
UNIT 7: FINANCIAL EVALUATION

7.1. INTRODUCTION

Project is evaluated (or analyzed) from financial point of view and economic point of view. **Financial analysis** of the project is **concerned with the analysis of the profitability of the project based on monetary costs and benefits**. On the other hand, **economic analysis** of the project **deals with project analysis based on social costs and benefits**. This unit deals with financial analysis of the project. Financial analysis requires the determination of project costs, the estimation of cost of production and other expenses, the estimation of project net cash flows, and the evaluation of the desirability of the project using various criteria.

7.2 Financial evaluation

7.2.1 Cost of project

Conceptually, the cost of project represents **the total of all items of outlay associated with a project which are supported by long-term funds**. It is the sum of the outlays on the following: Land and site development, Building and civil works, Plant and machinery, Technical know-how and engineering fees, Expenses on foreign technicians and training local technicians abroad, Miscellaneous fixed assets, Pre-operative expenses, Margin money for working capital and Initial cash losses.

Land and Site Development

The cost of land and site development is the sum of the following:

- Basic cost of land including conveyance and other allied charges
- Premium payable on leasehold and conveyance charges
- Cost of leveling and development
- Cost of laying approach roads and internal roads
- Cost of gates

- Cost of tube wells

The cost of land varies considerably from one location to another. While it is very high in urban and even semi-urban locations, it is relatively low in rural locations. The expenditure on site development, too, varies widely depending on the location and topography of the land.

Buildings and Civil Works

Buildings and civil works cover the following:

- Buildings for the main plant and equipment
- Buildings for auxiliary services like steam supply, workshops, laboratory, water supply, etc.
- Godowns, warehouses, and open yard facilities
- Non-factory buildings like canteen, guesthouses, time office, excise house, etc.
- Quarters for essential staff
- Silos, tanks, wells, chests, basins, cisterns, hoopers, bins, and other structures necessary for installation of the plant and equipment
- Garages
- Sewers, drainage, etc.
- Other civil engineering works.

The cost of the buildings and civil works depends on the kinds of structures required which, in turn, are dictated largely by the requirements of the manufacturing process. Once the kinds of structures required are specified, cost estimates are based on the plinth area and the rates for various types of structures. These rates, of course, vary with the location to some extent.

Plant and Machinery

The cost of the plant and machinery, typically the most significant component of the project cost, consists of the following:

- Cost of imported machinery: This is the sum of (i) FOB (free on board) value, (ii) shipping, freight, and insurance cost, (iii) import duty, and (iv) clearing, loading, unloading, and transportation charges.
- Cost of indigenous machinery: This consists of (i) FOR (free on rail) cost, (ii) taxes, if any, and (iii) railway freight and transport charges to the site.
- Cost of stores and spares
- Foundation and installation charges

The cost of plant and machinery is based on the latest available quotation adjusted for possible escalation. Generally, the provision for escalation is equal to the following product: (latest rate of annual inflation applicable to the plant and machinery) x (length of the delivery period).

7.2.4. Technical Know-how and Engineering Fees

Often it is necessary to engage technical consultants or collaborators from local and /or abroad for advice and help in various technical matters like preparation of the project report, choice of technology, selection of the plant and machinery, detailed engineering, and so on. While the amount payable for setting up the project is a component of the project cost, the royalty payable annually, which is typically a percentage of sales, is an operating expense taken into account in the preparation of the projected profitability statements.

7.2.5. Expenses on Foreign Technicians and Training of Local Technicians Abroad

Services of foreign technicians may be required for setting up the project and supervising the trial runs. Expenses on their travel, boarding, and lodging along with their salaries and allowances must be shown here. Likewise, expenses on local technicians who require training abroad must also be included here.

7.2.6. Miscellaneous Fixed Assets

Fixed assets and machinery which are not part of the direct manufacturing process may be referred to as miscellaneous fixed assets. They include items like furniture, office machinery and equipment, tools, vehicles, railway siding, diesel generating sets, transformers, boilers, piping systems, laboratory equipment, workshop equipment, effluent treatment plants, fire fighting equipment, and so on. Expenses incurred for the procurement or use of patents, licenses, trademarks, copyrights, etc. and deposits made with the electricity authority may also be included here.

7.2.7. Preliminary and Capital Issue Expenses

Expenses incurred for identifying the project, conducting the market survey, preparing the feasibility report, drafting the memorandum and articles of association, and incorporating the company are referred to as preliminary expenses.

Expenses borne in connection with the raising of capital from the public are referred to as capital issue expenses. The major components of capital issue expenses are underwriting commission, brokerage, fees to managers and registrars, printing and postage expenses, advertising and publicity expenses, listing fees, and stamp duty.

7.2.8. Pre-operative Expenses

Expenses of the following types incurred till the commencement of commercial production are referred to as pre-operative expenses these include (i) establishment expenses, (ii) rent, and taxes, (iii) traveling expenses, (iv) interest and commitment charges on borrowings, (v) insurance charges, (vi) mortgage expenses, (vii) interest on deferred payments, (viii) start-up expenses, and (ix) miscellaneous expenses.

Pre-operative expenses are directly related to the project implementation schedule. So, delays in project implementation, which are fairly common, tend to push up these expenses. Pre-operative expenses incurred up to the

point of time the plant and machinery are set up may be capitalized by apportioning them to fixed assets on some acceptable basis. Pre-operative expenses incurred from the point of time the plant and machinery are set up are treated as revenue expenditure. The firm may, however, treat them as deferred revenue expenditure and write them off over a period of time.

7.2.9. Provision for Contingencies

A provision for contingencies is made to provide for certain unforeseen expenses and price increase over and above the normal inflation rate which is already incorporated in the cost estimates.

To estimate the provision for contingencies, the following procedure may be followed:

(i) Divide the project cost items into two categories, viz, 'firm' cost items and 'non-firm' cost items (firm cost items are those which have already been acquired or for which definite arrangements have been made). (ii) Set the provision for contingencies at 5 to 10 percent of the estimated cost of non-firm cost items. Alternatively, make a provision of 10 percent for all items (including the margin money for working capital) if the implementation period is one year or less. For every additional one-year, make an additional provision of 5 percent.

7.2.10 Margin Money for Working Capital

The principal support for working capital is provided by commercial banks and trade creditors. However, a certain part of the working capital requirement has to come from long-term sources of finance. Referred to as the 'margin money for working capital' this is an important element of the project cost.

The margin money for working capital is sometimes utilized for meeting over-runs in capital cost. This leads to a working capital problem (and sometimes a crisis) when the project is commissioned. To mitigate this

problem, financial institutions stipulate that a portion of the loan amount, equal to the margin money for working capital, be blocked initially so that it can be released when the project is completed.

7.2.11. Initial Cash Losses

Most of the projects incur cash losses in the initial years. Yet, promoters typically do not disclose the initial cash losses because they want the project to appear attractive to the financial institutions and the investing public. Failure to make a provision for such cash losses in the project cost generally affects the liquidity position and impairs the operations. Hence prudence calls for making a provision, overt or covert, for the estimated initial cash losses.

7.3 MEANS OF FINANCE

To meet the cost of the project, the means of finance that are available include Share capital, Term loans, Bonds, Deferred credit, Incentive sources, and Miscellaneous sources.

1. Share Capital. There are two types of share capital; namely, equity capital (through the issuance of common stock) and preference capital (through the issuance of preferred stock). Equity capital represents the contribution made by the owners of the business, the equity shareholders, who enjoy the rewards and bear the risks of ownership. Equity capital being a risk capital carries no fixed rate of dividend. Preference capital represents the contribution made by preference shareholders and the dividend paid on it is generally fixed.

2. Term Loans. They are provided by financial institutions and commercial banks. Term loans represent secured borrowings which are a very important source (and often the major source) for financing new projects as well as for the expansion, modernization, and renovation schemes of existing firms.

3. Bond capital. Bonds are instruments for raising debt capital. The typical example of bonds is debentures. There are two broad types of debentures; namely, non-convertible debentures and convertible debentures. Non-convertible debentures are straight debt instruments. Typically they carry a fixed rate of interest. Convertible debentures, as the name implies, are debentures, which are convertible, wholly or partly, into equity shares. The conversion period and price are announced in advance.

4. Deferred Credit. Many a time the suppliers of the plant and machinery offer a deferred credit facility under which payment for the purchase of the plant and machinery can be made over a period of time.

5. Incentive Sources. The government and its agencies may provide financial support as an incentive to certain types of promoters or for setting up industrial units in certain locations. These incentives may take the form of seed capital assistance (provided at a nominal rate of interest to enable the promoter to meet his contribution to the project), or capital subsidy (to attract industries to certain locations), or tax deferment or exemption for a certain period.

6. Miscellaneous Sources. A small portion of the project finance may come from miscellaneous sources like unsecured loans, public deposits, and leasing and hire purchase finance. Unsecured loans are typically provided by the promoters to bridge the gap between the promoters' contribution (as required by the financial institutions) and the equity capital the promoters can subscribe to. Public deposits represent unsecured borrowings from the public at large. Leasing and hire purchase finance represent a form of borrowing different from the conventional term loans and debenture capital.

Planning the Means of Finance

The various means of finance that can be tapped for a project have been described above. How should you go about determining the specific means

of finance for a given project? The guidelines and considerations that should be borne in mind for this purpose are as follows:

1. Norms of Regulatory Bodies and Financial Institutions. In some countries, the proposed means of finance for a project must either be approved by a regulatory agency or conform to certain norms laid down by the government or financial institutions in this regard. The primary purpose of such regulations is to impart prudence to project financing decisions and provide a measure of protection to investors. In addition, the norms of financial institutions, which often provide substantial assistance to projects significantly shape and circumscribe project financing decisions.

2. Key Business Considerations. The key business considerations which are relevant for the project financing decision are **cost, risk, control, and flexibility**.

a. Cost. In general, the cost of debt funds is lower than the cost of equity funds. Why? The primary reason is that the interest payable on debt capital is a tax-deductible expense whereas the dividend payable on equity capital is not.

b. Risk. The two main sources of risk for a firm (or project) are business risk and financial risk. Business risk refers to the variability of earnings before interest and taxes and arises mainly from fluctuations in demand and variability of prices and costs. Financial risk represents the risk arising from financial leverage. It must be emphasized that while debt capital is cheap it is also risky because of the fixed financial burden associated with it.

Generally the affairs of the firm are, or should be, managed in such a way that the total risk borne by equity shareholders, which consists of business risk and financial risk, is not unduly high. This implies that if the firm is exposed to a high degree of business risk, its financial risk should be kept

low. On the other hand, if the firm has a low business risk profile, it can assume a high degree of financial risk.

c. Control. From the point of view of the promoters of the project, the issue of control is important. They would ordinarily prefer a scheme of financing which enables them to maximize their control, current as well as potential, over the affairs of the firm, given their commitment of funds to the project.

d. Flexibility. This refers to the ability of a firm (or project) to raise further capital from any source it wishes to tap to meet the future financing needs. This provides maneuverability to the firm. In most practical situations, flexibility means that the firm does not fully exhaust its debt capacity. Put differently, it maintains reserve-borrowing powers to enable it to raise debt capital to meet largely unforeseen future needs.

7.4. PRODUCTION COSTS

There are three major categories of manufacturing costs. These are

1. **Direct materials cost:** - The acquisition costs of all materials that are identified as part of the cost object and that may be traced to the cost object in an economically feasible way. Acquisition costs of direct materials include inward delivery charges, tax, and custom duties. Direct material often does not include minor items such as glue or tacks. Why? Because the cost of tracing insignificant items do not seem worth the possible benefits of having more accurate product costs. Such items are called supplies or indirect materials and are classified as part of the indirect manufacturing costs.
2. **Direct labour.** The compensation of all labour that can be identified in an economically feasible way with a cost object. Examples are the labour of machine operators and assembler. Indirect labour costs are all factory labour compensation other than direct labour compensation. These are labour costs that are impossible or impractical to trace to a specific

product. They are classified as part of the indirect manufacturing cost. Examples include wages of janitors, and plant guards.

3. **Indirect manufacturing costs (manufacturing overhead).** All manufacturing costs that cannot be identified specifically with or traced to the cost object in an economically feasible way. Other terms used are factory overhead, factory burden, manufacturing overhead, and manufacturing expenses. Examples of factory overhead (when products are cost object) include power, supplies, indirect labour, factory rent, insurance, property taxes, and depreciation.

7.5. ESTIMATES OF SALES AND PRODUCTION

7.5.1. Estimating Sales

The sales forecast is the starting point for the projections of profitability. In estimating sales revenues, the following should be taken into account:

1. Economic level (activities)
2. The project's probable market share in each distribution territory
3. Competitor's and their capacities
4. Pricing strategies
5. The effect of inflation on prices
6. Advertising campaigns, promotional discounts, and credit terms.

7.5.2. Estimating Production

Once sales projections are made, the next step is production estimates. Production may be estimated as follows:

Production = sales + Desired ending Inventory - Beginning finished goods inventory

For the first year of operation, there is no beginning inventory. To illustrate, assume that the sales are projected to be 100,000 units in the first year although the capacity is 180,000 units. It is estimated that there should be finished goods inventory of 5000 units on hand at the end of the first year. Estimated production would be:

$$\text{Production} = 100,000 + 5000 - 0 = 105,000 \text{ units}$$

Similar approach can be followed for a period of more than one year. Production can also be estimated in another way. To illustrate, assume that Addis Company has set the policy of maintaining finished goods inventory of 10,000 units at the end of each year. The installed plant capacity is estimated to be 300,000 per year. It is estimated that the project will operate at 50% and 60% in year 1 and year 2 and full capacity from year 3 to year 5.

Annual production is computed as follows:

	<u>Year 1</u>	<u>Year 2</u>	<u>Year 3</u>	<u>Year 5</u>	<u>Year</u>
6					
Installed capacity	300,000		300,000	300,000	
	300,000				
Capacity utilization	<u>50%</u>	<u>60%</u>	<u>100%</u>	<u>100%</u>	<u>100%</u>
Production	<u>150,000</u>	<u>180,000</u>	<u>300,000</u>	<u>300,000</u>	
	<u>300,000</u>				

Based on production estimates and ending finished goods inventory policy, sales revenue projections can be that a unit of out put is expected to be gold at Br. 160. Revenue budget is prepared as follows:

Table 7-1 Estimation of total Revenue

	Year				
	1	2	3	4	5
Production	150,000	180,000	300,000	300,00	300,000
Desired ending inventory	10,000	10,000	10,000	10,000	10,000
	140,000	170,000	290,000	290,00	290,000
Sold	160	160	160	160	160
Expected selling price/unit	22,400,00	27,200,00	46,400,00	46,400,00	46,400,00
Total sales revenue					

7.6 ESTIMATION OF MATERIAL COSTS

The costs of materials include the cost of raw materials, chemicals, components, and consumable stores required for production. The following should be considered in estimating the cost of materials:

1. The requirements of various material inputs per unit of output.

When materials inputs requirements are established, it is necessary to consider:

- Theoretical consumption norms
- Experience of the industry
- Performance guarantees
- Specification of machinery suppliers

2. The total requirements of various inputs

Total requirements = Requirements per unit X Expected Production

3. The prices of material inputs

The prices of material inputs are defined in cost, insurance, and freight (CIF)

4. The present costs of various material inputs
5. The seasonal fluctuations in prices

To exemplify, refer to the above example, suppose that each unit of output requires two types of materials: three units of input x and 2 units of material y. The estimated costs of one unit of material x and one unit of material y are Br. 5 and Br. 10 respectively. To adjust for estimation error the company allows a 2% contingency on the costs of materials. The total requirement of each material type is computed as follows:

Table 7-2 Estimated cost of Material x

	Year				
	1	2	3	4	5
Production	150,000	180,000	300,000	300,000	300,000

Material x /unit of output	3	3	3	3	3
Total requirements	450,000	540,000	900,000	900,000	900,000
Unit cost	5	5	5	5	5
Total cost of material x before contingency	2,250,000	2,700,000	4,500,000	4,500,000	4,500,000
Contingency (2%)	45,000	54,000	90,000	90,000	90,000
Total cost of material x	2,295,000	2,754,000	4,590,000	4,590,000	4,590,000

Table 7- 3 Estimated cost of material Y

	Year				
	1	2	3	4	5
Production	150,000	180,000	300,000	300,000	300,000
Material y/unit of output	2	2	2	2	2
Total requirements	300,000	360,000	600,000	600,000	600,000
Unit cost	10	10	10	10	10
Cost before contingency	3,000,000	3,600,000	6,000,000	6,000,000	6,600,000
Contingency (2%)	60,000	72,000	120,000	120,000	120,000
Total cost of material y	3,060,000	3,672,000	6,120,000	6,120,000	6,120,000

Total material costs are summarized below:

Year	Material X	Material Y	Total
1	2,295,000	3,060,000	5,355,000
2	2,754,000	3,672,000	6,426,000
3	4,590,000	6,120,000	10,710,000

4	4,590,000	6,120,000	10,710,000
5	4,590,000	6,120,000	10,710,000

7.7. ESTIMATING LABOR COSTS

Labor cost includes the cost of all the manpower employed in the factory. Labor cost is a function of the number of employees and the rate of payment. Refer to Addis Company's example; assume that 3 hours of direct labor are required to produce one unit of output. It is estimated that direct labor cost per hour is Br. 20 and is expected to increase at the rate of 5% every year. Accordingly, direct labor cost is estimated as follows:

Table 7- 4 estimated direct labor cost

	Year				
	1	2	3	4	5
Production	150,000	180,000	300,000	300,000	300,000
Labor hour/unit of output	3	3	3	3	3
Total labor hours required	450,000	540,000	900,000	900,000	900,000
Labor rate/hour	20	21	22.05	23.15	24.31
Total cost of labor	9,000,000	11,340,000	19,845,000	20,835,000	21,879,000

Note that direct labor rate increases at 5% per year.

7.8. ESTIMATING OVERHEAD COSTS

Overhead costs are costs other than direct material costs and direct labor costs. Certain bases should be used to estimate overhead costs. Some of the bases could be direct labor hours, direct labor costs, material costs etc. To illustrate, suppose that (refer to Addis Company's example) factory overhead costs are estimated to be 60% of direct labor costs. Then factory overhead costs are estimated as follows:

Table 7- 5Estimates of Factory overhead

	Year
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	1	2	3	4	5
Estimated labor costs	9,000,000	11,340,000	19,845,000	20,835,000	21,879,000
Overhead rate	60%	60%	60%	60%	60%
Estimated Factory Overhead	5,400,000	6,804,000	11,907,000	12,501,000	13,127,400

7.9. Computation of Unit Costs

The computation of unit cost is based on manufacturing costs which is composed of Direct materials, direct labor, and overhead costs

$$\text{Unit Cost} = \frac{\text{Manufacturing costs}}{\text{Units produced}}$$

The unit cost is computed for each of the five years as shows below:

Table 7- 6 Computation of unit cost

Year	Direct Material Costs	Direct labor cost	Factory overhead Costs	Total	Production	Unit cost
1	5,355,000	9,000,000	5,400,000	19,755,000	150,000	131.70
2	6,426,000	11,340,000	6,804,000	24,570,000	180,000	136.50
3	10,710,000	19,845,000	11,907,000	42,462,000	300,000	141.54
4	10,710,000	20,835,000	12,501,000	44,046,000	300,000	146.82
5	10,710,000	21,879,000	13,127,400	45,716,400	300,000	152.39

Once unit cost is determined, the cost of ending inventory and cost of goods sold can be computed. The following table shows the cost of ending finished goods inventory assuming that FIFO method is used:

Table 7- 7 Estimated cost of ending inventory

	Year				
	1	2	3	4	5
Desired ending inventory	10,000	10,000	10,000	10,000	10,000
Unit cost	131.70	136.50	141.54	146.82	152.39
Cost of ending Inventory	1,317,000	1,365,000	1,415,400	1,468,200	1,523,900

Cost of ending inventory = Desired ending inventory X Unit cost

Based on the above data, the cost of goods sold can also be computed as follows:

Table 7- 8 Estimated cost of goods sold

	Year				
	1	2	3	4	5
Cost of production	19,755,000	24,570,000	42,462,000	44,046,000	45,716,400
Add: Beg. Finished Goods inventory	-	1,317,000	1,365,000	1,415,400	1,468,200
Available for sale	19,755,000	25,887,000	43,827,000	45,461,400	47,184,400
Ded: Ending Finished Goods inventory	1,317,000	1,365,000	1,415,400	1,468,200	1,523,900
Cost of goods sold	18,438,000	24,522,000	42,411,600	43,993,200	45,660,500

7.10. ESTIMATING ADMINISTRATIVE, SELLING, AND OTHER COSTS

Administrative, general, selling and other costs should be estimated in order to prepare projected income statements. To prepare the projected income statement, based on the foregoing illustration, assume the following additional data:

- a) Administrative and general expenses, including depreciation of Br. 100,000 per year are estimated at Br. 500,000 in year 1 and expected to increase by Br. 10,000 thereafter.
- b) Selling expenses, including depreciation of Br. 60,000 per year are estimated at Br. 400,000 in year 1 and year 2 and are expected to be Br. 420,000 thereafter.
- c) The project will be financed fully by equity.
- d) Income tax rate is 30% after two years

Accordingly, the projected income statement is prepared as follows:

Addis Company
Projected Income Statement
For the year ended Dec. 31, years 1 - 5

	Year				
	1	2	3	4	5
Sales	22,400,000	27,200,000	46,400,000	46,400,000	46,400,000
Cost of goods sold	18,438,000	24,522,000	42,411,600	43,993,200	45,660,500
Gross profit	3,962,000	2,678,000	3,988,400	2,406,800	739,500
Expenses:					

Administrative & General	500,000	510,000	520,000	530,000	540,000
Selling	400,000	400,000	420,000	420,000	420,000
Total expenses	900,000	910,000	940,000	950,000	960,000
Earning before taxes	3,062,000	1,768,000	3,048,400	1,456,800	(220,500)
Taxes (30%)	-	-	914,520	437,040	-
Net income	3062,000	1,768,000	2,133,880	1,019,760	(220,500)

It is also possible to prepare balance sheet and statement of cash flows, had the information is complete.

7.11. ESTIMATING PROJECT CASH FLOWS FOR REVENUE EXPANSION

The estimation of project cash flows is a key element in investment evaluation but also the most difficult step in capital budgeting. Forecasting project cash flows involves numerous variables and many parties participate in this exercise.

These parties include:

1. **Engineers** - estimate capital outlays
2. **Marketing group** - projects revenues
3. **Production people** - forecast operating costs.

The forecasting of operating costs also involves cost accountants, purchase managers, personnel executives, tax experts, and so on.

What is the role of finance manager in forecasting project cash flows? The role of finance manager is to coordinate the efforts of various departments and obtain information from them, ensure that the forecasts are based on a set of consistent economic assumptions, keep the exercise focused on relevant variables, and minimize the biases inherent in cash flow forecasting.

The Elements of Project Cash flows

Project cash flows comprises of three basic components.

These are:

1. **Initial investment.** The initial investment, also called net investment, is the cash outlay on capital expenditures. In revenue expansion projects, initial investments include the purchase price, installation costs, taxes, transportation costs, increase in networking capital etc.
2. **The operating cash flows.** These include the after-tax cash flows resulting from the operations of the project during its economic life.
3. **Terminal cash flow.** These are cash flows that occur at the end of the life of the project. Terminal cash flows involve mainly salvage value (net of tax) and recovery in networking capital.

To illustrate how project cash flows are forecasted, suppose that the project requires gross investment of Br. 900,000. Besides, it is forecasted that additional costs will be incurred at the beginning of the life of the project.

Transportation costs	60,000
Assembling & installation costs	20,000
Increase in networking capital	200,000

Based on the above data, initial investment can be computed as follows:

Gross investment	900,000
Transportation costs	50,000
Assembly and installation costs	20,000
Increase in networking capital	<u>200,000</u>
Initial Investment	<u>1,170,000</u>

Let's use Addis Company's project to illustrate how operating cash flows are forecasted. Project after-tax cash flows (or net cash flows) can be determined using the following formula:

$$\text{After tax cash} = \text{Net income} + \text{Non-cash expenses} + \text{Interest (1-tax}$$

rate)

In Addis Company's project, depreciation is considered the only non-cash expense. Assuming that the project required increase in networking capital of Br. 100,000 at the beginning of year 1 and is expected to be recovered at the end of year 5. Besides, the project has salvage value of Br. 80,000 at the end of year 5. Straight-line method of depreciation will be used.

After-tax cash flows of Addis Company are computed below:

Table 7- 9 Determination of project net cash flows

Items	Year				
	1	2	3	4	5
Net income	3,062,000	1,768,000	2,133,880	1,019,760	(220,500)
Add: Depreciation	160,000 ^a	160,000	160,000	160,000	160,000
Salvage proceeds	-	-	-	-	80,000
Recovery in NWC ^b	-	-	-	-	100,000
After tax cash flows	3,220,000	1,928,000	2,293,880	1,179,760	119,500

aObtained by adding Depreciation related to administrative and general expense (Br. 100,000) and selling expense (Br. 60,000)

b Net working capital

7.12. ESTIMATING PROJECT CASH FLOWS FOR REPLACEMENT PROJECTS

In replacement projects, old asset is replaced by new one. The old asset is sold. As a result, the initial investment can be determined using the following components:

1. Purchase price of new asset
2. Salvage proceed (net of tax) of old asset

The primary benefits from replacement projects is cost saving. Similarly, the manner in which net cash flows for replacement projects is different from that of revenue expansion projects.

$$\text{Net cash flows} = \text{After-tax cost saving} + \text{Tax saving on incremental}$$

depreciation

To illustrate the determination of initial investment for replacement projects, suppose that the firm is contemplating to replace old equipment with new equipment, which has a cost of Br. 900,000. The original cost and accumulated depreciation of old equipment are Br. 400,000 and Br. 280,000 respectively. Income tax rate and capital gain tax rate are 40% & 20% respectively. Old equipment is sold for Br. 150,000.

In replacement project, gain or loss on disposal of old equipment should be computed before initial investment is determined. This is due to the fact that any gain or loss on disposal has tax implication. Gain results in additional tax payment to taxing authority and loss results in tax saving (shield). Thus, gain or loss on disposal is computed as:

Gain/loss = Selling price of old equipment - Book value of old equipment

Book value = Original cost - Accumulated depreciation

$$= 400,000 - 280,000$$

$$= 120,000$$

Gain = 150,000 - 120,000

$$= 30,000$$

Tax increase = Gain X Income tax rate

$$= 30,000 \times 40\% = 12,000$$

Then initial investment is determined as follows:

Original cost of new equipment	900,000
Tax increase	(12,000)
Selling price of old equipment	<u>(30,000)</u>
Initial investment	<u>882,000</u>

Let's modify the assumption in that the selling price of old equipment is Br. 100,000. Book value of old equipment is Br. 120,000

Loss on disposal is Br. 20,000 (i.e., $120,000 - 100,000 = 20,000$).

Tax saving on loss is Br. 8,000 (i.e. $20,000 \times 40\% = 8,000$). Then initial investment is computed below:

Original cost of new equipment	900,000
Proceed from sales of old equipment	(100,000)
Tax selling	<u>(8,000)</u>
Initial investment	792,000

Old equipment may be sold above its original cost. In the illustration under consideration, let's assume that the old equipment is sold for Br. 480,000. When old asset is sold above its original cost, two types of gains result.

i. Ordinary gain = Original cost - Book value

$$= 400,000 - 120,000$$

$$= 280,000$$

ii. Capital gain = Selling price - Original cost

$$= 480,000 - 400,000$$

$$= 80,000$$

Ordinary gain is taxed at normal income tax rate.

Tax on ordinary gain = ordinary gain X normal income tax rate

$$= 280,000 \times 40\%$$

$$= \underline{112,000}$$

Similarly, tax is also paid on capital gain

Tax on capital gain = Capital gain X Capital gain tax rate

$$= 80,000 \times 20\%$$

$$= \underline{16,000}$$

Total tax increase = Ordinary tax + Capital gain tax

$$= 112,000 + 16,000$$

$$= \underline{128,000}$$

Then, initial investment is computed as follows:

Original cost of new equipment	900,000
Proceed from sale of old equipment	(480,000)
Tax increase	<u>128,000</u>

Initial investment 548,000

The evaluation of replacement project also requires the determination of net cash flows. To illustrate the estimation of net cash flows, assume that the company is planning to replace old equipment by new one. The old equipment had original cost of Br. 100,000, salvage value of Br. 5000 and useful life of ten years, but remaining life of five years. The new equipment has original cost, salvage value and useful life of Br. 150,000, Br. 10,000 and five years respectively. The company uses straight-line method. If old equipment is replaced, the company can have cost saving (before tax) of Br. 30,000 per year over five years. Income tax rate is 30%.

Net cash flow for replacement project is computed as follows:

Net cash flows = After-tax cost saving + tax saving on incremental depreciation

Depreciation on:

$$\text{Old equipment} = \frac{100,000 - 5000}{10} = 9500$$

$$\text{New equipment} = \frac{150,000 - 10,000}{5} = 28,000$$

$$\text{Incremental depreciation} = 28000 - 9500 = 18500$$

$$\begin{aligned}\text{Net cash flows (year 1 - year 4)} &= 30,000 (1 - 0.30) + 18500(0.30) \\ &= 21,000 + 5550 \\ &= \underline{26,550}\end{aligned}$$

Net cash flows (year 5) = Operating cash flows + Terminal cash flows

Terminal cash flows = Salvage value of new equipment

$$\text{Net cash flows (year 5)} = 26,550 + 10,000 = \underline{36,550}$$

7.13. PROJECT EVALUATION TECHNIQUES/CRITERIA

The key steps involved in determining whether a project is worthwhile or not are:

- Estimate the cost and benefits (revenues) of the project
- Calculate the cost of capital,(also called the Required Rate of Return)

- Compute the criterion of merit and judge whether the project is good or bad.

The estimation of the costs and revenues was the concern of the preceding sections. The cost of capital is dealt with in your financial management courses. Similarly, risk assessment was discussed at the end of unit three and you can also refer to your earlier accounting courses (financial management) and management courses.

This section is concerned with the project's evaluation techniques, (also called capital budgeting techniques). There are several project evaluation criteria that have been suggested by economists, accountants, and others to judge the worthwhileness of capital projects. However, only few of them and the most common ones are presented in this section. They are classified into two categories. These are:

1. Non-discounting (traditional) criteria

- a) Payback Period (PBP)
- b) Accounting Rate of Return (ARR)

2. Discounted Cash Flows (DCF) criteria

- a) Net Present Value (NPV)
- b) Internal Rate of Return (IRR)
- c) Profitability Index (Benefit-cost ratio)

Each of the above methods is discussed in the following sections:

7.13.1. Payback Period (PBP)

Payback period refers to the length of time it takes to recover initial investment of the project. Depending on the nature of net cash flows, payback period may be computed in two ways.

a) When cash flow is in annuity form

Annuity refers to equal amount of cash flows that occur every period over the life of the project

$$PBP = \frac{\text{Initial Investment}}{\text{Annual Net Cash Flows}}$$

To illustrate the computation of payback period, assume that a project requires an initial investment of Br. 24,000 and annual after tax cash flows of Br. 6000 for five years. How long it takes the company to recover its initial investment?

$$PBP = \frac{24000}{6000} = \underline{4 \text{ years}}$$

It is expected to take the company four years to recover the project's initial investment of Br. 24,000

b) When cash flows are not in annuity form

When net cash flows are not annuity, payback period is obtained by adding net cash flows for successful years until the total is equal to initial investment. To exemplify, assume that a project requires an initial investment of Br. 60,000. The after tax cash flows (or net cash flows) are as follows:

Year 1 = 8000	Year 4 = 20,000
Year 2 = 15,000	Year 5 = 20,000
Year 3 = 22,000	

The payback period is computed as follows:

$$PBP = 3 \text{ years} + \frac{15000}{20000} = \underline{3.75 \text{ years}}$$

In the above example, if the 1st three years' net cash flows are added, the sum is equal to Br. 45,000. But the initial investment is Br. 60,000. If the fourth year net cash flows (Br. 20,000) is added to Br. 45,000, the sum is Br. 65,000 which is greater than the initial investment. Thus, the payback period is between year 3 and year 4. To find the exact payback period, we take the three years and divide the remaining cash flows by the fourth year net cash flows. If the exact payback period is needed in months the fraction can be computed as follows:

$$\begin{aligned} \text{PBP} &= 3 \text{ years} + \frac{15000}{20000} (12 \text{ months}) \\ &= \underline{\underline{3 \text{ years and 9 months}}} \end{aligned}$$

Decision Rule for Payback Period

- i. Accept the project if its payback period is less than or equal to the required payback period (standard)
- ii. Reject the project if its payback period exceeds the required payback period. The shorter the payback period, the more desirable the project.

Advantages of Payback Period

1. It is simple both in concept and application
2. It is a rough and ready made method for dealing with risk
3. It may be a sensible criterion when the firm is pressed with problems of liquidity

Disadvantages of Payback Period

1. It fails to consider time value of money
2. It ignores cash flows beyond the payback period
3. It is a measure of the project's capital recovery, not profitability.
4. It does not indicate the liquidity position of the firm as a whole.

7.13.2. Accounting Rate of Return (ARR)

Also called the average rate of return on investment, the accounting rate of return is a measure of profitability which relates net income to investment. Both net income and investment are measured in accounting terms. Although there are several methods of computing ARR, the most common method is shown below:

$$\text{ARR} = \frac{\text{Average annual net income}}{\text{Average investment}}$$

$$\text{Average Investment} = \frac{\text{Original cost} + \text{salvage value}}{2}$$

To illustrate, assume that a project has original investment of Br. 70,000, life of 4 years, and salvage value of Br. 6000. Straight-line method of depreciation is used. Income before depreciation and taxes for each of the four years are as follows: year1, Br. 40,000; year 2, Br. 42,000; year 3, Br. 36,000; and year 4, Br. 50,000. Income tax rate is 40%.

$$\text{Depreciation} = \frac{70,000 - 6000}{4} = 16,000$$

Before ARR is determined, it is necessary to compute net income for each of the four years as follows:

	<u>Year 1</u>	<u>Year 2</u>	<u>Year 3</u>	<u>Year 4</u>
Income before depreciation tax	40,000	42,000		
				36,000 50,000
Less: Depreciation	<u>16,000</u>	<u>16,000</u>		
	<u>16,000</u>	<u>16,000</u>		
Income before taxes	24,000	26,000	20,000	
				34,000
Less: Taxes (40%)	<u>9600</u>	<u>10,400</u>	<u>8000</u>	
				<u>13,600</u>
Net income	<u>14,400</u>	<u>15,600</u>		
	<u>12,000</u>	<u>20,400</u>		

$$\text{Average Net income} = \frac{14,400 + 15,600 + 12,000 + 20,400}{4} = 15,600$$

$$\text{Average Investment} = \frac{70,000 + 6,000}{2} = 38,000$$

$$\text{ARR} = \frac{\text{Average Annual Net Income}}{\text{Average Investment}}$$

$$= \frac{15,600}{38,000} = 41\%$$

Decision Rule for Accounting Rate of Return

- i. Accept the project if ARR exceeds the required rate of return.
- ii. Reject the project if ARR is less than the required rate of return.

Advantages of ARR

1. It is simple to calculate
2. It is based on accounting information, which is readily available and familiar to businessmen.
3. It considers benefits over the entire life of the project.
4. It facilitates post-auditing of capital expenditures.

Limitations of ARR

1. It is based upon accounting profit, not cash flow.
2. It does not take into account the time value of money.
3. Since there are numerous measures of accounting rate of return, this may create controversy, confusion, and problems in interpretation.
4. Accounting income is not uniquely defined because it is influenced by various methods, such as depreciation methods, inventory costing method etc.

7.13.3. Net Present Value Method

The net present value of project is the difference between the present value of net cash inflows and present value of initial investment. In formula,

$$NPV = \sum_{t=1}^n \frac{C_t}{(1+r)^t} - I_0$$

Where:

NPV = Net present value

C_t = Net cash flows at the end of year t

n = Life of the project

r = Discount rate

I_0 = Initial investment

Net present value can also be determined as follows:

$$NPV = PV \text{ of NCF} - I_0$$

where: PV = Present value

NCF = Net cash flows

To illustrate, assume that a project is expected to have initial investment and life of Br. 40,000 and five years respectively. The annual after tax net cash flow is estimated at Br. 12,000 for each of the five years. The required rate of return is 10%. Net present value is determined as follows:

$$NPV = PV \text{ of NCF} - I_0$$

$$\begin{aligned} &= 12,000 \left(\frac{1 - \frac{1}{(1 + 0.10)^5}}{0.10} \right) - 40,000 \\ &= 12,000 (3.791) - 40,000 \\ &= 45,492 - 40,000 \\ &= 5,492 \end{aligned}$$

In the above formula, $\frac{1 - \frac{1}{(1 + 0.10)^5}}{0.10}$ represents the discount factor and its value is equal to 3.791. This discount factor can be taken from the present value of annuity of 1 table from the intersection of $i = 10\%$ and $n = 5$. It can also be determined using your calculator.

In the above example, net cash flows are annuity. The same procedure can be followed if net cash flows are not in annuity form. To illustrate the computation of NPV when net cash flows are not annuity, suppose the project has initial investment and useful life of Br. 30,000 and four years respectively. Its annual cash flows are as follows: Year 1, Br. 10,000; Year 2, Br. 8,000; year 3, Br. 15,000; and year 4, Br. 12,000. If the required rate of return is 10%, NPV is determined as follows:

Year	Net cash flows	Discount factor (10%)	Present value
1	10,000	0.909	9,090
2	8,000	0.826	6,608

3	15,000	0.751	11,265
4	12,000	0.683	<u>8196</u>
Present value of NCF			35,159
Less: Initial investment			<u>30,000</u>
NPV			+ <u>5159</u>

What does NPV represent? NPV represents the amount by which the value of (wealth of) the firm will increase if the project is accepted.

Decision Rule for NPV

1. If NPV is greater than zero ($NPV > 0$), the project is considered desirable.
2. If NPV is less than 0, the project is considered undesirable.

7.13.4. Internal Rate of Return (IRR)

Internal Rate of Return is the discount rate which equates the project NPV equal to zero. It is the discount rate at which the present value of Net cash flows is equal to the present value of initial investment. In other words, IRR is the rate of return on investments in the project. The determination of IRR is purely based on project cash flows. Mathematically, at IRR,

$$\sum_{t=1}^n \frac{C_t}{(1+r)^t} = \text{Initial investment}$$

IRR is determined using trial and error: the complexity of determining IRR is greater if net cash flows are not in annuity form. This section illustrates the determination of net cash flows when cash flows are annuity as well as non-annuity.

a) Determination IRR when NCFs are annuity.

Assume that the project has initial investment of Br. 40,000, and useful life of five years. the annual net cash flows is estimated at Br. 12000 for five years. The required rate of return is 10%. The following steps can be followed to determine IRR.

Step1: Compute the leading discount factor (payback period)

$$PBP = \frac{\text{Initial Investment}}{\text{Annual net cash flows}} = \frac{40000}{12000} = 3.333$$

Step 2. From the present value of annuity table, find two discount factors and their corresponding interest rates closest to the computed leading discount factor. If we look in the PV of annuity table on n = 5 years row (horizontally), the leading discount factor (3.333) is found between 15% and 16%.

Interest rate	15%	16%
Discount factor	3.352	3.274

Step 3: Compute the actual IRR using the following formula

$$IRR = r - \left(\frac{PBP - DFr}{DFr_L - DFr_H} \right)$$

Where:

r = Either of the two interest rates (15% or 16%)

DFr = Discount factor for the taken interest rate

DFr_L = Discount factor for the lower interest rate

DFr_H = Discount factor for the higher interest rate

Let's take r = 15%, IRR is determined as follows:

$$\begin{aligned} IRR &= 15\% - \left(\frac{3.333 - 3.352}{3.352 - 3.274} \right) \\ &= 15\% - (-0.24) \\ &= \underline{\underline{15.24\%}} \end{aligned}$$

If we take r = 16%, the computation of IRR looks like the following:

$$\begin{aligned} IRR &= 16\% - \left(\frac{3.333 - 3.274}{3.352 - 3.274} \right) \\ &= \underline{\underline{15.24\%}} \end{aligned}$$

b) Determination of IRR when net cash flows are non-annuity

The steps followed in the preceding section are equally applicable for non-annuity cash flows. However, one step is added at the beginning to determine the weighted average net cash flow, which will be used to determine the leading discount factor. To illustrate, assume that a project has initial investment of Br. 40,000 and the following net cash flows: year 1, Br. 15,000; year 2, Br. 10,000; year 3, Br. 10,000; year 4, Br. 15,000; and year 5, Br. 15,000. The discount rate is 15%. The following steps can be used to compute IRR:

Step 1. Compute the weighted average net cash flows.

Year	Net cash flows	Weight	NCF X weight
1	15,000	5	25,000
2	10,000	4	40,000
3	10,000	3	30,000
4	15,000	2	30,000
5	15,000	1	15,000
Total		15	190,000

Note that the weight is assigned in the reverse order of the project's useful life.

$$\begin{aligned}\text{Weighted average NCF} &= \frac{190000}{15} \\ &= 12,667\end{aligned}$$

Step 2: Compute the leading discount factor (PBP)

$$\begin{aligned}\text{PBP} &= \frac{\text{Initial Investment}}{\text{Weighted average NCF}} \\ &= \frac{40000}{12667} \\ &= 3.158\end{aligned}$$

Step 3: From the present value of annuity table, find the starting rate (a good first guess) by looking for the closest interest rate and discount factor. In this case, the nearest rate is 18% (i.e., first guess = 18%)

Step 4: Compute NPV at the 1st guess (18%)

NPV (18%)

	Year	NCF	Discount factor (18%)	Present value
	1	15,000	0.847	12,705
	2	10,000	0.718	7180
	3	10,000	0.609	6090
	4	15,000	0.516	7740
	5	15,000	0.437	<u>6555</u>
Present value of net cash flows				40,270
Less: Initial Investment			<u>40,000</u>	
NPV				+ 270

Since, at IRR, NPV is equal to zero, 18% is not the exact IRR. Thus, another rate should be tried. Which rate should be tried next? Generally as we go down (in rate decreasing direction), discount factor increases. Now we need to find a rate at which $NPV = 0$. Thus, we should try a higher rate. The next (2nd) guess could be 19%. Then NPV should be computed at 19% using the above procedure.

NPV at 19%:

	Year	NCF	Discount factor (19%)	Present value
	1	15,000	0.840	12,600
	2	10,000	0.706	7060
	3	10,000	0.593	5930
	4	15,000	0.499	7485
	5	15,000	0.419	<u>6285</u>
Present value of net cash flows				39,360
Less: Initial investment			<u>40,000</u>	
NPV				<u>-640</u>

At 19% NPV is negative, this implies that IRR lies between 18% and 19%. Thus, such iteration process ends when two neighboring rates, at lower rate

NPV is positive and at higher rate is negative. To find the exact IRR, steps 4 and 5 will be followed:

Step 4: Obtain the absolute sum of the two present values

$$\begin{aligned}\text{Sum} &= |+270| + |-640| \\ &= 270 + 640 \\ &= 910\end{aligned}$$

Step 5: Divided the NPV of the smaller rate by the absolute sum and add to the smaller rate

$$\begin{aligned}\text{IRR} &= 18\% + \frac{270}{910} \\ &= \underline{18.30\%}\end{aligned}$$

Decision Rule for IRR

Accept: If the IRR is greater than the discount rate

Reject: If the IRR is less than the discount rate

7.13.5. Profitability Index (PI)

The profitability index, also called benefit - cost ratio, is the ratio of the present value of net cash flows and initial investment.

$$\text{PI} = \frac{\text{Present value of NCF}}{\text{Initial Investment}}$$

To illustrate, assume that a project is expected to have initial investment and useful life of Br. 90,000 and four years respectively. Annual net cash flows amounted to Br. 40,000. The discount rate is 10%. Profitability index can be computed as follow:

$$\begin{aligned}\text{PI} &= \frac{\text{Present value of NCF}}{\text{Initial Investment}} \\ &= \frac{40000 \times 3.170}{90000}\end{aligned}$$

$$\begin{aligned}
 &= \frac{126800}{90000} \\
 &= \underline{\underline{1.41}}
 \end{aligned}$$

Decision rule for profitability Index

- i. Accept if the project's profitability index is greater than 1
- ii. Reject if the project's profitability index is less than 1