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**DEPARTMENT OF CONSTRUCTION TECHNOLOGY
AND MANAGEMENT**

**FINANCIAL MANAGEMENT IN
CONSTRUCTION (HB)**

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CHAPTER FOUR

WORKING CAPITAL MANAGEMENT

4.1. WORKING CAPITAL POLICY

One of the most important areas in the day-to-day management of the firm deals with the management of Working Capital, which is defined as all the short term assets used in daily operations. As discussed in the previous chapters, the key difference between long-term financial management and short term financial management (also referred as working capital management) is in terms of the timing of cash. While long term financial decisions like buying capital equipment, building structures or issuing debentures involve cash flows over an extended period of time, short term financial decisions typically involve cash flows within a year or within the operating cycle of the firm.

There are two concepts of working capital: gross working capital and net working capital. Gross working capital is the total of all current assets. Net working capital is the difference between current assets and current liabilities. The constituents of current assets and current liabilities are shown hereunder.

Current Assets: Liquidating assets in the accountable period

- Inventories that comprise
 - Raw materials and components
 - Work in progress
 - Finished goods
- Trade debtors (Accounts receivable)
- Cash and marketable securities

Current Liabilities: Cash or services delivered in advance but repayment not yet effected.

- Sundry creditors (Accounts payable)
- Trade advances
- Short term borrowings
- Accruals, deferred tax etc,

Working capital management is the functional area of finance that covers all the current accounts of the firm. It is concerned with the adequacy of current assets as well as the level of risk posed by current liabilities. Arranging short term financing, negotiating favorable credit terms, controlling the movement of cash, administering accounts receivable and monitoring the investment in inventories consume a great deal of time of financial managers. It is a discipline that seeks proper policies for managing current assets and liabilities and practical techniques for maximizing the benefits from managing working capital.

4.1.1. Characteristics of Current Assets

In the management of working capital, two characteristics of current assets must be borne in mind:

- Short life span,
- Swift transformation into other asset forms.

Current assets have a short life span. Cash balances may be held idle for a week or two, accounts receivables may have a life span of 30 to 60 days, and inventories may be held for 30 to 100 days. The life span of current assets depend upon the time required in the activities of procurement, production, sales and collection and the degree of synchronization among them.

Each current asset is swiftly transformed into other asset forms: cash is used for acquiring raw materials; raw materials are transformed into finished goods (these transformation may involve several stages of work in process); finished goods generally sold on credit basis are converted to accounts receivable; and finally accounts receivable, on realization, generate cash. Fig 4.1 shows the cycle of transformation of current assets.

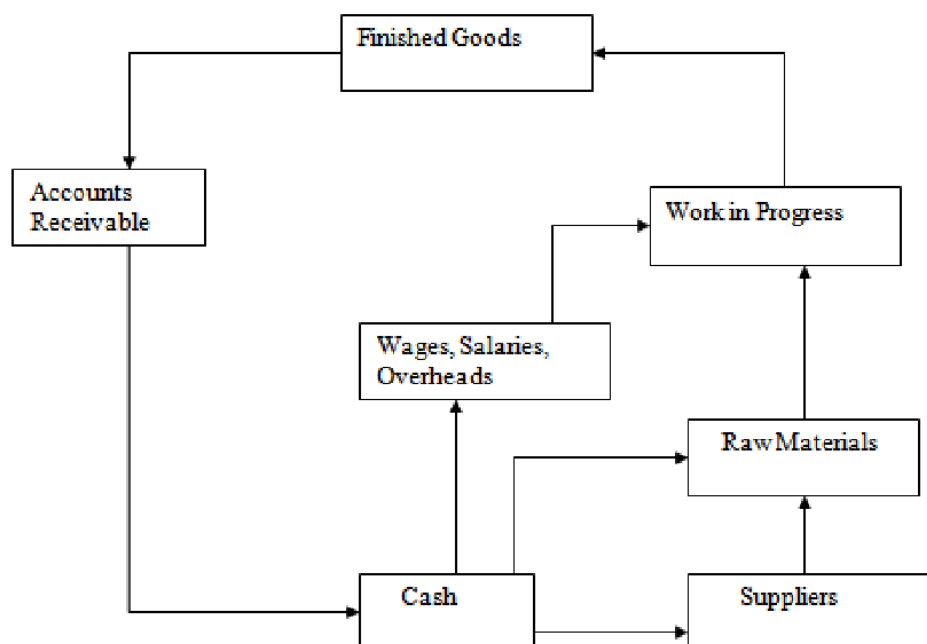


Fig 4.1 Current Asset Cycle

4.1.2. Operating Cycle and Cash Cycle

Investments in working capital are influenced by four key events in the production and sales cycle of the firm:

- Purchase of raw materials,
- Payment for raw materials,
- Sale of finished goods
- Collection of cash sales.

Fig 4.2 depicts these events on the cash flow line. The firm begins with the purchase of raw materials which are paid for after a delay which represents the accounts payable period. The firm converts the raw materials into finished goods and then sells the same. The time lag between the purchase of raw materials and the sale of finished goods is the inventory period. Customers pay the bills some time after the sales. The period that elapse between the date of sales and the date of collection of receivables is the accounts payable period. The time that elapse between the purchase of raw materials and the collection of cash for sales is referred to as the operating cycle, whereas the time length between the payment for raw material purchases and the collection of cash for sales is referred to as the cash cycle. The operating cycle is the sum of the inventory period and the accounts receivable period, whereas the cash cycle is equal to the operating cycle less the accounts payable period.

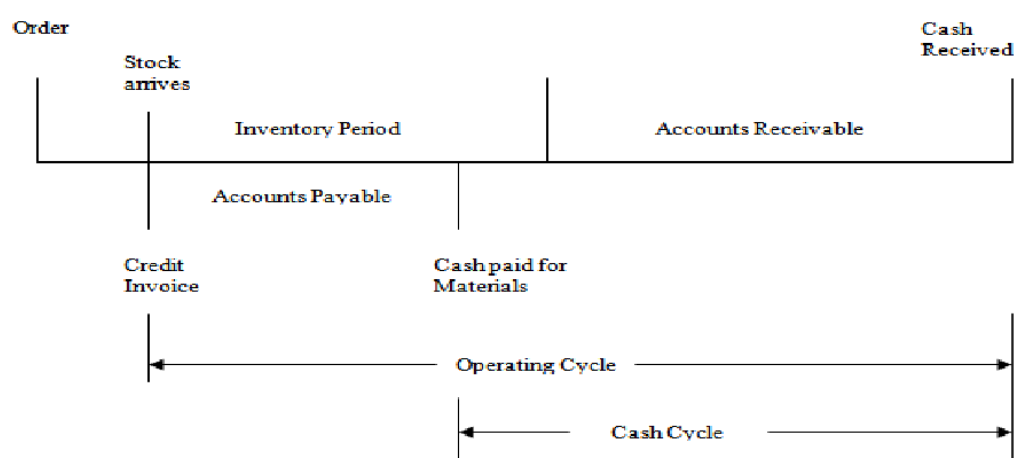


Fig 4.2 Operating and Cash Cycle

From the financial statement of the firm, one can estimate the inventory period, the accounts receivable period and the accounts payable period.

$$\text{Acc. Receivable Period (days)} = \frac{\text{Accounts Receivable (\$)}}{\text{Annual Sales (\$)} / 365 \text{ days}}$$

$$\text{Acc. Payable Period (days)} = \frac{\text{Acc. Payable (\$)}}{\text{Annual Cost of Goods (\$)} / 365 \text{ days}}$$

$$\text{Inventory Period (days)} = \frac{\text{Inventory (\$)}}{\text{Annual Cost of Goods sold (\$)} / 365 \text{ days}}$$

For the example below, estimate the operating and cash cycle of the firm given the following data taken from the financial statement.

- Annual Sale: Birr 500 million
- Total cost of goods sold: Birr 360 million
- Inventories: Birr 60 million
- Accounts Receivables: Birr 80 million
- Accounts Payable: Birr 50 million

Solution:

$$\text{Accounts Receivable} = (80 / 500) \times 365 = 58 \text{ days}$$

$$\text{Accounts payable} = (50 / 420) \times 365 = 43 \text{ days}$$

$$\text{Inventory Period} = (60 / 420) \times 365 = 52 \text{ days.}$$

$$\text{Operating Cycle} = 52 + 58 = 110 \text{ days}$$

$$\text{Cash Cycle} = 110 - 43 = 67 \text{ days.}$$

4.1.3. Factors Affecting Working Capital Requirements

The working capital needs of a firm are influenced by numerous factors. The important ones are:

- Sales Volume:** A firm maintains current assets because they are needed to support the operational activities that culminate in sales. Over time, a firm will keep a fairly steady rate of current assets to annual sales. A firm realizing a steady level of sales operates with a fairly constant level of cash, receivables, and inventory, if properly managed. Firms experiencing growth in sales require additional working capital. If sales are declining, a reduction in working capital can be expected.
- Nature of Business:** The working capital requirement of a firm is closely related to the nature of its business. A service firm with a short operating cycle and which sells predominantly on cash basis has modest working capital requirement. On the other hand, a firm which has a long operating cycle and which sells largely on credit has a very substantial working capital requirement.
- Production Policy:** A firm marked by pronounced seasonal fluctuation in its sales may pursue a production policy which may reduce the sharp variations in working capital requirements. For example, a manufacturer of ceiling fans may maintain a steady production throughout the year rather than intensify the production activity during the peak business season. Such a production policy may dampen the fluctuations in working capital.
- Market Conditions:** The degree of competition prevailing in the market place has an important bearing on working capital needs. When competition is keen, a larger inventory of finished goods is required to promptly serve customers who may not be inclined to wait

because other manufacturers are ready to meet their needs. Further, generous credit terms may have to be offered to attract customers in a highly competitive market. Thus working capital needs tend to be high because of greater investment in finished goods inventory and accounts receivable.

- e) *Conditions of Supply:* The inventory of raw materials, spares and stores depend on the conditions of supply. If the supply is prompt and adequate, the firm can manage with small inventory. If, however the supply is unpredictable and scant with the firm, to ensure continuity of production, the firm would have to acquire stocks as and when they are available and carry large inventory on average.

4.1.4. Cash Requirement for Working Capital

As a finance manager, one will be interested in figuring out how much cash to be arranged to meet the working capital need of the firm. To do this, two step procedures shall be followed:

Step 1: Estimation of the cash cost of various current assets require by the firm:

This follows to estimate the following:

- Cash cost of debtors (receivables) by removing the profit element (ROCE),
- Raw materials in stock
- Finished goods in stock
- Cash balance

Step 2: Deduct the current liabilities from the cash cost of current assets:

A portion of the cash cost of current assets is supported by trade credit and accruals of wages and expenses, which may be referred to as spontaneous current liabilities. The balance left after such deduction has to be arranged from other sources.

Example: Given the following annual figures of a firm:

- Annual sales (Two months credit is given) : Birr 240 million
- ROCE: 20%
- Material cost (Suppliers give three months credit): Birr 72 million
- Wages (wages are paid with one month arrears): Birr 48 million
- Manufacturing Expense (Plant expense) paid in one month arrears: Birr 48 million
- Administrative expenses (Paid as incurred) : Birr 32 million
- The firm keeps two months' stock of raw materials and one month's stock of finished goods.
- The firm wants to maintain a cash balance of Birr 5 million.
- Neglect work in progress

Estimate the working capital requirement of the project.

Solution:

Given cost of sale = Birr 200 million

ROCE = Birr 40 million

Step 1: Current Assets:

- Receivables = $(200/12) \times 2$ = Birr 33.33 million
 - Raw material in stock = $(72/12) \times 2$ = Birr 12 million
 - Finished goods = $(168/12) \times 1$ = Birr 14 million
 - Cash Balance = Birr 5 million
-

Total Current Assets = Birr 64.33 million

Step 2: Current Liabilities

- Sundry creditors = $(72/12) \times 3$ = Birr 18 million
 - Wages = $(48/12) \times 1$ = Birr 4 million
 - Plant expense = $(48/12) \times 1$ = Birr 4 million
-

Total current liabilities = Birr 26 million

Working Capital requirement = Birr 64.33 million – Birr 26 million = **Birr 38.33 million**

Birr 38.33 million should be arranged from other financial sources.

4.2. CASH & LIQUID MANAGEMENT

In a financial sense, the term cash refers to all money items and sources that are immediately available to help pay a firm's bill. Cash, the most liquid asset, is of vital importance to the daily operations of business firms. On the balance sheet, cash assets include deposits in financial institutions and cash equivalents in money market funds or marketable securities. All highly liquid short-term securities are treated as cash.

Three securities are widely used as short-term investments and alternative forms of cash. Each security offers different characteristics that make it suitable for different firms.

1. *Treasury Bills:* A treasury bill is an unconditional promise by Government's Treasury Agent to pay to the holder of the bill a specified amount at maturity. Treasury bills are issued for short periods of time, normally 3, 6 or 12 months. Two characteristics of treasury bills should be noted:

- *Non interest bearing:* Treasury bills are sold at a discount on a bid basis, mainly to security dealers and large commercial banks, who resell them to individuals and firms.
 - *Most secure and liquid marketable security:* Treasury bills are most secured and liquid kind of marketable security because government guarantees their redemption.
2. *Commercial Paper:* Commercial paper represents short term unsecured promissory notes issued by firms that are generally considered to be financially strong. Commercial paper usually has a maturity period of 90 days or 180 days. They are purchased by individuals or other firms with excess cash that have a desire to earn a higher yield than available from treasury bills. In turn for the higher yield, the firm accepts slightly greater risk and less liquidity.
 3. *Certificates of Deposit:* A certificate of deposit represents a negotiable receipt of funds deposited in a bank for a fixed period. The bank agrees to pay the bearer the amount of the deposit plus a stipulated amount of interest at maturity. Certificate of deposits are a popular form of short term investment for companies since they are fairly liquid, generally risk free and offer a higher rate of interest than treasury bills.

4.2.1. How large a cash balance is needed?

The size of a firm's cash balance depends basically upon the three major reasons for liquidity. This includes:

- i) *Transaction needs:* A firm needs cash to carry out the day-to-day functions of the business. Just as the firm's level of operations affects working capital requirements, it affects the need for cash. If the volume of sales increases, cash will be received from customers and will be expended for materials and wages in large amounts. Adequate cash to cover these and other transactions allow the firm to pay its bills on time.
- ii) *Contingency needs:* If the firm could perfectly forecast its needs for cash, it would not have to be concerned with unexpected occurrences or emergencies that require cash. Because this is not possible, the firm must be prepared for contingencies.
- iii) *Opportunity needs:* These involve the chance to profit from having cash available. For example, a supplier may have several cancellations of orders and may wish to move a large unwanted inventory of raw materials from his warehouse. If the supplier offers a large discount for cash purchasing of the materials, the firm will have the opportunity to realize a substantial savings on its purchase and, hence, profits from the sale of the finished goods.

4.2.2. Forecasting Cash Flow

Once the financial manager has identified the firm's policies on cash flow management, he must face the problem of predicting the amounts and timing of future inflows and outlays of cash. This is a difficult process for most firms because cash flows are affected by many factors. The failure to prepare for the proper level of cash poses three risks to the company:

- i) **Default:** The failure to pay interest or principal payments on a firm's borrowings or failure to perform as per contract is a default, a situation that may result in legal actions by the firm's creditors.
- ii) **Overdue Bills:** The failure to pay short-term obligations, such as payables, is less serious than default but may result in a lowering of the firm's credit rating in the business community. This may be accompanied by higher interest rates when the firm applies for loans or may cause creditors to refuse to ship supplies on credit.
- iii) **Lost Savings on Purchases:** Inadequate cash may cause the firm to lose opportunities to make special cash purchases or to take generous trade discounts on purchases of goods.

In attempting to minimize these risks, the firm pursues the twin goals of cash forecasting, namely:

- **Liquidity:** By predicting cash surpluses or cash shortages, the firm achieves liquidity-sufficient money in the bank to pay debts as they come due.
- **Profitability:** Accurate cash forecasting achieves profits by allowing the firm to take profitable discounts on purchases, invest surplus funds, or reduce the costs of maintaining idle cash balances.

Example: On Cash flow forecast & Working Capital

Given the following information for a construction project: A contract budget has been prepared and the monthly evaluation forecasts are as indicated hereunder:

Month	1	2	3	4	5	6
Monthly Value (Birr)	8,000	10,000	12,000	14,000	10,000	6,000

- Profit included in the estimate is 12 %
 - Payments are to be made monthly within 28 days
 - Retention money for every monthly payment – 3 % where 1.5% will be released during the completion period and the remaining at the expiry of defects liability period.
 - Defects liability period – 6 months
 - No advance payment
 - 5 % of the total project cost is used as mobilization cost.
- i) Prepare the gross and net cash requirements for the project.
 - ii) Assuming even contract budget throughout the contract period, estimate the working capital.
 - Material on site to be considered in the payment as delivered to the site: 50% of production cost
 - Wages and plants : every month amounting to 40% of production cost
 - Overhead cost 10%

Solution:

1) Cumulative contract value forecast from the monthly value forecast.

Months	1	2	3	4	5	6
Cumulative Forecast (Birr)	8,000	18,000	30,000	44,000	54,000	60,000

2) Cumulative self-cost of contract & expenditure:

Cumulative self-cost = Cumulative contract value – profit release- mobilization cost

Months	1	2	3	4	5	6
Cumulative self-cost (Birr)	6,640	14,940	24,900	36,520	44,820	49,800

Cumm. Expenditure = Cumulative self-cost + mobilization

Months	1	2	3	4	5	6
<u>Cumm. Expenditure</u> (Birr)	9,640	17,940	27,900	39,520	47,820	52,800

3) Cumulative Income

Monthly Income Forecast: It can be determined from cumulative contract value forecast subject to deductions as retention money, advance payment and any previous payments.

Income month(i+1) = Cumm. Contract Value month(i) – retention – previous payments

Income month (2) = 8,000 – 0.03(8,000) -0 = Birr 7,760

Income month (3) = 18,000 – 0.03 (18,000) – 7,760 = Birr 9,700

Income month (4) = 30,000 – 0.03(30,000) – (7,760+9,700) = Birr 11,640

Income month (5) = 44,000 – 0.03(44,000) – (7,760 +9,700+11,640) = Birr 13,580

Income month (6) = 54,000 – 0.03 (54,000) – (7,760+9,700+11,640+13,580) = Birr 9,700

Income month (7) = 60,000- 0.015(60,000) – (7,760+9,700+11,640+13,580+9,700) = Birr 6,720

Income month (12) = 0.0015 (60,000) = Birr 900

Cumulative Income:

Months	1	2	3	4	5	6	7	12
Monthly Income (Birr)	0	7,760	9,700	11,640	13,580	9,700	6,720	900
<u>Cumm. Income</u> (Birr)	0	7,760	17,460	29,100	42,680	52,380	59,100	60,000

4) Gross and Net Cash Requirements

et cash required (monthly) = Cumm. Income after receipt of each monthly payment - Cumm. Expenditure

Gross cash required (monthly) = Cumm. Income prior to receiving monthly payment - Cumm. Expenditure

Months	1	2	3	4	5	6	7	12
Net Cash Req'd (Birr)	-9,640	-10,180	-10,440	-10,420	-5,140	-420	6,300	7,200
Gross cash Req'd (Birr)	-9,640	-17,940	-20,140	-22,060	-18,720	-10,120	-420	6,300

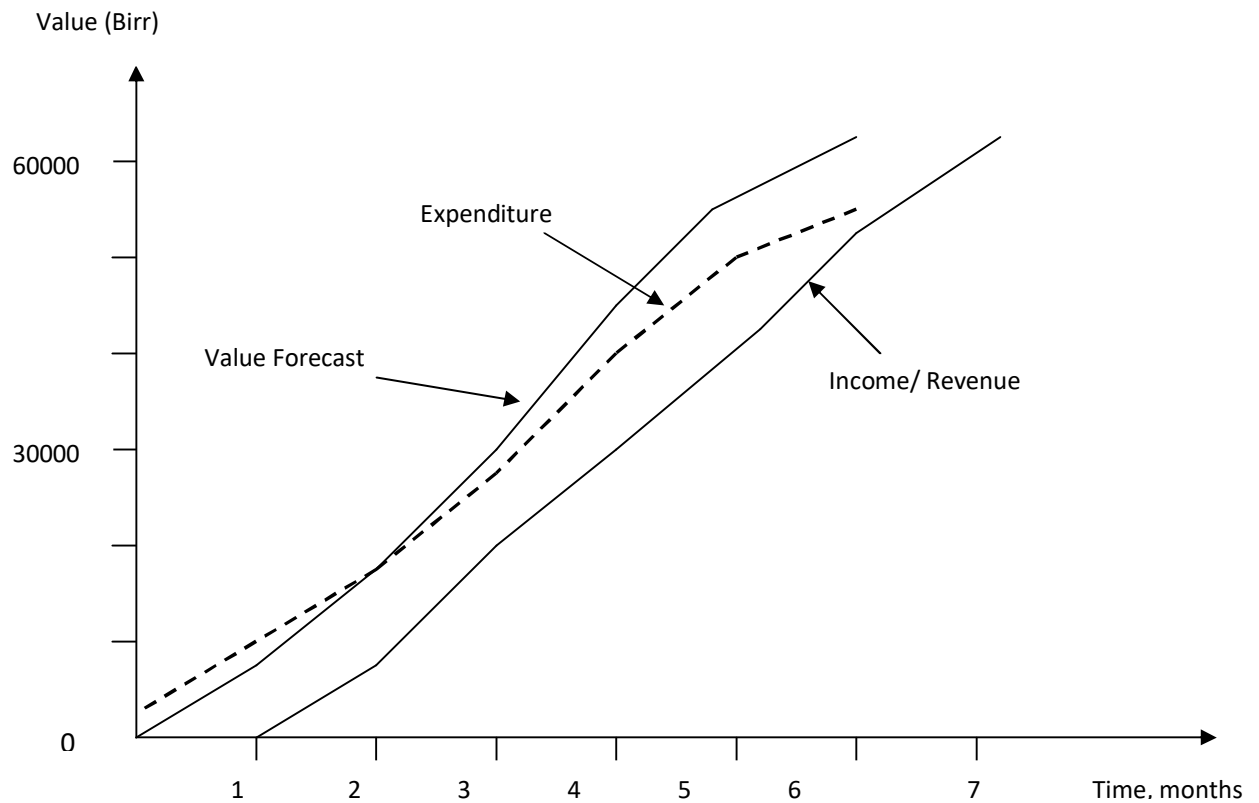


Fig 4.3a Cash Flow Forecast

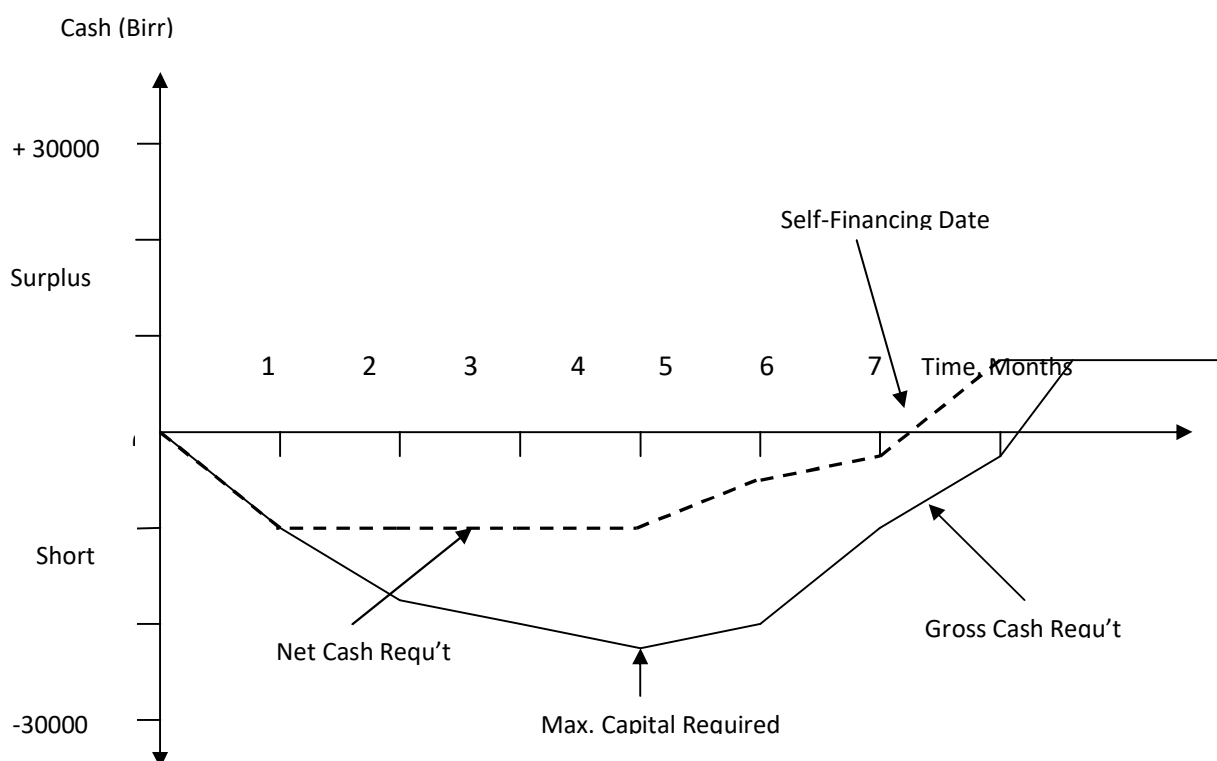


Fig 4.3b Gross and Net Cash Requirements.

ii) Working Capital Requirement:

Given cost of sale = Birr 52,800

ROCE = Birr 7,200

Step 1: Current Assets

- Receivables: $(52,800/6) \times 1 = \text{Birr } 8,800$
- Raw material on stock = $((0.5 \times 52,800)/6) \times 1 = \text{Birr } 4,400$

Total current assets = Birr 13,200

Step 2: Current Liabilities

- Wages and plant cost = $((0.4 \times 52,800)/6) \times 1 = \text{Birr } 3,520$
- Raw material $((0.5 \times 52,800)/6) \times 1 = \text{Birr } 4,400$

Total Current liabilities = Birr 7,920

Working capital Requirement = Birr 5,280 monthly.

iii) Working Capital assuming 20% advance payment.

4.3. CREDIT MANAGEMENT

While business firms would like to sell on cash, the pressure of competition and the force of custom persuade them to sell on credit terms. Firms grant credit to facilitate sales. It is valuable to customers as it augments their resources. It is particularly appealing to those customers who cannot borrow from other sources or find it very expensive or inconvenient to do so. The credit period extended by business firms usually ranges from 15 to 60 days. When goods are sold on credit, finished goods get converted into accounts receivable (trade debtors) in the books of the seller. In the books of the buyer, the obligation arising from credit purchase is represented as accounts payable (trade creditors).

A firm's investment in accounts receivable depends on how much it sells on credit and how long it takes to collect receivables. For example, if a firm sells Birr 1 million worth of goods on credit a day and its average collection period is 40 days, its accounts receivable will be Birr 40 million.

4.3.1. Terms of Payment

Terms of payment vary widely in practice. At one end, if the seller has financial sinews it may extend liberal credit to the buyer till it converts goods bought into cash. At the other end, the buyer may pay cash in advance to the seller and finance the entire trade cycle. Most commonly, however, some in between arrangements is chosen wherein the trade cycle is financed partly by the seller, partly by the buyer, and partly by some financial intermediary. The major terms of payment are discussed below:

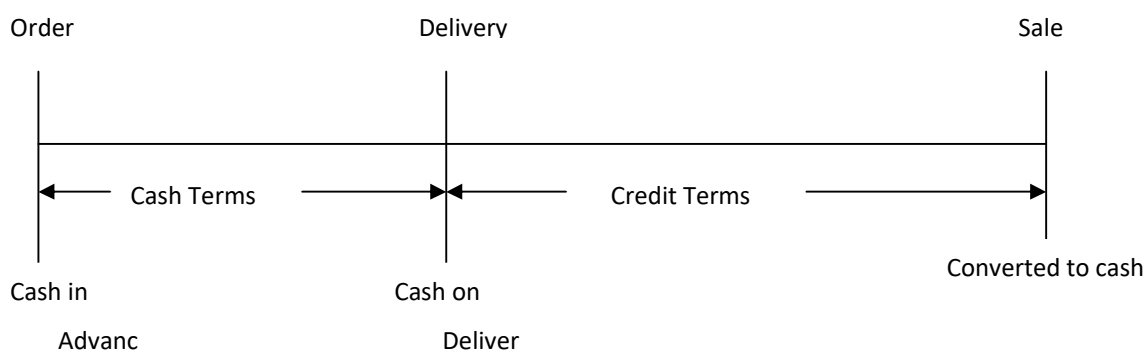


Fig 4.4 Terms of Payment

- i) **Cash Terms:** When goods are sold on cash terms, the payment is received either before the goods are shipped (cash in advance) or when the goods are delivered (cash on delivery). Cash in advance is generally insisted upon when goods are made to order. In such a case, the seller would like to finance production and eliminate marketing risks. Cash on delivery is often demanded by the seller if it is in a strong bargaining position and/or the customer is perceived to be risky.
- ii) **Credit Terms:**
 - **Open Account:** Credit sales are generally on open account. This means that the seller first ships the goods and then sends the invoice. The credit terms (credit period, cash discount for prompt payment, the period discount, and so on) are stated in the invoice which is acknowledged by the buyer.
 - **Bill of exchange:** A more secure arrangement that represents an unconditional order by the seller asking the buyer to pay on demand or at a certain future date, the amount specified on it. It is typically accompanied by shipping documents that are delivered to the buyer when he pays or accepts it. The bill of exchange performs three useful functions:
 - It serves as a written evidence of a definite obligation
 - It helps in reducing the cost of financing to some extent,
 - It represents a negotiable instrument.
 - **Consignment:** When goods are sent on consignment, they are merely shipped but not sold to the consignee. The consignee acts as the agent of the seller. The title of the goods is retained by the seller till they are sold by the consignee to the third party.
 - **Letter of Credit (L/C):** Commonly used in international trade. A letter of credit is issued by a bank on behalf of its customer to the seller. As per this document, the bank agrees to honor drafts drawn on it for the supplies made to the customer if the seller fulfills the conditions laid down in the L/C. The L/C serves several useful functions:
 - Virtually eliminates credit risk,
 - Reduces uncertainty as the seller knows the conditions that should be fulfilled to receive payment,
 - Offers safety to the buyer who wants to ensure that payment is made only in conformity with the conditions of the L/C.

4.3.2. Costs of Maintaining Receivables:

As with all assets and operations, the willingness to allow credit sales involve certain costs. These include:

- i) **Financing the Receivables:** Carrying accounts receivables ties up a portion of the firm's financial resources seeking for addition in working capital. These resources must be financed from other sources such as past profits retained in the business, contributed capital from owners and debt from creditors.
- ii) **Administrative and Collection Expenses:** To keep records on credit sales and payment and the efforts made to aware and push debtors to settle their payments incurs additional cost to the firm. In addition, most firms conduct investigations of potential credit customers to determine their creditworthiness. These and other expenses, such as telephone charges and postage constitute the administrative and collection costs of maintaining receivables.
- iii) **Bad Debt Loss:** After making serious efforts to collect on overdue accounts, the firm may be forced to give up. If a customer declares bankruptcy, no payment may be forthcoming. If the customer leaves the city or state, it may be too costly to trace him and demand payment. In these cases, the firm is forced to accept a bad debt loss on the account.

4.3.3. Policies for Managing Receivables

The firm should establish its receivable policies after carefully considering both the benefits and costs of different policies:

- i) **Profit:** The firm should investigate different possibilities and forecast the effect of each on its future profits. The cost of funds tied up in receivables, collection costs, bad debt losses and money lost with discounts for early payment should be compared with additional sales as a consequence of the proposed policy.

Degree of relaxing the credit policy as determined by residual income may be estimated as follows:

$$\Delta R = \Delta S(p) - \Delta S(r) - \Delta I(k)$$

ΔR : Residual Income

$\Delta S(p)$: Profit from change in sale

$\Delta S(r)$: Bad debt loss

$\Delta I(k)$: Opportunity cost of additional funds locked in receivables.

$p, r, \& k$: Multiplying factors for profit, bad debt loss and opportunity cost respectively.

- ii) **Growth in sales:** Sometimes firms are willing to accept short term setbacks with respect to profits if a new policy enables the firm to increase its sales significantly. Because growth is so important aside from profits, it should be viewed as a separate factor in determining receivable policies.

4.3.4. Credit Policy Variables

The important dimensions of a firm's credit policy are credit standards, credit period, cash discount and collection effort. These variables are related and have a bearing on the level of sales, bad debt loss, discounts taken by customers, and collection expenses.

- i) **Credit Standards:** A pivotal question in the credit policy of a firm is: What standard should be applied in accepting or rejecting an account for credit granting? A firm has a wide range of choice in this respect. At one end of the spectrum, it may decide not to extend credit to any customer, however strong his credit rating may be. At the other end, it may decide to grant credit to all customers irrespective of their credit rating. Between these two extreme positions lie several possibilities, often the more practical ones.

In general, liberal credit standards tend to push sales up by attracting more customers. This is, however, accompanied by a higher incidence of bad debt loss, a larger investment in receivables, and a higher cost of collection. Stiff credit standards have the opposite effects. They tend to depress sales, reduce the incidence of bad debt loss, decrease the investment in receivables and lower the collection cost.

- ii) **Credit Period:** The credit period refers to the length of time customers are allowed to pay for their purchases. When a firm does not extend any credit, the credit period would obviously be zero. Lengthening the credit period pushes sales up by inducing existing customers to purchase more and attracting additional customers. This is, however, accompanied by a larger investment in debtors and a higher incidence of bad debt loss. Shortening of the credit period should have an opposite effect. It tends to lower sales, decrease investment in debtors, and reduce the incidence of bad debt loss.

- iii) **Cash Discount:** Firms generally offer cash discounts to induce customers to make prompt payments. The percentage discount and the period during which it is available are reflected in the credit terms. For example, credit terms of 2/10, net30 mean that a discount of 2 percent is offered if the payment is made by the tenth day; otherwise the full payment is due by the thirteenth day.

Liberalizing the cash discount policy may mean that the discount percentage is increased and/or the discount period is lengthened. Such an action tends to enhance sales, reduce the average collection period and increase the cost of discount.

- iv) **Collection Effort:** The collection program of the firm, aimed at timely collection of receivables may consist of the following:

- Monitoring the state of receivables,
- Dispatch of letters to customers whose due date is approaching,
- Electronic and telephonic advice to customers around the due date,
- Threat of legal action to overdue accounts,
- Legal action against overdue accounts.

A rigorous collection program tends to decrease sales, shorten the average collection period, reduce bad debt percentage and increase the collection expense. A lax collection program, on the other hand, would push sales up, lengthen the average collection period, increase the bad debt percentage and perhaps reduce the collection expense.

4.4. INVENTORY MANAGEMENT

Inventory may be defined as the goods held for eventual resale by the firm. Decisions relating to inventories are taken primarily by executives in production, purchasing and marketing departments. Usually, raw material policies are shaped by purchasing and production executives, work in process inventory is influenced by the decisions of production executives, and finished goods inventory policy is evolved by production and marketing executives. Yet, as an inventory management has important financial implications. The financial manager has the responsibility to ensure that inventories are properly monitored and controlled. He has to emphasize the financial point of view and initiate programs with the participation and involvement of others for effective management of inventories.

Generally three types of inventories may be identified.

- Raw materials: These are goods that have not yet been committed to production.
- Goods in process: This category includes those materials that have been committed to production process but have not been completed. Goods in process include such items as components and sub components that are not yet ready to be sold.
- Finished goods: These are completed products awaiting sale. In construction process, they are the final output of the production process. For retail firms and wholesalers, they are usually referred to as the merchandise inventory.

4.4.1. Benefits of Holding Inventories

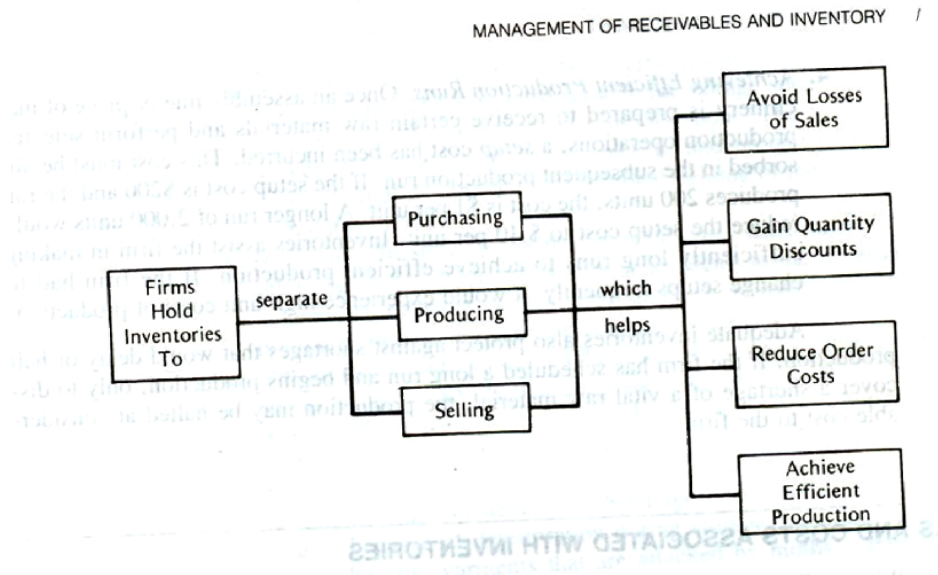
Inventories are used to provide cushions so that the purchasing, production, and sales functions can proceed at their own optimum paces.

In achieving the separation of these functions, the firm realizes a number of specific benefits.

- i) Avoiding Losses of Sales: If the firm does not have goods available for sale, it will lose sales. Customers requiring immediate delivery will purchase their goods from the firm's competitors, and others will decide that they do not need the goods after all, if they must wait for delivery. The ability of the firm to give quick service and to provide prompt delivery is closely tied to the proper management of inventory.
- ii) Gaining Quantity Discounts: If a firm is willing to maintain large inventories in selected product lines, it may be able to make bulk purchases of goods at large discounts. Suppliers frequently offer a great reduced price if the firm orders double or triple its normal requirement. By paying less for its goods, the firm can increase profits, as long as the costs of maintaining the inventories are less than the amount of discount.
- iii) Reducing Order Costs: Every time a firm places an order, it incurs certain costs. Forms must be types, checked, approved and mailed. When goods arrive, they must be accepted,

inspected and counted. The variable costs associated with individual orders can be reduced if the firm places a few large rather than numerous small orders.

- iv) Achieving Efficient Production Runs: Once an assembly line or work team is prepared and composed to receive certain raw materials and perform selected production operation, a setup cost has been incurred which must be absorbed in the subsequent production run. If the firm has to change setups frequently, it would experience high unit costs of production.



4.4.2. Costs of Holding Inventories

When a firm holds goods for future sale, it exposes itself to a number of risks and costs. The effective management of inventory involves a tradeoff between having too little and also too much inventory. The benefits of holding inventory have already been discussed, basically helps to reduce risks, hold down costs and increase revenues. To examine inventory from cost side, one shall identify the following categories of costs:

- Ordering Costs: relating to purchased items would include expenses on the following: requisitioning, preparation of purchase order, expediting, transport and receiving and placing in storage.
- Carrying Costs: includes expense on the following: interest on capital locked up in inventory, storage, insurance, obsolescence, and taxes.
- Shortage Costs: arise when inventories are short of requirement for meeting the needs of production or the demand of customers.

4.4.3. Inventory Management - Minimizing Costs

The goal of effective inventory management is to minimize the total costs that are associated with ordering and holding inventories. One need to estimate the different expenses with varying inventory levels and chooses the level with the lowest total cost.

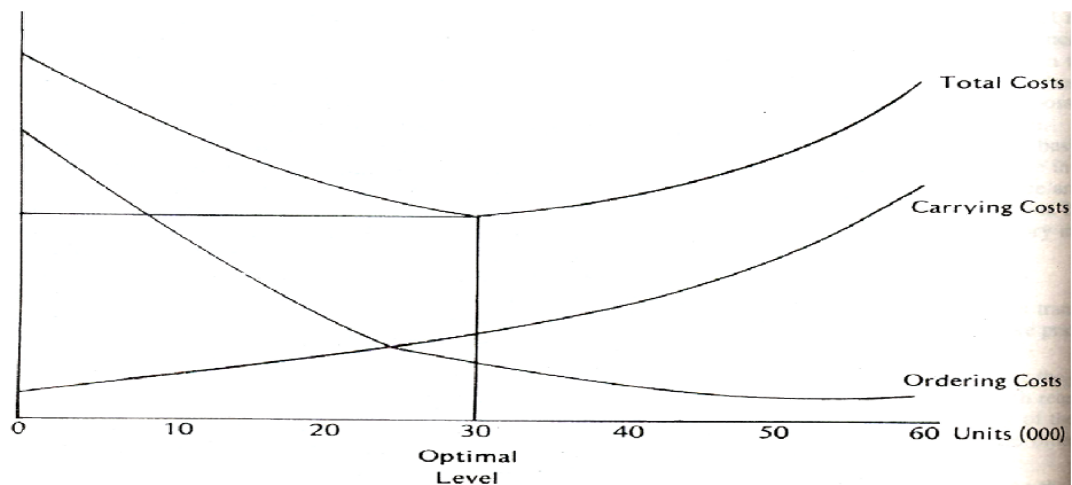


FIGURE 9-4 Minimizing total costs with inventory management

In the figure, we can see the rising slope to carrying costs as the level of inventory is increased. One can also see the declining order costs with higher inventory levels. The lowest total cost considers both in carrying costs and ordering costs.

There are two basic questions relating to inventory management.

- The size of the order- Q optimal
- The level to order – Q level.

i) Order Quantity- Economic Order Quantity(EOQ)

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

Variables in the EOQ model:

- U: The forecast usage/demand for goods or raw materials for a year is known,
- Q: Quantity Ordered,
- F: Cost per Order,
- C: Percent Carrying Cost
- P: Price per Unit,
- TC: Total Costs of ordering and carrying.

$$TC = \frac{U}{Q}(F) + \frac{Q}{2}(P)(C)$$

The first term on the right hand side is the ordering cost, obtained as the product of the number of orders (U/Q) and the cost per order (F), and the second term on the right hand side is the carrying cost, obtained as the product of the average value of inventory holding ($QP/2$) and the percentage carrying cost (C).

The total cost of ordering and carrying is minimized when the derivative of the above equation is equated to zero:

$$\frac{dTC}{dQ} = -\frac{UF}{Q^2} + \frac{PC}{2} = 0$$

$$Q^2 = \frac{2UF}{PC}$$

$$Q = \sqrt{\frac{2FU}{PC}}$$

Example: Given the following for a company:

U = Annual sale = 20,000 Units

F = fixed cost per order = Birr 2,000

P = Purchase price per unit = Birr 12

C = Carrying cost = 25% of inventory value

$$Q = \sqrt{\frac{2 \times 2,000 \times 20,000}{12 \times 0.25}} = 5,164 \text{ units}$$

ii) Order Level/Order Point

The standard EOQ model assumes that materials can be procured instantaneously and hence implies that the firm may place an order for replenishment when the inventory level drops to zero. In the real world, however, procurement of materials takes time and hence the order level must be such that the inventory at the time of ordering suffices to meet the needs of production during the procurement period.

If the usage rate of materials and lead time for procurement are known with certainty then the ordering level would simply be:

Lead time in days for procurement X Average daily usage.

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