer to the plant for Associate in nursing uninterrupted production. It’s unfeasible for an organization to obtain raw materials whenever it’s required. A pause exists between demand for materials and its offer. Also, there exists uncertainty in procuring raw materials in time on several occasions. The procural of materials is also delayed thanks to such factors as strike, transport disruption or short offer. Therefore, the firm ought to maintain adequate stock of raw materials at a given time to contour production. Different factors which can necessitate getting and holding of staple inventories square measure amount discounts and anticipated increase. The firm could purchase giant quantities of raw materials than required for the required production and sales levels to get amount discounts of bulk getting. At times, the firm would love to accumulate raw materials in anticipation of worth rise.

Work-in-process inventory builds up thanks to the assembly cycle. Production cycle is that the time span between introduction of staple into production and emergence of finished product at the completion of production cycle. Until production cycle completes, Stock of work-in-process has got to be maintained. Economical corporations perpetually try and build production cycle smaller by up their production techniques.

Stock of finished product has got to be control as a result of production and sales aren’t fast. A firm cannot turn out in real time once products are demanded by customers. Therefore, to produce finished product on a daily basis, their stock has got to be maintained. Stock of finished product has additionally to be maintained for sharp demands from customers. Just in case the firm's sales square measure seasonal in nature, substantial finished product inventories ought to be unbroken to satisfy the height demand. Failure to produce merchandise to customers, once demanded, would mean loss of the firm's sales to competitors. the amount of finished product inventories would rely on the coordination between sales and production in addition as on production time.
3.1.3 Objectives of Inventory Management:

The basic responsibility of the financial manager is to form positive that the firm's cash flows area unit managed with efficiency. Economical management of inventory ought to ultimately result in the maximization of the owner's wealth. So as to attenuate cash needs, inventory ought to be turned over as quickly as potential, avoiding stock-outs which may end in closing down the assembly line or cause a loss of sales. It implies that whereas the management ought to attempt to pursue the financial objective of turning inventory as quickly as potential, it ought to at a similar time guarantee decent inventories to satisfy production and sales demands. In alternative words, the financial manager has got to reconcile these two conflicting needs. Declared otherwise, the target of inventory management consists of 2 counter reconciliation elements: (i) to attenuate the firm's investments in inventory, and (ii) to fulfil a requirement for the merchandise by with efficiency organizing the firm's production and sales operations. These two conflicting objectives of inventory management may also be expressed in terms of cost and advantages related to inventory. That the firm ought to minimize investments in inventory implies that maintaining a listing involves prices, such the smaller the inventory, the lower the price to the companies. However inventories additionally give advantages to the extent that they facilitate the sleek functioning of the firm: the larger the inventory, the higher it's from this read purpose. Obviously, the financial manager ought to aim at level of inventory which is able to reconcile these conflicting parts. That’s to mention, associate degree optimum level of inventory ought to be determined on the idea of the trade-off between prices and advantages related to the levels of inventory.

An effective inventory management should:

- Ensure a nonstop offer of raw materials to facilitate uninterrupted production,
- Maintain decent stocks of raw materials in periods of short offer and anticipate worth changes,
- Maintain decent finished goods inventory for swish sales operation, and economical client service,
- Minimize the opportunity cost and time, and
- Control investment in inventories associate degree keeps it at an optimum level.
3.1.4 INVENTORY MANAGEMENT TECHNIQUES

A firm’s inventory may take different forms. For instance, a manufacturing firm’s inventory is likely to consist of raw materials, which are inputs to the production process; work in progress, which are unfinished goods that are in the process of being produced at the time the balance sheets are closed; and finished goods, which are goods that the firm has produced and is ready to ship. Retailers typically have only finished goods in their inventory, as they do not add value through a manufacturing process. And service firms generally have no goods to store. Together with investments in cash holdings and receivables, investment in inventory constitutes the main operating investment of many firms. Why is such an investment so important to a firm? Well, inventory balances can help firms meet variation in demand, as well as variation in the supply of raw materials. They can also allow for flexibility in the production schedule, and they can allow a firm to take advantage of economies related to purchase order size. Yet not all types of inventory are easy to turn into cash. For example, while raw materials that are near-commodities are typically liquid, finished goods may or may not be easy to sell quickly without a considerable discount (e.g., airplanes are less liquid than computers, and computers are less liquid than candies), and works in progress tend to be highly illiquid. Thus, cash invested in inventory holdings may be tied up for a considerable amount of time.

Inventory management involves the setting of inventory levels so as to maximize the benefits while minimizing the costs of holding inventory. Inventory management is important to most firms, for a diverse set of reasons. For example, firms that sell goods associated with high obsolescence rates (e.g., high-technology goods or goods related to fashion trends) need to take care to not set inventory levels so high that they could suffer significant losses in terms of inventory obsolescence. In addition, firms that sell perishable goods need to avoid inventory levels that far exceed short-term demand to avoid losses from perished inventory. On the other hand, firms that sell goods that are hard to access (e.g., because they take a long time to produce, they require imported materials with a long backlog time, etc.) need to manage inventory levels to avoid losing sales. These examples show that while different firms may have different reasons to pursue inventory management, determining optimal inventory levels is quite important for most firms, especially for those whose profits are largely based on asset rotation rather than margin on sales, as in the case of retailers.
So how does a firm go about managing its inventory? There are many techniques for inventory management. Some firms do not set an explicit inventory policy, but instead purchase inputs or goods on an as-needed basis. If inputs or goods can be accessed immediately and goods can be sold at once, this mechanism might work efficiently. The effectiveness of such a system depends on factors such as potential quantity discounts, which would be missed if orders are in small lots, and potential costs of stock-out.

Other firms, in contrast, prefer to buy large quantities to take advantage of size discounts and to avoid stock-out problems. However, this strategy might involve storage and obsolescence costs. Additionally, absent a mechanism to determine the optimal size and composition of inventory, this technique may lead to overinvestment problems, specifically, the cost of financing larger-than-needed investment in inventory.

A third way firms can manage their inventory is to follow the ABC approach. To do so, a firm divides its inventory into three classes—A, B, and C—based on annual volume in monetary terms (estimated as annual demand multiplied by unit cost). Class A consists of items that have a large effect on total inventory value, class B consists of items that have less of an effect on inventory value, and class C includes items that contribute little to total inventory value. Based on this classification, firms maintain tighter physical control over the class A items, that is, those items that contribute most to inventory value. Thus, for example, a firm using this approach may forecast the demand for class A items more closely, or may decide to forge closer relationships with the suppliers of these items.

In a fourth approach, many firms manage their inventory by combining the previous technique with cycle counting. Cycle counting involves physically counting a subset of the total stock of inventory at predetermined points in time. This combined approach helps a firm maintain accurate inventory records and identify and resolve inventory stock-outs on a timely basis.

Some firms may manage their inventory using more sophisticated optimization mechanisms based not only on cost-benefit analysis but also on risk-return analysis. To perform such an approach, many inputs are needed, such as supply and demand functions, failure and obsolescence rates, and cost of capital estimates. These inputs can be obtained from specific software applications, or from a customized simulation procedure specifically built by the firm.
Finally, the best-known approach for managing inventory is the economic order quantity (EOQ) approach. This mechanism is based on the idea of minimizing the total costs associated with inventory investment.

**Just-in-time Inventory Control:** The just-in-time inventory control system, originally developed by Taichi Okno of Japan, merely implies that the firm ought to maintain a minimum level of inventory and trust suppliers to provide components and elements "just-in-time" to satisfy its assembly necessities. This could be contrasted with the standard inventory management system that involves maintaining a healthy level of safety stock of give an inexpensive protection against uncertainties of consumption and supply-the traditional system could also be remarked as a "just-in-time" system.

The just-in-time inventory system, whereas conceptually terribly appealing, is tough to implement as a result of it involves a major modification within the total production and management system. It needs lay to rest alia (i) a powerful and dependable relationship with suppliers who are geographically not very remote from the producing facility, (ii) a reliable transportation system, and (iii) a simple physical access within the kind of enough doors and conveniently located docks and storage areas to dovetail incoming provides to the requirements of production line.

In this section a number of the factors that have an effect on the topic is bestowed. Specifically, within the next section other ways to live inventory is mentioned. Then the most costs of holding inventory and also the most typical method for managing inventory are mentioned. Finally, discussion has been created on the utilization of inventory for hedging functions and additional issues regarding optimum inventory levels.

### 3.1.5 MEASURING INVENTORY

Before a firm can think about optimal investment in inventory, it needs to define a sensible measure of its inventory balances.

In operating efficiency ratios firms commonly summarize the firm’s inventory using days of inventory and inventory turnover. The first of these measures, days of inventory, is calculated by dividing the inventory account on the assets side of the balance sheet by the daily cost of goods sold (CGS); that is:

\[
\text{Days of Inventory} = \frac{\text{Inventories}}{\text{CGS/360}}
\]

This figure can be interpreted as the average number of days a firm can
continue selling based on the inventory it has in its warehouse, or the average number of days it takes a firm to turn over its inventory. This number varies across firms depending on (1) the characteristics of the good itself (e.g., whether it suffers from quick obsolescence, whether it requires more time to build, etc.), (2) the competitive environment of the industry (which will determine, for example, potential losses from stock-outs), (3) firms idiosyncratic strategies, and/or (4) firm size (e.g., to benefit from economies of scale, new small firms may maintain higher levels of inventory relative to their still modest sales than more mature firms will need to maintain).

The second measure inventory

\[
\text{Inventory Turnover} = \frac{\text{Sales}}{\text{Inventory}}
\]

This figure captures the number of times a company sells its inventory during a given period of time (usually a year, quarter, or month). A low inventory turnover ratio means that each unit of investment that the firm puts into the warehouse is not efficient in generating sales, due perhaps to market conditions (if it happens to the whole industry) or to a firm-specific business strategy or inefficiency. To see the importance of this ratio, one should know that profitability is a function of both margin and turnover. Thus, turnover is especially important for firms that rely on high turnover to generate profits.

Note, however, that since sales are influenced by mark-ups and other considerations, this figure is not typically measured consistently. More specifically, because the numerator (sales) is computed at market prices, whereas the denominator (inventory) is usually valued at cost, this ratio can overestimate the actual figure. A more accurate estimate can be obtained by using CGS instead of sales. Further, since sales (or CGS) are obtained for the entire year, whereas inventory is evaluated at a particular point in time, a more correct estimate can be obtained by using the firm’s average inventory over the year, especially for seasonal businesses. This discussion suggests that a more accurate expression for the estimation of a turnover would be:

\[
\text{Inventory Turnover} = \frac{\text{CGS}}{\text{Average Inventory}}
\]

Nevertheless, managers tend to use the sales-to-inventory ratio rather than this alternative expression. In practice, the sales-to-inventory measure can still be useful to identify trends in a firm’s inventory over time or to compare how a firm is doing relative to its industry peers.

For purpose of monitoring the effectiveness of inventory management,
following ratios and indexes are also helpful:

- **Raw Material Inventory Turnover Ratio**
  \[
  \text{Raw Material Inventory Turnover Ratio} = \frac{\text{Cost of Raw Materials Used}}{\text{Average Raw Materials}}
  \]

- **Work in Process Inventory Turnover Ratio**
  \[
  \text{Work in Process Inventory Turnover Ratio} = \frac{\text{Cost of Goods Manufacturing}}{\text{Average Work in Process}}
  \]

- **Finished Goods Inventory Turnover Ratio**
  \[
  \text{Finished Goods Inventory Turnover Ratio} = \frac{\text{Cost of Goods Sold or Sales}}{\text{Average Finished Goods}}
  \]

- **Average Raw Material Inventory**
  \[
  \text{Average Raw Material Inventory} = \frac{\text{Average Daily Purchase of Raw Materials}}{\text{Average Raw Materials}}
  \]

- **Average Inventory**
  \[
  \text{Average Inventory} = \frac{\text{Opening Inventory} + \text{Closing Inventory}}{2}
  \]

Most of the above ratios and indices may be calculated separately for important raw materials and finished goods.

**An Accounting Perspective**

A firm’s inventory balance is linked to the firm’s purchases, sales, and initial balances of inventory. More formally, a firm’s inventory balance can be expressed by:

\[
\text{Final Inventory} = \text{Initial Inventory} + \text{Purchases} - \text{CGS}
\]

Firms may choose from various methodologies to value inventory sold and residual inventory, or inventory held as operating assets. Three common approaches are the first in first out (FIFO), last in first out (LIFO), and next in first out (NIFO) approaches. If the firm uses the FIFO approach, the first goods sold will be the first ones used to compute CGS. In an inflationary environment, accounting systems using FIFO will report lower costs of goods sold and higher margins due to the use of old lower CGS in the cost of sales. For the same reason, this method tends to overestimate the value of residual inventory. The higher inventory valuation associated with this approach can be useful if the firm intends to use inventory as collateral when pursuing financing choices.

If the firm instead uses the LIFO approach, it will estimate CGS assuming that the first goods sold was the last to enter its inventory. This method allows the firm to compute its CGS close to current market costs. If prices show increasing patterns (as they typically do), the firm will report lower margins, which in turn usually lead to a lower tax bill.

Finally, if the firm follows the NIFO approach, CGS is computed using the cost of the next good to be included in the inventory. This approach can be thought of as a more extreme version of the current market pricing approach associated with the LIFO method. We note that a firm can value its inventory following other methodologies, such as average costing (where CGS is based on a combination of all
the goods available in inventory) and standard costing (where measures are assessed relative to predetermined standards). However, a more rigorous presentation of all possible choices is beyond the scope.

3.1.5.1 CARRYING COSTS AND SHORTAGE COSTS

Inventory investment is associated with two chief types of costs: **carrying costs**, which capture the direct costs, including opportunity costs, of holding inventory, and **shortage costs**. On the carrying cost side, one of the first types of direct cost to come to mind is likely storage costs. Holding a stock of inventory implies the use of space dedicated to this purpose. Such space has to be bought or rented. Moreover, this space probably requires some complements such as shelves, boxes, mechanical lifts, and, depending on the product, even cooling or other specific equipment. Other common types of direct cost include handling costs (i.e., the costs of tracking inventory) and security costs (i.e., the costs of ensuring that the goods are free of other unexpected costs; e.g., insurance costs). Obsolescence that causes value losses can also be thought of as a direct cost of holding inventory.

A type of direct cost that is often ignored is the opportunity cost of investment capital. As with any type of investment, investment in inventory represents a use of funds. Consequently, inventory faces an opportunity cost, equal to the forgone return on an alternative investment. This opportunity cost is associated with firms’ average cost of capital.

Taken together, the total carrying costs of firms have proven to be quite large, ranging on an annual basis from 20% to 30% of the total value of inventory.

Given that inventory represents a significant portion of a firm’s assets, this is an important cost. However, if we only consider the implications of carrying costs, we might conclude that a firm’s main objective in relation to inventory would be to reduce inventory stocks as much as possible, as the lower the inventory is, the lower the carrying costs. Yet this is not what we observe in reality. Why might this be the case? The answer to this question lies in large part with the other chief type of cost mentioned previously, namely, shortage costs, or the costs of not having enough products on hand to operate. Firms may face shortage costs for several reasons. For instance, firms may fail to complete sales and/or satisfy customer orders simply because they run out of stock of the desired good. Additionally, each time firms replenish their ware-houses, they face transaction costs (e.g., the time and cost of placing orders). Thus, in contrast to the case of carrying costs, the probability of
facing shortage costs decreases as inventory balances increase.

The presence of these two types of costs—carrying costs and shortage costs—implies a trade-off that each firm needs to analyze. The most practical way of solving the resulting problem is to find the combination of these two costs that minimizes their sum. This method is discussed in more detail in the next section.

However, before moving on, it is worth highlighting that a uniform production schedule implies higher inventory carrying costs than a system that matches production to sales. But uniform production typically optimizes the use of productive capacity, including human resources. Thus, if a company moves from a uniform to a seasonal or other type of fluctuating production program, it will need to evaluate the trade-off between the gains in efficiency and the increased carrying costs of inventory.

### 3.1.5.2 ECONOMIC ORDER QUANTITY

The EOQ approach is based on the idea of minimizing the sum of a firm’s carrying and shortage costs. As we discussed earlier, carrying costs are increasing in inventory investment, whereas shortage costs are decreasing in this investment. The aim of the EOQ model is simply to find the minimum total cost. So how does this model work? We begin by looking at expressions for carrying and shortage costs.

Carrying costs can be estimated as the firm’s average inventory times per-unit carrying costs, \( C \), or:

\[
\text{Carrying Costs} = \text{Average Inventory} \times C
\]

To estimate the firm’s average inventory, we need to consider the EOQ’s assumptions about inventory management. The EOQ model assumes that inventory is sold off at a constant rate; once exhausted, it is returned to some optimal level, \( Q^* \). The model also assumes instantaneous receipt of ordered material. This selling and restocking process generates a pattern like the one depicted in Figure 5.1.

As can be seen from Figure 5.1, inventory investment goes from \( Q \) to 0, yielding an average value of \( Q / 2 \).
With this average value of inventory, carrying costs can be computed as:

$$Carrying\ Costs = \frac{Q}{2} \times C$$

Shortage costs have a more broad definition. However, the EOQ model uses a simplified version of it. In particular, it assumes there are no stock-outs, concentrating almost exclusively on restocking costs. Assuming that restocking costs (including the cost of placing orders and other administrative costs) are fixed at, say, $F$, total restocking costs $\times$ can be computed as:

$$Total\ Shortage\ Costs = F \times Number\ of\ Orders$$

To perform this calculation, we need to estimate the number of times the firm will have to restock during the year. That is easy to compute. If the firm has an annual demand for inventory material equal to $D$, and if the firm purchases $Q$ each time it places an order, the number of orders during the year will be equal to $D / Q$. Therefore, total shortage costs can be estimated as:

$$Shortage\ Costs = \frac{D}{Q}$$

Given estimates for both components of inventory costs, we can now estimate the total costs of holding inventory as:

$$Total\ Inventory\ Costs = Carrying\ Costs + Shortage\ Costs$$

$$= \frac{Q}{2} \times C + F \times \frac{D}{Q}$$

Figure 3.2 summarizes this.
In the previous formula, $Q$ is our decision variable; that is, we need to determine the optimum order quantity, $Q^*$. All the other variables ($C$, $F$, and $D$) are data we need to provide to solve the problem. Using maximum and minimum identification techniques, $Q^*$ can be obtained by solving:

\[
\text{Figure 3.2 Total Inventory Costs}
\]

Naturally, the optimum order quantity is increasing in total demand, $D$. Additionally, $Q^*$ is increasing in per-order fixed costs, $F$; that is, the higher these costs are, the more the firm will attempt to avoid them by ordering larger quantities each time it places an order. Finally, $Q^*$ is decreasing in $C$, the per-unit carrying costs; thus, the higher these costs are, the lower the investment in inventory the firm will be willing to make.

It is worth noticing that the previous formula suggests some effect of economies of scale: inventory grows according to the square root of its demand, or in other words, optimal inventory grows much less than proportionately with respect to sales. Moreover, the higher the total inventory demand, $D$, is, the lower the corresponding relative increase in inventory (decreasing slope).

The EOQ model described earlier assumes, among other things, that restocking is performed when inventory is completely exhausted. However, while in reality this might be ideal (it would help in minimizing average holdings), it is usually not the case. Indeed, it is common to find firms placing orders according to some predetermined lead time. Taking such behavior into account would naturally alter our previous results, but the basic idea remains the same: the order will be placed not at the time when inventory reaches zero, but at a given lead time before the zero boundary is reached. Similarly, the model can be adjusted to allow firms with high potential stock-out costs to set pre-established safety inventory levels that trigger new orders when such thresholds are reached.
3.1.5.3 Optimum Production Run: The use of the EOQ approaches are often extended to production runs to see the optimum size of manufacture. Two prices concerned are set-up costs and carrying costs. Setup costs embrace costs on the subsequent activities: getting ready and process the stock orders, getting ready drawings and specifications, tooling machines set-up, handling machines, tools, equipment’s and materials, overtime etc. Production costs or set-up costs can cut back with bulk production runs, however carrying costs can increase as large stocks of factory-made inventories are going to be control. The economic production size are going to be the one wherever the entire of discovered and carrying costs is minimums.

3.1.5.4 Quantity Discount: Many suppliers encourage their customers to place undertaking by giving them quantity Discount. With amount discount, the firm can save on the per unit purchase price. However, the firm can got to increase its order size over the EOQ level to avail the quantity discount. this can scale back the number of orders and increase the common inventory holding. Thus, additionally to discount savings, the firm can save on ordering costs, however can incur extra carrying costs. If net return is positive, the firm’s order size ought to equal the quantity necessary to avail the discount. If negative, its order size ought to adequate to EOQ level.

![Re-order Point under Certainty](image)

**Figure 3.3: Re-order Point under Certainty**

3.1.5.5 Re-Order Point: The question, how much to order, is solved by decisive the economic order quantity, nonetheless the answer ought to be sought-after to the second downside, once to order. this can be a tangle of decisive the re-order point. The re-order purpose is that inventory level at that associate order ought to be placed to fill the inventory. to work out the re-order purpose under certainty,
we have a tendency to should know: (a) lead time, (b) average usage, and (c) economic order quantity. Lead time is the time usually taken in replenishing inventory once the order has been placed. By certainty, it means usage and lead time don't fluctuate. Under such scenario, re-order point is solely that inventory level which is able to be maintained for consumption during the lead time. That is:

$$\text{Re-order point} = \text{Lead} \times \text{Average Usage}$$

3.1.5.6 Safety Stock:

The re-order point is computed below the assumption of certainty. It’s tough to predict usage and lead time accurately. The demand for material might fluctuate from day to day or from week to week. Similarly, the particular delivery time is also completely different from the normal lead time. If the particular usage will increase or the delivery of inventory is delayed, the firm will face a tangle of stock-out which may persuade be costly for the firm. Therefore, in order to protect against the stock out, the firm might maintain a safety stock-some minimum or buffer inventory as cushion against expected increased usage and/or delay in delivery time. to determine the re-order point when safety stock is maintained is as follows:

$$\text{Re-order point} = \text{Lead} \times \text{Average usage} + \text{Safety Stock}$$

3.1.6 INVENTORY AND HEDGING

As discussed earlier, high inventory balances reduce the possibility of incurring shortage costs (though at the expense of facing higher carrying costs). For instance, firms that hold higher levels of inventory face lower risk of having to cease production due to backorders or long lead times. Similarly, firms that have higher levels of inventory have less probability of losing sales due to product shortages. This idea, while not different from what we have discussed previously, builds on the prior discussion by adding a hedging dimension to optimal inventory policy.

Inventory holdings can also help guard against unfavourable changes in the price of raw materials, due, for instance, to changes in commodity prices or to inflation. Indeed, some firms go so far as to decide that, due to the nature of their business, they do not want to hold any raw material price risk and thus they purchase and maintain in their inventory all their product needs for an entire project. This sort of hedging practice is quite common in the case of construction projects, especially if the firm has agreed to deliver the project at a fixed price.
3.1.7 OPTIMAL INVENTORY LEVELS

Thus far we have discussed many factors that a firm should consider in setting optimal inventory levels. For instance, we have considered how a firm might measure inventory levels, techniques for managing inventory investment, and risks worth considering when evaluating and managing inventory levels. There is no model, however, that can combine all of these elements into a single optimization equation. Thus, as is often the case in the face of complex business and social sciences issues, we simply have several criteria that we can apply and balance in response to changing business situations.

Addition can be made to the aforementioned criteria with other factors that may also be relevant to the management of inventory. For example, if a firm produces and sells components for replacement purposes, then it will probably need to hold a much larger inventory than a similar firm that sells the same components to original equipment manufacturers. Consider the case of a firm that sells auto parts for replacement purposes: this firm will probably need to keep in its inventory not only those components used in current models but also those used in still-in-use older cars. Similarly, if a firm produces and sells within a highly seasonal frame-work, then its optimal inventory will depend on whether it employs seasonal or level production systems. If the firm opts for a uniform production schedule, then it will accumulate a much larger inventory balance over the course of the year, in which case the risks of accumulating such a balance (e.g., the risk of obsolescence, or simply of not selling) will be different from the risks of not doing so (e.g., the risk of running over or under capacity).

Another relevant consideration includes the extent to which a firm can use its inventory holdings as collateral to obtain financing. Given that not all goods are equally usable for this purpose—lenders normally accept as collateral goods that are non-perishable and that are not likely to suffer obsolescence—the types of goods in inventory can influence a firm’s inventory policies.

3.1.8 CRITERIA FOR JUDGING THE INVENTORY SYSTEM

While the overall objective of the inventory system is to minimize the cost to the firm at the risk level acceptable to management, the more proximate criteria for judging the inventory system are:

i. Comprehensibility
ii. Adaptability
iii. Timeliness

i. Comprehensibility: Inventory systems range from the utterly simple to the weirdly complex. Irrespective of how simple or complex a system is regardless of whether it is automated or manual; it should be clearly understood by all affected parties. The system must be properly explained to all concerned so that its purpose, logic and rationale are transparent.

ii. Adaptability: A certain degree of flexibility and adaptability must be designed into the system to make it versatile. The system must not provide for every possible and imaginable contingency. If it is developed with this deal, it is likely to be a complex monstrosity.

iii. Timeliness: Inventories may suffer loss in value on account of a variety of factors. The more common sources of value decline are:

- Obsolescence caused by changes in technology and shifts in consumer taste.
- Physical deterioration with the passage of time.
- Price fluctuation because of inherent volatility of certain commodities.

The inventory system should be capable of inducing timely action. It should provide adequate forewarning which triggers appropriate corrective steps.

In this section, we started by discussing the importance of efficient inventory management. The first part of the section stressed the fact that, like other assets, inventory is an investment and as such needs to be financed by the firm. Next, we presented the main factors affecting firm’s inventory policies. Finally, we considered some of the hedging implications of holding inventory, and we provided a summary discussion on various factors relevant to identifying optimal inventory balances.

3.2 INVENTORY MANAGEMENT PRACTICES IN INDIA

1. Inventory levels in India appear to be high. The reasons commonly cited for this are as follows:

   (a) Purchase executives are severely penalised for stock outs, however they're not questioned for high inventories.

   (b) Lengthy and cumbersome import procedures within the past forced companies to hold huge amounts of inventories for imported items.

   (c) It pays to stay inventories high as a result of prices rise due to inflation.

   (d) Most of the vendors aren't reliable in terms of delivery schedules and
quality of the material supplied. Hence, corporations carry giant safety stocks.

(e) Due to lack of standardization there's an outsized form of stores.

2. The foremost unremarkably used tools of inventory management in Asian country are basics analysis, FSN analysis, and inventory turnover analysis.

**ABC Analysis**: although basics analysis is widely used, one usually finds that the ABC classification isn't reviewed and revised sporadically.

FSN Analysis: For the purpose of control, companies classify items into fast-paced (F), slow moving (S) and non-moving (N) classes. Unfortunately, companies don't eliminate non-moving things fleetly.

Inventory Turnover Analysis: this sort Associate in study research is completed at a collective level.

**Areas of Improvement**: Inventory management in Asian country may be improved in numerous ways in which. Enhancements might be established through:

- **Effective Computerization**: Computers shouldn't be used just for accounting purpose however conjointly for rising higher cognitive process.
- **Review of Classification**: basics and FSN classifications should be sporadically reviewed.
- **Improved Coordination**: higher coordination among purchase, production, marketing, and finance departments can facilitate in achieving larger potency in inventory management.
- **Development of future Relationship**: corporations ought to develop future relationships with vendors. this is able to facilitate in rising quality and delivery.
- **Disposal of Obsolete/ Surplus Inventories**: Procedures for disposing obsolete and surplus inventories should be simplified.
- **Adoption of difficult Norms**: corporations ought to set bench marks with international competitors and use ideas like Just-in-time technique to boost inventory management.

3.3 Analysis of Inventory of Indian Pharmaceutical Industry

**3.3.1 Compression of Inventory**:

The volume of inventory represents the level of required material for production and sales. Table 3.1 shows the level of inventory in selected Indian
pharmaceutical companies taken in this research. It is observed from Table 1 that on the basis of average inventory Cipla Ltd. is the biggest pharmaceutical company in India maintaining average inventory of Rs.12217.6 million during the research period followed by Aurobindo Pharma Ltd. with average inventory of Rs.7122.4 million. Cipla ltd. registered growth as the inventory increased Rs 25111.6 million in the 2013 from Rs.2753.6 million of 2000, which shows a growth of 9.12 times. During the 2000 to 2014 Cipla Ltd. maintained the largest level of inventory than that of other company in India with average of Rs.5151.0 million, Rs.11934.0 million and Rs.22146.7 million of the first five year, second five year and third five year respectively.

On the basis of average inventory Glenmark Pharmaceuticals Ltd. is smallest company maintain of Rs 1392.7 millions. Glenmark Pharmaceuticals Ltd. registered growth as the inventory increased Rs 2103.4 million in the 2013 from Rs.348.9 million of 2000, which shows a growth of 6.03 times. Divi'S Laboratories Ltd. had the average inventory of Rs 3826.9 million which encountered the highest growth than other companies. During the study period the growth was 17.69 times. Its inventory was Rs.504.8 million in 2000 and reached to Rs 8932.7 million in 2013.

The industry average shows an increasing trend in inventory of Indian Pharmaceutical companies. It has grown more three times.

From the chart 3.1A and 3.1B it can be easily seen that Divi'S Laboratories Ltd. has recorded the maximum growth that is 17 times more than that of other pharmaceutical companies in India during the study period. Cipla Ltd. had the highest inventories throughout the study period and second & third position registered by Aurobindo Pharma Ltd. and Dr. Reddy'S Laboratories Ltd.

From the study of inventory management, it was found that on the basis of amount of inventory Cipla Ltd. is the biggest company among Indian pharmaceutical companies. In other companies the growth of Divi'S Laboratories Ltd. more impressive than others, which was at 9th position at starting of study period i.e. 2000 but 2013 it has reached at 6th position. Whereas Cipla Ltd. registered Number one position throughout the study period. Industry average of inventory has grown more three times.
Figure – 3.4 A Line chart of Inventory of Indian Pharmaceutical Industry.
### Table-3.1 Total Inventory (Rs. in Millions)

<table>
<thead>
<tr>
<th>Company Name</th>
<th>2000</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aurobindo Pharma Ltd.</td>
<td>1729.9</td>
<td>1254.6</td>
<td>2035.2</td>
<td>2596.4</td>
<td>3235.8</td>
<td>3834.4</td>
<td>5472.8</td>
<td>6512.3</td>
<td>7355.2</td>
<td>9448.2</td>
<td>12610.2</td>
<td>12192.6</td>
<td>14317.3</td>
<td>17118.1</td>
<td>7122.4</td>
</tr>
<tr>
<td>Cadila Healthcare Ltd.</td>
<td>837.4</td>
<td>1057.0</td>
<td>1756.0</td>
<td>1603.0</td>
<td>1939.0</td>
<td>2128.0</td>
<td>3287.0</td>
<td>3310.0</td>
<td>3490.0</td>
<td>3808.0</td>
<td>4645.0</td>
<td>5012.0</td>
<td>5872.0</td>
<td>6635.0</td>
<td>3241.4</td>
</tr>
<tr>
<td>Cipla Ltd.</td>
<td>2753.6</td>
<td>3962.8</td>
<td>5892.3</td>
<td>5689.4</td>
<td>7456.8</td>
<td>9570.0</td>
<td>9786.0</td>
<td>11204.9</td>
<td>13983.2</td>
<td>15125.8</td>
<td>18831.6</td>
<td>18245.0</td>
<td>23433.7</td>
<td>25111.6</td>
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<td>444.8</td>
<td>671.2</td>
<td>1076.0</td>
<td>1390.6</td>
<td>1838.5</td>
<td>2100.5</td>
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<td>5430.6</td>
<td>6509.7</td>
<td>8059.6</td>
<td>8932.7</td>
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</tr>
<tr>
<td>Dr. Reddy'S Laboratories Ltd.</td>
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<td>1898.1</td>
<td>2401.2</td>
<td>2580.1</td>
<td>3038.1</td>
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<td>4876.0</td>
<td>6409.0</td>
<td>7351.0</td>
<td>8974.0</td>
<td>10632.0</td>
<td>13267.0</td>
<td>15265.0</td>
<td>15921.0</td>
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<tr>
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<td>1713.2</td>
<td>1807.5</td>
<td>1956.0</td>
<td>2008.9</td>
<td>2265.0</td>
<td>2181.2</td>
<td>2409.5</td>
<td>2059.6</td>
<td>2283.8</td>
<td>2530.2</td>
<td>2815.4</td>
<td>3301.4</td>
<td>2820.4</td>
<td>3424.0</td>
<td>2398.3</td>
</tr>
<tr>
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<td>322.4</td>
<td>444.4</td>
<td>821.7</td>
<td>1110.6</td>
<td>1388.9</td>
<td>2182.0</td>
<td>2736.3</td>
<td>1303.1</td>
<td>1504.1</td>
<td>1570.0</td>
<td>1759.4</td>
<td>1901.5</td>
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<td>1392.7</td>
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<tr>
<td>Lupin Ltd.</td>
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<td>1418.6</td>
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<td>8411.1</td>
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<td>2697.2</td>
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<td>2524.9</td>
<td>2880.0</td>
<td>2854.7</td>
<td>2302.0</td>
<td>2667.1</td>
<td>2617.1</td>
<td>3004.9</td>
<td>2290.1</td>
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<tr>
<td>Sun Pharmaceutical Inds. Ltd.</td>
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<td>1310.5</td>
<td>1556.2</td>
<td>1614.5</td>
<td>1866.2</td>
<td>2634.1</td>
<td>3333.8</td>
<td>3896.3</td>
<td>4867.4</td>
<td>5701.4</td>
<td>6182.6</td>
<td>6400.7</td>
<td>8687.6</td>
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<td>1496.5</td>
<td>1983.3</td>
<td>2209.9</td>
<td>2748.0</td>
<td>3322.4</td>
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<td>6187.9</td>
<td>7343.1</td>
<td>8059.1</td>
<td>9628.3</td>
<td>10515.8</td>
<td>4931.3</td>
</tr>
</tbody>
</table>
Figure – 3.4 B

**Trend of inventory in Aurobindo Pharma Ltd.**

\[ y = 1204.2x - 1909.2 \]

\[ R^2 = 0.9376 \]

**Trend of inventory in Cadila Healthcare Ltd.**

\[ y = 422.83x + 70.191 \]

\[ R^2 = 0.9613 \]
Trend of inventory in Cipla Ltd.

$y = 1672.5x - 326.45$

$R^2 = 0.9633$
Trend of inventory in Divi's Laboratories Ltd.

\[ y = 660.22x - 1489.4 \]

\[ R^2 = 0.9279 \]

Trend of inventory in Dr. Reddy's Laboratories Ltd.

\[ y = 1159.7x - 1658.2 \]

\[ R^2 = 0.9338 \]
Trend of inventory in Glaxosmithkline Pharmaceuticals Ltd.

\[ y = 115.21x + 1534.2 \]
\[ R^2 = 0.8398 \]

Trend of inventory in Glenmark Pharmaceuticals Ltd.

\[ y = 130.83x + 411.46 \]
\[ R^2 = 0.5627 \]
Trend of inventory in Lupin Ltd.

- Linear equation: $y = 1010.6x - 1619.5$
- $R^2 = 0.9263$

Trend of inventory in Piramal Enterprises Ltd.

- Linear equation: $y = 116.64x + 1415.2$
- $R^2 = 0.6934$
Trend of inventory in Sun Pharmaceutical Inds. Ltd.

\[ y = 622.67x - 476.15 \]
\[ R^2 = 0.9323 \]

Trend of inventory in industry average

\[ y = 711.54x - 405.28 \]
\[ R^2 = 0.9615 \]
3.3.2 Size of Inventory:

Inventory to current liabilities, Inventories to current assets, inventories to total asset ratio has been used to evaluate size of inventory.

3.3.2.1 Inventory to Current Assets:

Inventory to current assets ratio shows that what portion of a company’s inventories is financed from its available cash. In general, the lower the ratio, the higher the liquidity of a company is. However, the value of inventory to current assets ratio varies from industry to industry and company to company.

Table 3.2 shows the relationship between inventories to current assets, which shows the percentage of inventories total current assets. The size of inventory is showing the industry average of Indian pharmaceutical companies is 38.71%, which may be ideal ratio for pharmaceutical companies in India. The highest inventory to current assets ratio can be seen in Divi’s Laboratories which is near about 56% of inventory in total current assets. The lowest inventories to current assets ratio is maintained by Dr. Reddy’S Laboratories Ltd., it has 26.04% and higher is maintained by Divi’S Laboratories Ltd. it has 55.86% overall inventories to current assets ratio. The inventories to current assets ratio of Cipla Ltd. is always higher than industry average, it has been moving from 40.77% to 63.13% throughout of the study period and its annual average is 51.65%.

The ratio of industry average shows declining trend as it declined from 47.67% to 30.77%.

3.3.2.2 Inventory to Current Liabilities:

Inventory to current liabilities indicates reliance on the available inventory for payment of short term debt. It is one of the measures of the solvency of a firm. A high Inventory to Current Liabilities ratio, relative to industry norms, suggests over-reliance on unsold goods to finance operations. Inventory to current liabilities indicates the relationship between inventory and current liabilities.
Figure 3.5 (A) Trend of Inventory to current assets in Indian Pharmaceutical Industry
Figure: 3.5 (B) Inventory / Current Assets
<table>
<thead>
<tr>
<th>Company Name</th>
<th>2000</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aurobindo Pharma Ltd.</td>
<td>42.80</td>
<td>24.83</td>
<td>30.78</td>
<td>33.62</td>
<td>40.57</td>
<td>32.65</td>
<td>31.24</td>
<td>36.05</td>
<td>36.21</td>
<td>42.56</td>
<td>42.35</td>
<td>42.65</td>
<td>40.62</td>
<td>34.67</td>
<td>36.54</td>
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<tr>
<td>Cadila Healthcare Ltd.</td>
<td>46.49</td>
<td>58.33</td>
<td>54.21</td>
<td>43.98</td>
<td>58.56</td>
<td>52.78</td>
<td>56.33</td>
<td>51.96</td>
<td>45.60</td>
<td>46.24</td>
<td>45.53</td>
<td>39.59</td>
<td>41.96</td>
<td>44.00</td>
<td>48.97</td>
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<tr>
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<td>63.13</td>
<td>58.84</td>
<td>61.28</td>
<td>52.61</td>
<td>54.89</td>
<td>49.98</td>
<td>44.46</td>
<td>41.54</td>
<td>40.77</td>
<td>44.49</td>
<td>50.61</td>
<td>49.59</td>
<td>54.89</td>
<td>56.02</td>
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<td>56.51</td>
<td>60.94</td>
<td>53.59</td>
<td>54.73</td>
<td>57.15</td>
<td>65.94</td>
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<td>56.13</td>
<td>60.59</td>
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<td>13.35</td>
<td>11.20</td>
<td>13.51</td>
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<td>25.41</td>
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<td>26.80</td>
<td>33.04</td>
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<td>22.95</td>
<td>29.89</td>
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<td>29.26</td>
<td>20.23</td>
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<td>30.28</td>
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<td>49.63</td>
<td>40.97</td>
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<td>60.23</td>
<td>47.18</td>
<td>43.29</td>
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<td>39.58</td>
<td>45.02</td>
<td>2.32</td>
<td>5.60</td>
<td>6.62</td>
<td>19.45</td>
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<tr>
<td>Sun Pharmaceutical Inds. Ltd.</td>
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<td>36.06</td>
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<td>45.99</td>
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<td>41.03</td>
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<td>43.99</td>
<td>43.63</td>
<td>39.94</td>
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</table>
Figure: 3.6 Inventory to Current Liabilities
Table 3.3 Inventory / Current Liability (in %)

<table>
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<th>Company Name</th>
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<th>2002</th>
<th>2003</th>
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<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>Average</th>
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<td>Aurobindo Pharma Ltd.</td>
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<td>98.6</td>
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<td>135.0</td>
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<td>157.8</td>
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<td>158.8</td>
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<td>191.0</td>
<td>148.8</td>
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<td>87.3</td>
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<td>118.9</td>
<td>98.1</td>
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<td>110.7</td>
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<td>150.5</td>
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<td>138.1</td>
<td>157.4</td>
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<td>197.7</td>
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<td>195.2</td>
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<td>96.0</td>
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<td>84.7</td>
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<td>Lupin Ltd.</td>
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<td>92.8</td>
<td>77.5</td>
<td>109.4</td>
<td>103.5</td>
<td>103.6</td>
<td>113.0</td>
<td>142.8</td>
<td>92.7</td>
<td>117.4</td>
<td>120.5</td>
<td>127.7</td>
<td>134.9</td>
<td>123.1</td>
<td>111.4</td>
</tr>
<tr>
<td>Piramal Enterprises Ltd.</td>
<td>84.0</td>
<td>89.8</td>
<td>108.5</td>
<td>104.5</td>
<td>122.0</td>
<td>103.2</td>
<td>96.0</td>
<td>90.0</td>
<td>88.0</td>
<td>79.0</td>
<td>28.3</td>
<td>33.5</td>
<td>34.7</td>
<td>39.0</td>
<td>78.6</td>
</tr>
<tr>
<td>Sun Pharmaceutical Inds. Ltd.</td>
<td>247.2</td>
<td>218.9</td>
<td>185.0</td>
<td>142.2</td>
<td>136.2</td>
<td>158.5</td>
<td>68.5</td>
<td>53.6</td>
<td>84.9</td>
<td>216.5</td>
<td>196.9</td>
<td>137.7</td>
<td>170.8</td>
<td>149.3</td>
<td>154.7</td>
</tr>
<tr>
<td>Industry Average</td>
<td>139.4</td>
<td>121.3</td>
<td>115.8</td>
<td>128.4</td>
<td>133.9</td>
<td>120.8</td>
<td>118.1</td>
<td>114.5</td>
<td>112.8</td>
<td>133.9</td>
<td>131.4</td>
<td>125.4</td>
<td>133.8</td>
<td>126.9</td>
<td>125.5</td>
</tr>
</tbody>
</table>
### Table-3.4  Inventory Turnover Ratio (in Times)

<table>
<thead>
<tr>
<th>Company Name</th>
<th>2000</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aurobindo Pharma Ltd.</td>
<td>4.55</td>
<td>6.09</td>
<td>4.39</td>
<td>3.82</td>
<td>2.83</td>
<td>3.15</td>
<td>2.96</td>
<td>2.80</td>
<td>3.02</td>
<td>2.76</td>
<td>2.59</td>
<td>2.91</td>
<td>3.12</td>
<td>2.97</td>
<td>3.43</td>
</tr>
<tr>
<td>Cadila Healthcare Ltd.</td>
<td>3.82</td>
<td>3.44</td>
<td>3.63</td>
<td>4.55</td>
<td>4.00</td>
<td>4.06</td>
<td>2.99</td>
<td>3.19</td>
<td>3.37</td>
<td>3.92</td>
<td>3.85</td>
<td>3.91</td>
<td>3.98</td>
<td>4.10</td>
<td>3.77</td>
</tr>
<tr>
<td>Cipla Ltd.</td>
<td>2.34</td>
<td>2.15</td>
<td>1.68</td>
<td>2.13</td>
<td>1.97</td>
<td>2.01</td>
<td>2.26</td>
<td>2.34</td>
<td>2.24</td>
<td>2.30</td>
<td>2.23</td>
<td>2.48</td>
<td>2.35</td>
<td>2.62</td>
<td>2.22</td>
</tr>
<tr>
<td>Divi'S Laboratories Ltd.</td>
<td>2.86</td>
<td>3.18</td>
<td>2.54</td>
<td>2.16</td>
<td>1.83</td>
<td>1.41</td>
<td>2.17</td>
<td>2.31</td>
<td>2.00</td>
<td>1.34</td>
<td>1.46</td>
<td>1.81</td>
<td>1.79</td>
<td>1.87</td>
<td>2.05</td>
</tr>
<tr>
<td>Dr. Reddy'S Laboratories Ltd.</td>
<td>3.50</td>
<td>3.74</td>
<td>3.29</td>
<td>3.70</td>
<td>3.19</td>
<td>2.92</td>
<td>3.94</td>
<td>3.54</td>
<td>3.63</td>
<td>3.27</td>
<td>3.44</td>
<td>3.01</td>
<td>3.46</td>
<td>3.36</td>
<td>3.43</td>
</tr>
<tr>
<td>Glaxosmithkline Pharmaceuticals Ltd.</td>
<td>4.28</td>
<td>5.10</td>
<td>4.33</td>
<td>4.10</td>
<td>4.09</td>
<td>4.43</td>
<td>4.06</td>
<td>4.60</td>
<td>4.47</td>
<td>4.62</td>
<td>4.64</td>
<td>4.71</td>
<td>6.25</td>
<td>5.72</td>
<td>4.67</td>
</tr>
<tr>
<td>Glenmark Pharmaceuticals Ltd.</td>
<td>3.13</td>
<td>3.91</td>
<td>3.57</td>
<td>2.45</td>
<td>2.53</td>
<td>2.33</td>
<td>2.19</td>
<td>2.55</td>
<td>3.54</td>
<td>3.48</td>
<td>4.39</td>
<td>5.38</td>
<td>6.20</td>
<td>6.82</td>
<td>3.75</td>
</tr>
<tr>
<td>Lupin Ltd.</td>
<td>3.32</td>
<td>3.66</td>
<td>4.86</td>
<td>3.99</td>
<td>3.68</td>
<td>3.90</td>
<td>3.65</td>
<td>3.10</td>
<td>3.00</td>
<td>3.48</td>
<td>3.69</td>
<td>3.38</td>
<td>3.51</td>
<td>3.79</td>
<td>3.64</td>
</tr>
<tr>
<td>Piramal Enterprises Ltd.</td>
<td>3.76</td>
<td>3.91</td>
<td>4.15</td>
<td>4.64</td>
<td>3.49</td>
<td>4.20</td>
<td>4.81</td>
<td>5.25</td>
<td>5.30</td>
<td>6.28</td>
<td>3.40</td>
<td>3.70</td>
<td>4.24</td>
<td>4.29</td>
<td>4.39</td>
</tr>
<tr>
<td>Sun Pharmaceutical Inds. Ltd.</td>
<td>1.88</td>
<td>2.74</td>
<td>2.41</td>
<td>3.43</td>
<td>3.80</td>
<td>4.14</td>
<td>4.33</td>
<td>4.73</td>
<td>4.74</td>
<td>2.24</td>
<td>2.27</td>
<td>2.76</td>
<td>1.58</td>
<td>1.78</td>
<td>3.06</td>
</tr>
<tr>
<td>Industry Average</td>
<td>3.34</td>
<td>3.79</td>
<td>3.49</td>
<td>3.49</td>
<td>3.14</td>
<td>3.26</td>
<td>3.34</td>
<td>3.44</td>
<td>3.53</td>
<td>3.37</td>
<td>3.20</td>
<td>3.40</td>
<td>3.65</td>
<td>3.73</td>
<td>3.44</td>
</tr>
</tbody>
</table>
Figure: 3.7 Inventory Turnover Ratio
Table 3.3 & chart 3.3 shows the relationship between inventories to current liability. This ratio shows the safe position of current liability. The industry average of inventory to current liability is 125.5%. The industry average of inventory to current liability ratio is fluctuated throughout the study period. The highest inventory to current liability is recorded by Divi’s Laboratories Ltd. on an overall average 204.1% and lowest of Piramal Enterprises Ltd. at 76.6%. Cipla Ltd. is at second position for this ratio as it is 169% as an overall average throughout the study period. Cipla Ltd. has shown opposite trend than the industry average, it has increased from 165.1% of 2000 to 195.2% of 2013.

Table 3.4 shows the inventory turnover ratio of Indian Pharmaceutical companies. The inventory turnover ratio is helpful to analyse the velocity of inventory in the company. It is a relationship between cost of goods sold and average inventory, the higher the ratio shows the higher efficiency of inventory. The inventory turnover ratio of Indian Pharmaceutical companies shows the industry average is 3.44 times. The highest inventory turnover ratio of Glaxosmithkline Pharmaceuticals Ltd. with on an average of 4.67 times and lowest is of Divi’s laboratories Ltd. with 2.05 time as an annual average. The inventory turnover ratio of Cipla Ltd. is moving between 1.68 times to 2.62 times, Piramal Enterprises Ltd. has recorded second highest inventory turnover ratio of 4.39 times. During 2010 to 2014 inventory turnover ratio of Cipla Ltd. is moving between 2.23 to 2.62 times. The inventory turnover ratio of Cipla Ltd. is not quite good. It is lower than the industry average.

**Inventory Conversion Period (ICP)**

Table 3.5 shows the conversion period of inventory, it is shown from the table that the industry average of inventory conversion period is 118 days (approx). On the basis of industry average Divi’s Laboratory Ltd. is taking most time of 189 days (approx) in conversion of inventory, whereas Glaxosmithkline Pharmaceuticals Ltd. has shown the best performance as it takes just 79 days (approx) in inventory conversion. Cipla Ltd. stands at 9th position in inventory conversion period. It takes 166 days (approx) in inventory conversion; Cipla Ltd. has improving his performance last five years from 164 days in 2011 to 139 days in 2013.
### Table 3.5: Inventory Period (in days)

<table>
<thead>
<tr>
<th>Company Name</th>
<th>2000</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aurobindo Pharma Ltd.</td>
<td>8.00</td>
<td>59.96</td>
<td>83.09</td>
<td>95.56</td>
<td>128.89</td>
<td>115.95</td>
<td>123.44</td>
<td>130.47</td>
<td>121.01</td>
<td>132.37</td>
<td>140.67</td>
<td>125.49</td>
<td>116.95</td>
<td>123.00</td>
<td>107.49</td>
</tr>
<tr>
<td>Cadila Healthcare Ltd.</td>
<td>95.43</td>
<td>106.11</td>
<td>100.54</td>
<td>80.30</td>
<td>91.23</td>
<td>89.86</td>
<td>122.12</td>
<td>114.42</td>
<td>108.47</td>
<td>93.01</td>
<td>94.77</td>
<td>93.32</td>
<td>91.68</td>
<td>89.08</td>
<td>97.88</td>
</tr>
<tr>
<td>Cipla Ltd.</td>
<td>155.95</td>
<td>170.09</td>
<td>217.52</td>
<td>171.32</td>
<td>185.13</td>
<td>181.28</td>
<td>161.65</td>
<td>155.79</td>
<td>162.62</td>
<td>158.56</td>
<td>163.98</td>
<td>147.11</td>
<td>155.08</td>
<td>139.14</td>
<td>166.09</td>
</tr>
<tr>
<td>Divi’S Laboratories Ltd.</td>
<td>127.53</td>
<td>114.81</td>
<td>143.78</td>
<td>168.78</td>
<td>199.82</td>
<td>258.43</td>
<td>167.87</td>
<td>158.08</td>
<td>182.59</td>
<td>271.76</td>
<td>249.68</td>
<td>201.91</td>
<td>203.47</td>
<td>195.20</td>
<td>188.84</td>
</tr>
<tr>
<td>Dr. Reddy’S Laboratories Ltd.</td>
<td>104.37</td>
<td>97.71</td>
<td>110.81</td>
<td>98.68</td>
<td>114.27</td>
<td>125.01</td>
<td>92.72</td>
<td>103.08</td>
<td>100.60</td>
<td>111.49</td>
<td>106.25</td>
<td>121.33</td>
<td>105.35</td>
<td>108.68</td>
<td>107.17</td>
</tr>
<tr>
<td>Glaxosmithkline Pharmaceuticals Ltd.</td>
<td>85.28</td>
<td>71.64</td>
<td>84.30</td>
<td>89.07</td>
<td>89.28</td>
<td>82.45</td>
<td>89.95</td>
<td>79.40</td>
<td>81.64</td>
<td>78.96</td>
<td>78.66</td>
<td>77.55</td>
<td>58.43</td>
<td>63.77</td>
<td>79.31</td>
</tr>
<tr>
<td>Glenmark Pharmaceuticals Ltd.</td>
<td>116.66</td>
<td>93.25</td>
<td>102.32</td>
<td>149.21</td>
<td>144.12</td>
<td>156.85</td>
<td>166.54</td>
<td>143.37</td>
<td>103.06</td>
<td>104.76</td>
<td>83.17</td>
<td>67.88</td>
<td>58.83</td>
<td>53.48</td>
<td>110.25</td>
</tr>
<tr>
<td>Lupin Ltd.</td>
<td>109.87</td>
<td>99.71</td>
<td>75.06</td>
<td>91.58</td>
<td>99.07</td>
<td>93.48</td>
<td>99.88</td>
<td>117.80</td>
<td>121.85</td>
<td>104.81</td>
<td>99.04</td>
<td>108.05</td>
<td>103.95</td>
<td>96.31</td>
<td>101.46</td>
</tr>
<tr>
<td>Piramal Enterprises Ltd.</td>
<td>97.15</td>
<td>93.24</td>
<td>87.97</td>
<td>78.74</td>
<td>104.69</td>
<td>86.89</td>
<td>75.80</td>
<td>69.48</td>
<td>68.82</td>
<td>58.13</td>
<td>107.28</td>
<td>98.73</td>
<td>86.09</td>
<td>85.03</td>
<td>85.57</td>
</tr>
<tr>
<td>Sun Pharmaceutical Inds. Ltd.</td>
<td>194.12</td>
<td>133.04</td>
<td>151.48</td>
<td>106.53</td>
<td>96.12</td>
<td>88.13</td>
<td>84.31</td>
<td>77.20</td>
<td>76.96</td>
<td>163.23</td>
<td>160.84</td>
<td>132.18</td>
<td>231.00</td>
<td>205.44</td>
<td>135.76</td>
</tr>
<tr>
<td>Industry Average</td>
<td>109.44</td>
<td>103.95</td>
<td>115.69</td>
<td>112.98</td>
<td>125.26</td>
<td>127.83</td>
<td>118.43</td>
<td>114.91</td>
<td>112.76</td>
<td>127.71</td>
<td>128.43</td>
<td>117.36</td>
<td>121.08</td>
<td>115.91</td>
<td>117.98</td>
</tr>
</tbody>
</table>
Figure: 3.8 Inventory Period
3.3.3 IMPACT OF INVENTORY MANAGEMENT ON PROFITABILITY:

Numerous factors are wont to manage inventory. These factors are analyzed within the below section to point out its impact on profitability:

Explanatory variables

The efficiency ratios, particularly accounts receivable, inventory and accounts payable are computed, exploitation the formulas as follows:

Inventory Conversion period (in days) = (Stocks * 365)/Cost of Sales

Control variables

In order to account for firm’s size and also the alternative variables that will influence profits thus we tend to use sales a proxy for size (the log of sales), the gearing ratio (financial debt/total assets), the gross working capital turnover ratio (sales/current assets) and also the ratio of current assets to total assets are enclosed as control variables within the regressions.

The regressions also include the ratio of current liabilities to total assets to measure the degree of aggressive financing policy, with a high magnitude relation being comparatively a lot of aggressive.

Regression Analysis

To investigate the impact of inventory management on profitability, the model used for the regressions analysis is expressed within the general type as given in equation 1:

\[
ROTA = f (\ln sales, gear, cata, clta, turnca, ivndays)
\]

\[Equation (1)\]

\[
ROTA = \beta_0 + \beta_1 \ln sales_{it} + \beta_2 gear_{it} + \beta_3 cata_{it} + \beta_4 clta_{it} + \beta_5 turnca_{it} + \beta_6 ivndays_{it} + \epsilon_{it}
\]

[model 1]

Where i denoting firms (cross-section dimension) starting from one to ten and t denoting years (time-series dimension) starting from one to fourteen.

The model specifies on top of is calculable using the regression-based framework (Fixed Effects and Pooled OLS) as used by Deloof (2003). Our model differs, initial by using ROTA as a comprehensive measure of profitability and also the model includes asset-management and funding policy as management variables. the information set used for this half is pooled across companies and years, given associate balanced panel data set of one hundred forty firm-year observations.

A classical check for panel information is one among mounted effects model (FEM) versus Random Effects Model (REM). In the REM, it's assumed that there's one
common intercept term, however that the intercepts for individual companies vary from this common intercept in a very random manner. to see that of those estimators are a lot of applicable to use, each a fixed effects and a random effects expert was used to estimate the coefficients in model one. The Hausman check, that may be a check for the null hypothesis of no correlation, rejects this null hypothesis then the choice is taken to employ a fixed effects framework.

The Table 3.6 represents the results of regression one, applying a fixed effects methodology, wherever the intercept term is allowed to vary across corporations. it's instantly obvious from the adjusted R-squared values that the employment of a firm specific intercept improves the informative power of those models. In Regression, the adjusted R-squared explain make a case for.44% of the variation in profitability

<table>
<thead>
<tr>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-ratio</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>const</td>
<td>-0.248755</td>
<td>0.155005</td>
<td>-1.6048</td>
</tr>
<tr>
<td>GEAR</td>
<td>-0.135787</td>
<td>0.195005</td>
<td>-0.6963</td>
</tr>
<tr>
<td>CATA</td>
<td>0.605913</td>
<td>0.114072</td>
<td>5.3117</td>
</tr>
<tr>
<td>CATURN</td>
<td>0.0488044</td>
<td>0.0155259</td>
<td>3.1434</td>
</tr>
<tr>
<td>CLTA</td>
<td>-0.666031</td>
<td>0.268386</td>
<td>-2.4816</td>
</tr>
<tr>
<td>INVDAYS</td>
<td>-8.18222e-05</td>
<td>0.000285896</td>
<td>-0.2862</td>
</tr>
<tr>
<td>LNSales</td>
<td>0.0182702</td>
<td>0.0126318</td>
<td>1.4464</td>
</tr>
</tbody>
</table>

R-squared 0.334465

While the coefficient of inventories variable is negative during this regression, however the coefficient isn't different totally different from zero. The coefficients of the opposite variables enclosed within the model are significant, apart from GEAR and LNSales. The firms’ profitability as measured by ROTA will increase with firms’ size, gross working capital potency, and with a lesser aggressiveness of asset management. this is often contrary to the traditional theory of asset management, wherever a conservative policy is anticipated to sacrifice profitability at the expense of liquidity. As reveals by the study of Deloof (2003), the capital structure incorporates a negative impact on profitability; apart from our findings the coefficient
of financial debt is significant at five percent level. The aggressive financing policy observes for the sample companies that is anticipated to contribute completely to profitability have unconcealed otherwise. This is often a usually observed feature of the sample companies and this has the tendency of skyrocketing the risk of a short-run liquidity problem.