UNIT-10 Investment Methods

Learning Outcomes

By the end of this unit the learner will be able to:

- ✓ Describe an appreciation for the need for proper investment appraisal.
- ✓ Explain the various methods of appraising capital projects, including their relative merits and demerits
- ✓ Identify some other concepts relevant in investment appraisal.

Unit 10

Investment Methods

Introduction

Investment is defined as expenditure of cash or cash equivalents, during one or more periods of time, in anticipation of a net inflow of cash or cash equivalent in future period of time. Proper decision making with respect to investment in one of the central features of financial management and any successful business depends on the proper investment of its funds in projects that yield returns.

Investment appraisal is important to ensure that the firm is investing in projects that will bring benefits in the future. In case of abundant funds and resources, firms would have simply invested in all of the available options; however, scarce resources require that an assessment be made to determine the most profitable investment based on its merits compared to other options. There should be some techniques to help in conducting investment appraisals. This unit will familiarise you with different methods of appraising investments, their comparative merits, and the usage in different situations.

Types of Investment Proposals

There is no set definition for 'long-term', but accounting practices, policies, regulations and banking institutions use it to refer to a period that is longer than ten years. In financial management, 'investment decisions', 'investment projects', and 'investment proposal' are all related to long-term resources of the firm.

All proposals or projects that run for a period of ten years - or longer - will be called investment proposals/projects. Generally, long-term investments are used for the following:

- Expanding business operations;
- Diversifying operations;
- Replacing or modernising existing plant and machinery; and
- Research and Development

Each of these purposes is explained in detail below.

Expansion

Take, for example, a manufacturing firm that plans on increasing its production from 10,000 units to 20,000 units. It will have to increase funds, variable costs, current assets, and overall financial resources, which are spent on Working Capital in order to double its production. If the production is less than the firm's capacity, then, the additional investment of funds is not required in the long-term. If, on the other

hand, the firm's existing production infrastructure i.e. plant, machinery, equipment etc. is inadequate to meet its demands then there needs to be additional investment of funds in the long-term. Therefore, the firm will have to increase expenditure on fixed assets as well as increase its working capital in order to meet its production requirements.

Diversification

It is the practice undertaken by companies to spread out their operations into new markets, or new products. It requires a large investment of funds for the long-term. There are various examples of diversification in the real world, such as Philips, which was once only famous for radio and electric bulbs and then diversified into newer products like television sets and other electrical appliances.

Replacement

Sometimes the firm's machinery and equipment becomes outdated due to the introduction of new technology and more efficient alternatives. In this case, the firm needs to invest funds to modernize its production equipment and become more competitive and efficient. There are times when the firm has to replace its machinery all together, which requires more investment as compared to modernisation. Therefore, renovation or modernisation is always more desirable than a complete replacement.

Research and Development

Investing large amounts of funds over the long term in research and development ultimately results in more efficient and sophisticated methods of production. Although there are no immediate benefits from this kind of investment, however, there has been growing emphasis on the need for conducting research to develop more modern and efficient production techniques. New technology can be borrowed from firms that have invested in research and development first or it can also be developed.

Project Report

Preparing a project report involves analysis of financial data to project future cash outflows and inflows, as well as a thorough assessment of the following:

- The project's potential in the market;
- Its technical feasibility;
- Its environmental impact;
- Its financial feasibility; and
- Availability of managerial skills required for the project

We will only discuss the financial aspect of investment appraisal in this unit.

Relevant Data

For appraisal following factors are taken into account:

- Initial Investment Outlays – its amount and timing;
- Subsequent Investment Outlays – its amount and timing;
- The Project's Economic Life;
- The Salvage Value at the end of the Project; and
- Cash Inflows – its amount and timing

Initial Investment Outlays

Initial Investment Outlays includes the total cash that is needed for project's implementation. This total cash covers costs for design, consultancy, survey, and working capital. It also includes cost to maintain stocks and contingency reserves. The availability of credit from different suppliers always helps in minimising the needed Working Capital.

Subsequent Investment Outlays

Maintenance and replacement costs are covered in subsequent investment outlays and are listed as outflows in the period when they are to be incurred.

Economic Life of a Project

Economic life of a project is calculated by the period or duration in which earnings flows are generated by the project. This is different than the life of individual assets. An individual asset like a building may have life of fifty years; a plant may have twenty years; some machinery or equipment may have a life of five or ten years.

The economic life may end:

- When renovation or replacement costs outweigh the benefits;
- When a project no longer remains viable due to its old age or undesirability of benefits;
- When maintenance costs outweigh the approximate disposal value; and
- When an introduction of new technology requires new investment and disposal of the old project.

The Salvage Value

When the economic life of a project ends, there may be equipment or other assets having q sale value. This value is covered under the inflow at the end of the economic life of a project and is known as Salvage Value.

Operating Cash Flows

Following are three main areas in operating Cash Flows:

a) Sales' Revenue: Sales' revenue is calculated from the volume of sales and the selling price per unit. The calculations of sales' revenue always influence appraisal of an investment proposal. For instance, during assessment of an investment opportunity, incremental sales revenues are generated as a result of it are given due weight.

   In some cases, an investment results in reduction of operation and maintenance costs. This may result due to introduction of some new technology or latest model equipment that is economical to operate. So, not only installing equipment with additional production capacity but also using more efficient and economical machinery can increase the overall revenues.

b) Production costs: Productions costs may include fixed as well as variable costs. It is pertinent to treat both these costs distinctly in order to accurately analyse the cost behaviour.

c) Other direct costs: Other direct costs include advertisement, promotion or selling costs and other categories like additional rent.

   All these categories are allocated period wise and then net inflow/outflow of cash is calculated. Outflow includes the total amount to be invested and inflow covers the generated Sales revenue and the Salvage revenue. Once the net inflow/outflow of cash is worked out, it can help us in making decision regarding the financial viability of an investment proposal and adopting the best among several proposals.

   The following example illustrates this concept:

Illustration 1

Year	**Net Cash Flows (£I,000)**	
	A	**B**
0	40	-360
1	150	200
2	200	300
3	220	400
4	230	450

5	370	600
	1,210	**1,590**

This example suggests that proposal A generates net Cash inflow of £1,210 thousand while proposal B brings in Cash inflow of £1,590 thousand. Still, we need more information to arrive at the best possible proposal. For that we require the total investment needed, time value of money, and acceptable rate of return on investment.

The preceding illustration tells us only that proposal B generates a total cash flow of £1,590,000 whereas proposal A brings in only £1,210,000. This alone does not help us in arriving at any appropriate decision, unless we know the total investment needed for each of them the time value of money and the desired acceptable rate of return on investment. Hence it will be useful to examine a few methods of assessing the return on investment.

Methods of Appraisal

Investment proposals are evaluated by following methods:

- Pay Back Period;
- Accounting Rate of Return;
- Discounted Cash Flow;
- Net Present Value;
- Internal Rate of Return; and
- Profitability Index

The Pay Back Period

It is the period in which the total investment is returned or recovered through net cash flow. Consider the following example in which an amount of £5000 is invested in a project. The expected net cash flows are given below in tabular form:

Illustration 2

	Incremental Cash Flow (£)		
Year	**Annual**	**Annual Cumulative**	
	(-) 5000	(-)	5000
1	1850	(-)	3150
2	1250	(-)	1900

3	1400	(-)	500
4	1700	1200	
5	1800	3000	

The total investment made is £5000, which is reflected as a negative cash flow. As shown in the table, this amount is recovered by the fourth year (3.29 years).
This recovery period can be calculated as shown below:

$$P = E + \frac{B}{C}$$

Where P = payback period

E = number of years immediately preceding the year of final recovery

B = balance amount still to the recovered
C = cash flow during the year of final recovery

It is apparent that, if the payback period is small, the business has better prospects. Short-term definite results are preferable than long-term indefinite estimates.

The downside of this method is that it does not take into account the timing of cash inflows and also ignores the cash flows after the payback period. So this method cannot provide us with an absolute or comparative appraisal. To understand this better, let us consider the following example:

Illustration 3

(£)

	Project A		**Project**	
Years	**Cash Flow**	**Cumulative Cash Flow**	**Cash Flow**	**Cumulative Cash Flow**
0 (-)	7000	(-) 7000	7000	(-) 7000
1	1000	(-) 6000	4000	(-) 3000
2	2000	(-) 4000	3000	(-) 0
3	3000	(-) 1000	2000	(-) 2000
4	4000	3000	1000	3000

5	5000	8000		
Payback period		3.25 years	-	2 years

In both projects in the above example, the total investment is £7000 reflected as negative cash flow in zero year. As seen from the table, the payback period for Project B is shorter than Project A. For this very reason, Project B may be preferred over Project A. As discussed above, the total cash inflows generated are ignored in this method. For instance, in this very example the Project A brings in cash flows for a longer period than Project B. Also the returns in case of Project B decrease in succeeding years, which is not the case with Project A.

Hence, the Payback Period method does not consider the overall profitability of the project. This method, however, is still used as a secondary criterion while making investment appraisals. Particularly, when maximum Payback Period is selected, this method is used to discard proposals, which have payback periods exceeding than desirable.

Accounting Rate of Return

According to this method, the net annual profits are calculated after taking into account depreciation and taxes. Then, average of the net annual profits is worked out using the number of years of the life of the project. This method is linked with the financial accounting practices of a company for which annual profits are worked out. Let us consider following example:

Illustration 4

Years	**Cash Flow**	**Depreciation**	**Interest**
(after tax)			
1	13,000	6,000	400
2	11,000	6,000	.400
3	9,000	6,000	400
4	6,400	6,000	400
5	6,000	6,000	400
Total	45,800	30,000	2,000

Table 1

With an initial investment of £30,000, the accounting rate of return is the average of net cash flow (after deducting depreciation, interest and tax) expressed as a percentage of investment as shown below:

$$\frac{(45{,}800\text{-}30{,}000\text{-}2{,}000)\times\frac{1}{5}}{30{,}000} = 9.2 \text{ Per cent}$$

The initial investment i.e. £30,000, is considered a depreciable asset with an estimated life of five years and no salvage value. Therefore, we can argue that the investment base for calculating ARR should be half of the initial investment, which would be £15,000 in this case. Hence, the ARR calculated on the basis of average investment is as follows:

$$\frac{(45{,}800\text{-}30{,}000\text{-}2{,}000)\times\frac{1}{5}}{15{,}000} = 18.4 \text{ Per cent}$$

It is evident, from our example above, that since there is no salvage value, the average investment is equal to half of the initial investment and the rate of return will be double the rate that is calculated on the original investment.

One of the drawbacks of ARR is that it does not take Working Capital into consideration, whereas, additional Working Capital is required for the new investment should be taken into account. The timing of cash flows is a very important factor that should be considered and it should be realized that higher cash flows in earlier years (lower cash flows in later years) should be distinguished from higher cash flows in later years (lower cash flows in earlier years).

The calculation of ARR, just like the Payback Period method, ignores the time value of money, as it does not take into account the timing of cash generation. The ARR method also ignores an asset's scrap value at the end of its useful life. Another drawback of the ARR method is that it does not suggest one uniform method for profit calculation, which means that accounting data and ultimately ARR can be manipulated. The drawbacks mentioned above indicate that ARR is not the most reliable method to calculate returns on investment.

Discounted Cash Flow (DCF)

The Discounted Cash Flow concept is based on the factor that is ignored by methods discussed previously i.e. time value of money. According to this concept, an investment yields returns that are spread over a few years and the real value of £1 today is more than its value a year from now. Therefore, the future returns on investment should be discounted in order to reflect the real current cash outflow associated with the investment. There are two methods of investment appraisal that incorporate this concept:

I. Net Present Value (NPV)
II. Internal Rate of Return (IRR)

Net Present Value Method

This method is based on compounding the rate of interest to determine the value of future income. Let's say that we invest £100 today for a period of one year at 10% interest rate per annum.

'P' denotes our initial investment, and 'r' the interest rate.

We calculate the value of our investment at the end of the year by the following formula:

$$P\left(1+\frac{r}{100}\right)^{n}$$
$$= 100\left(1+\frac{10}{100}\right)^{n}$$
$$= \left(100+\frac{11}{100}\right)^{n=1}$$
$$= 110$$

In other words, £110 earned after one year is worth £100 today. The formula mentioned above can be reconstructed to calculate the present value (PV) of future cash inflows as shown below:

$$PV = \frac{P}{\frac{(1+r)^{n}}{100}}$$

'P' is the amount that will be received after 'n' years at an interest rate, 'r'. For example if we want to calculate the PV of £500, which will be received after 5 years, discounted an interest rate of 10%, our calculation will be as follows:

$$\frac{P = 500}{\left(1+\frac{(r = 10)}{100}\right)^{n=5}} = \text{£ } 310.5$$

Looking up the discount factor for 10% over 5 years in table 1 is an alternative to making the calculation above. This value is 0.621 for £1 according to the table. If we multiply this with our expected income of £500, we will get the present value i.e. £310.5.

If we are expected to receive an equal amount, let's say £1000, every year for a period of five years, the present value will be calculated as follows:

Years	Amount (£)	Present Value Factor	Present Value (£)
1	1,000	.909	909
2	1,000	.826	826
3	1,000	.751	751
4	1,000	.683	683
5	1,000	.621	621
			3790

Table. 2

Discounting is, therefore, the process of reducing expected cash flows in the future to reflect their present value. Table 2 provides a simple method to calculate present value when the expected cash flows are equal in amount. In our example, if we look in the 10% column and the 5 years row in table 2, we will find a factor of 3.790, and if we multiply this factor with £1000, we will get the present value i.e. £3790. The same figure was calculated by the longer method using table 1. Hence, table 2 lists all factors that represent the present value of £1 received for a specific number of years. The annual receipt of a uniform amount of cash for a given number of years is called an annuity.

When the present values of expected cash inflows for each year of the project's life are calculated, they are added up to calculate the aggregate inflows. This figure can be compared to the total cash outflow, which is associated with the investment, and a decision can be reached regarding the investment. If the aggregate PV of cash inflows exceeds the total cash outflow than the project should be accepted.

When comparing two projects, the one with the higher the aggregate PV is, will give precedence to that project. Therefore, the Discounted Cash Flow – the Net Present Value method provides a rational basis for decision-making. This is further illustrated in our example below:

Illustration 5

Project	**Initial**	**Net Cash Income (before depreciation but after Tax)**							
		(£ in Thousands)							
Year									
	£	1	2	3	4	5			8
A	20,000	4	4	4	8	2	-	-	-

B	20,000	8	6	2	2	2	2	2	2

When the present value of the expected cash inflows exceeds the capital outlay, it indicates that the investment is profitable for the firm. When two projects or investments are being compared, then, the one with the higher Net Present Value is selected. Furthermore, other things being constant, a project that has a shorter pay back duration (which starts yielding results sooner) is more desirable.

	Project A			**Project B**		
Year	**Net Cash Income £**	**Discount Factor***	**PV £**	**Net Cash Income £**	**Discount Factor**	**PV £**
1	400	0.935	3,740	8000	0.935	7,480
2	400	0.873	3,492	6000	0.873	5,238
3	4000	0.816	3,264	2000	0.816	1,632
4	8000	0.763	6,104	2000	0.763	1,526
5	2000	0.713	1,426	2000	0.713	1,426
6	-	-	-	2000	0.666	1,332
7	-	-	-	2000	0.623	1,246
8	-	-	-	2000	0.582	1,164
Total Present Value			18,026			21,044
Initial Cost			20,000			20,000
Net Present Value			(1,974)			1,044

The discounting rates that we have used in our examples are also called the ‘cut-off rate’, ‘hurdle rate’ or ‘rate of return’. It is particularly useful when the firm has to choose one proposal out of many due to scarcity of funds and needs to appraise more than one investment.

Some of the most common questions, regarding the discounting rate, are as follows: ‘how is it chosen?’ and ‘is it the rate at which the firm borrows and lends money or is the rate of return on capital employed by the firm?’

Usually, a firm sets the rate of return for appraising investments that is less than the interest rate at which funds are borrowed for investment. However, monetary interest rates do not incorporate the risks that a

firm is taking. It can be argued that a firm should choose a discounting rate that reflects risk to some extent and is close to the overall rate of return on capital employed.

A few advantages of using the NPV method are as follows:

(i) it considers the time value of money;
(ii) it recognizes the project's benefits over the entire span of its life;
(iii) it is useful when the firm is appraising mutually exclusive projects;
(iv) it focuses on financial management's objective of maximising the shareholders' wealth; and
(v) Proposals, with a positive NPV, are selected leading to a positive effect on the market prices of the firm's shares.

Some of its drawbacks include:

(i) it is difficult to calculate (unlike ARR and PBP);
(ii) it is difficult to decide which discounting rate should be used when calculating present values;
(iii) a change in the discounting rate may affect the desirability of the project;
(iv) The NPV is an absolute measure which may not give reliable results for projects involving different capital outlays; and
(v) The reliability of results produced by the NPV method may be affected when the proposals being appraised have different expected lives

Internal Rate of Return

It has already been established that discounted cash flow techniques are superior to the Payback Period and ARR methods, due to the fact that they are based on time value of money. Internal Rate of Return (IRR) is another discounted cash flow method used to appraise investments.

The IRR is used to derive a discounting rate at which the present value of all future cash inflows becomes equal to the current cash outflows associated with the investment proposal. This is illustrated in the example below:

Illustration 6

Present Value of Net Cash Flow

Year	**Net Cash Flow**	**At Discount Rate 20 %**		**At Discount Rate 10%**	
		Discount Factor*	**£**	**Discount Factor***	**£**

0	-	100	1.000	100.00	1.000	(-)	100.00
1	40		0.833	33.30	0.909	36.40	
2	35		0.694	24.30	0.826	28.90	
3	30		0.579	17.40	0.751	22.50	
4	25		0.482	12.10	0.683	17.30	
5		20	0.402	8.00	0.621	12.40	
				(-) 4.90		17.30	

*See Table 1

It is evident, from the example above, that, at a discount rate of 20%, the total present value of future cash inflows, £95.10, is £4.90 less than the current cash outflow of £100 for each investment. At a discount rate of 10%, the total PVs is £17.30 more than the cash outflow. Our IRR (where the PVs will equal the cash outflow) will lie somewhere between the two discount rates. This will be determined through interpolation as shown below:

$$IRR = LRD + \frac{(NPVL)}{PV} \times R$$

Where; IRR = Internal Rate of Return
LRD = Lower rate of discount
NPVL = Net Present Value at lower rate of discount (i.e. difference between present values of cash inflows and present value of cash outlay).
PV = difference in present values at lower and higher discount rates
R = difference between two rates of discount
Substituting the values, we get:

$$IRR = 10 + \frac{(17.30)}{(22.20)} \times 10 = 17.8$$

Therefore, at a discount rate of 17.8%, the PVs of future inflows are equal to the current initial investment.

If the discount rate is higher than the interest rate used to calculate the cost of funds, then the investment is desirable.

IRR through Payback Reciprocal

One of the drawbacks of IRR is that its calculation is a largely hit and trial procedure, which is time consuming. To avoid this, we use the Payback Reciprocal method, this method can be used in cases where we have a fixed cash inflow and where there are different cash inflows.

Where cash inflows are constant every year (called annuity):

The following is a procedure to calculate IRR:

I. Calculate project's payback period.
II. Then select the factor that lies closest to the payback period in Table 2, while life of the project would be the relevant year. For example, if we have a project that has a life of 6 years and payback period is calculated as 4 years. From the table we look for a factor closest to 4 for 06 years. The factors closest to 4.0 are 3.998 (13 % rate of interest) and 4.111 (12 % discount rate). Between these two4 is closer to 3.998. Hence, the actual values is somewhere between 12 and 13 per cent (close to 13). The exact value can be calculated by interpolation as shown in Illustration 6.

If the stream of cash flow is of a varying nature:

In this scenario, the calculation of Internal Rate of Return (IRR) is more difficult. In order to deal with it in a simpler way we use 'fake annuity'. Following is the procedure that is usually adopted:

i. In the first step, average of annual cash flows is calculated to have a 'fake annuity', which is not necessarily the representative annuity.

ii. From there we calculate a payback period, which again is not the true payback period, by dividing the outlay with average annual cash flows taking into account taxes (CFAT).

iii. Then, we look for the closest factor to the 'fake payback period' in Table 2, as done before, in order to obtain IRR.

iv. The IRR is adjusted by looking at the pattern of average annual cash flows and comparing it with the real varying stream of cash flows. In case the real cash flow stream in initial years is higher than the average, the IR is adjusted a few percentage points upward. In case the real cash flow stream is lower than the average, the IRR percentage is adjusted a few percentage points downward.

v. The calculated IRR is then taken as the discount rate to calculate Present Value of the uneven Cash Flows using Table 1.

vi. If the Present Value is equal to the initial outlays, it means we have got the right IRR. Otherwise, repeat the previous step. If the Net Present Value is positive, then, we should work with higher IRR to get a negative value. Conversely, if the Net Present Value is negative, then, we should work with lower IRR to get a positive figure. After doing this, we will have found two discount rates, which cause the Net Present Value to be positive, and negative, the real IRR can then be worked out using interpolation as shown in Illustration 6.

In a nutshell, it does not matter if the cash inflows of a project are varied each year or not; we need to work out two discount rates –one lower and the other higher. The lower discount rate gives us a positive Net Present Value, while the higher discount rate gives us a negative Net Present Value. Interpolation is then used to get the accurate IRR.

The IRR calculation is easier for managers to understand because although, like NPV, it considers the time value of money and the cash inflows during the entire life of a project, it is a percentage rather than an absolute figure. Unlike the NPV, IRR does not need the discount rate as it calculates the rate. The projects that have an IRR greater than the required rate if return lead to maximisation of the shareholders' wealth.

However, there are a few assumptions that the IRR calculation is based on, such as, the cash flows are invested at the same rate as IRR. For example, if the IRRs of two projects are 16% and 20% then it is assumed that cash flows generated from these projects will also be invested their the same respective rates. This is unrealistic considering that a firm will not reinvest funds at two different rates. Sometimes the cash flows are not even reinvested within the firm.

Profitability Index

Sometimes an investment proposal is rejected because it has a lower IRR as compared to the other proposal, but the proposal with a lower IRR may be more profitable in reality when the NPV is calculated using the target discount rate. Consider the example below:

Project	**Cash outflow In year 0**	**Cash inflow Per annum For 5 years £**	**IRR %**	**NPV at 10% £**
A	50,000	15,000	15.4	6,850
B	68,000	20,000	14.4	7,800

Based on the IRRs given above, the firm may reject project B, as its IRR is lower. However, with a target rate of 10%, project B will be more profitable than project A based on NPV calculation. If a target rate of 15% is used then project A will have a higher NPV.

We have already discussed that an investment proposal is selected depending on the excess of its discounted cash inflows over cash outflows.

Illustration 7

Proposal	PV of total inflows £	Outflows £	Surplus £
A	4,50,000	4,00,000	50,000
B	1,20,000	1,00,000	20,000

According to the information provided in the table above, proposal A has a bigger surplus than proposal B does. However, the rate of return on investment is being overlooked and therefore the amount of cash inflow is irrelevant unless it is assessed against the total amount of investment.

We will start by calculating the rate of return of proposal A:

$$\frac{50,000 \times 100}{4,00,000} = 12.5\%$$

And then proposal B:

$$\frac{20,000 \times 100}{1,00,000} = 20\%$$

According to our calculation of rate of return, proposal B is clearly superior to proposal A.

The Profitability Index (PI) represents the relationship between present values of net cash inflows and the present value of cash outflows. It can be calculated in the form of a percentage or in a unitary form. The formula for PI is:

$$\text{Profitability Index} = \frac{\text{Present Value of Cash inflows}}{\text{Present Value of Cash outflows}}$$

We can calculate the profitability index of the two proposals in our example above:

A. 4,50,0004 ÷ 4,00,000 = 1.125 or 112.5%
B. 1,20,000÷ 1,00,000 = 1.20 or 120%

The result is the same as the one calculated through rate of return on investment method. Proposal B should be chosen, as its PI is higher.

A question that comes to mind is: Why have two methods (profitability index and rate of return) when the result is the same? The answer is that the management often suggests a 'cut-off rate' and if the rate of return is lower than the cut-off rate then proposal is rejected. The Profitability Index is useless when the cut-off rate is not provided. If, however, the firm has two investment proposals that qualify the rate of return test but the firm can only choose one, then the Profitability Index is a very important tool in determining which proposal to choose.

Depreciation, Tax, and Inflows

It is important to understand that the Discounted Cash Flow (DCF) method is only concerned with cash inflows and outflows and is not associated with the accrual concept of revenues and expenses. Therefore, the depreciation is not accounted for when DCF calculations are made. In other words, when cash flows are being calculated for DCF computation, depreciation should not be deducted because depreciation does not result in a cash flow. It is only a measure of an asset's usage over the span of its useful life.

The initial cost of an investment is a lump sum amount recorded in year zero. It is assumed that the cash inflows will be after income taxes have been paid. Although deprecation does not affect cash inflows, it does have some influence because depreciation is considered a business expense and is connected with the income tax payable. Depreciation does not reduce the cash inflows from an investment, as it does not require repeated cash outlays over the useful life of an asset.

However, depreciation reduces the tax burden on cash inflows from investment. Earnings from an investment are taxed at the prevailing tax rate and, therefore, taxes reduce the cash earnings. Depreciation reduces the value of an asset and this, in turn, reduces tax payment.

Illustration 8

XYZ Company has the option of buying a machine with an original cost of £12,000. It is estimated that the company will save £5,600 (before taxes) annually if it uses the machine. Depreciation calculated on a straight-line basis is £2,400 on the initial cost. The machine has an estimated useful life of five years and no salvage value. The tax rate if 50%.

Calculate cash inflows after taxes.

	Tax Purpose£	Cash inflow£
Gross annual cash cost savings	5,600	5,600
Less: Depreciation	2,400	
Net incremental income subject to tax	**3,200**	
Income tax at 50% (payment in cash)	1,600	(1,600)
Net cash inflow after taxes		**4,000**

If we had not deducted the depreciation, then income tax would have been applicable on £5,600 and would have amounted to £2,800 rather than £1,600. The company was able to retain a cash inflow of £1,200 due to depreciation. This is called a 'tax shield'.

Cost of Capital

We have noted how the investment appraisal of different projects proposals is done using the Net Present Value techniques, which involve the use of the discount rate (the required rate of return or cost of capital or hurdle rate). Opportunity cost rate of a project is calculated by the amount that can be earned if the funds were invested elsewhere with similar risk involved. Rate of return of a project should at least be equal to the opportunity cost rate.

So, if a project has higher risk associated with it, it will also have a higher expected rate of return. Different investment opportunities have their own respective rates of return or cost of capital based on the risks involved. Thus, it makes sense to increase Required Rate of Return (RRR) with an increase in risk. Required Rate of Return can also be described as a sum of risk-free rate of interest and risk premium.
Firms calculate and maintain their average risk and average cost of capital. For each investment project, it is expected that if the risk is equal to the average value, then rate of return should at least be equal to the average cost of the capital of the firm.

Firms setup their desired minimum rates in following two ways:

I. Minimum rates are based on what is acceptable in the industry or on the performance of the company.
II. Minimum rates can also be based on the cost of funds.

The first option is more subjective than the second. It depends on the management to term its operating performance satisfactory and it can select that for carrying out new capital projects. The management may also decide to go with the industry standard if it feels that it is better for improved results while undertaking new projects. Still, the management can also decide to ignore firm's performance and industrial standard, and can setup an independent minimum rate keeping in mind the level of future profits and firm's strategy.

The second option is based on the cost of funds or cost of capital. In this method, the minimum rate is selected based on how much it costs the firm for funds or money in the market. The cost of capital can be determined using different methods. The cost is reflected in the form of an interest rate for an amount borrowed. The cost of preference shares is clearer than cost of equity funds but as preference stocks have the same characteristics as borrowed funds, it may not be entirely useful for the cost of this type of capital.

This leads us to a problem when working with common shareholders' equity, for instance retained earnings. One can argue that in this case capital has no cost as it is being internally generated. However, this inference would not be an accurate one. The argument is that the retained earnings still have an opportunity cost. If this capital cannot generate satisfactory return when invested into operations, then it should be handed out in form of dividends to the shareholders.

It is pertinent to note that if the shareholders had invested the dividends, after receiving the distribution, they would have earned on it. This reflects opportunity cost. If the funds are not distributed and are retained in the business then that means the shareholders have to forego these returns.

The market price of a company's shares listed on the stock exchange indicates the company's earnings per share (after taxes). The market price of shares in also affected by the company's dividend and earnings retention policies. Therefore, relating a company's earnings per share to the market value of its stock is one of the methods of calculating the cost of common equity capital of the company.

The cost of capital of a company keeps changing depending on the capital structure, the company's future financing plans and changes in the rate of earnings. In order to calculate a company's cost of capital, the capital structure, expected cost of borrowing and the market cost of equity must be taken into account.

Illustration 9

For example, a company's capital structure comprises 40% debentures (with an interest of 14%) and 60% equity shares showing a market value of £25 per share and current earnings per share is £7 (after taxes). The weighted average cost of capital will be:

Type of capital	Weight	After-tax rate	Weighted average
Debentures	40%	7	2.8%
Common stock	60%	28	16.8%
	100%	-	19.6%

In our calculation above, the rate of 7% is the interest rate after taxes because interest is a deductible expense for the purpose of taxation (14% before taxation x 0.50% assumed tax rate). This means that the effective rate for common stock is 28% (£7 earnings per share or £25 market price) and this is also taken after taxes, therefore, the weighted average of 19.6% is calculated after taxation. Based on this, the management will reject the proposal that offers less than 19.6% return after taxes. Acceptance of proposals will also depend on other constraints such as budgetary limitations. It can be concluded that the calculation of cost of capital is very important when accepting an investment proposal.

Limitations of Investment Appraisal Techniques

Although the investment appraisal techniques discussed in this unit are precise, the true value of an investment proposal cannot be exact. It depends on a lot of factors that have to be considered. The extent to which the results of investment appraisal are dependable and usable depend on; reliability and objectivity of the input data, anticipated inflation etc.

There are three elements in the quantitative methods of investment appraisal; capital investment, project life, and returns or cash flows.

Sometimes, the capital investment can be estimated quite accurately, such as, determining the purchase price of equipment, while in other instances it is hard to arrive at an exact estimate, for example when developing a new product or venturing into a new market.

Cash savings, incremental cash inflows, and earnings are always estimates, which depends upon the subjective probabilities and risk associated with all possible outcomes. Therefore, in light of an uncertain future, estimated returns can only be hard truths rather than factual assessments. Most errors are a direct result of misestimating the price or volume of sales. For example, estimating cash savings from the use of labour saving equipment may depend on the number of labour hours saved, the maintenance cost, power consumption etc. similarly, estimating the contribution margin in increased sales due to the introduction of new product, opening of a new market or an enhanced advertising campaign may be very speculative and subjective.

Estimating the useful life of an asset or a project is dependent on several environmental and technological factors. An engineer can only make a guess if he/she has a fair idea of technological change. A new product's life is dependent on the customers,' as well as the competitors' reactions, which cannot be anticipated accurately. Although statistical techniques help a great deal in making estimates and speculating but even they cannot guarantee an error free judgment and elimination of all uncertainty.

In short, the accuracy of an investment decision relies not only on the usage of reliable investment appraising methods, but also on good common sense of the decision makers.

Summary

Investment decisions involving long-term capital projects have a large impact on the overall health of the organization. Using finite capital resources effectively ensures wealth maximization and business profitability. However, these decisions involve uncertainty, risk and large investment of funds.

In this unit, we focused on using investment appraisal techniques in order to enable management to rank and choose between various investment proposals intelligently, and minimize the risk and uncertainty factor.

The following techniques were discussed:

a. Payback Period (PBP);
b. Accounting Rate of Return (ARR); and
c. Discounted Cash Flow (DCF) methods

The Payback Period technique is a simple method of determining how long will it take for a project to yield returns and recoup the initial investment. This method had serious drawbacks such as not considering the project's profitability and being concerned only with the liquidity aspect.

The next method, the accounting rate of return, is also simple to understand and use. It calculates the average cash flows generated by a project. Its limitations include disregarding the useful life of projects, uniformity of cash flows and time value of money. This method of investment appraisal can be useful when considering projects that are not limited by resource constraints or whose returns are significantly higher than the required rate of return.

We looked at two types of discounted cash flow techniques: the Net Present Value (NPV) and Internal Rate of Return (IRR). The NPV uses the required rate of return as a discount factor to calculate the present value of expected future cash inflows. If the present value of future returns produced by the investment exceeds the capital outlay then the project is desirable. The IRR calculates the discount rate at which the present value of future cash flows is equal to the initial cash outflow or the original cost of investment. In many cases, NPV and IRR produce the same results approximately.

The Profitability Index reflects the relationship between the present value of future cash flows (discounted at the desired rate of return) and the cost of investment in the form of a percentage. This is an effective method of investment appraisal when considering projects of different life spans and sizes.

Generally, discounted cash flow techniques are most reliable investment appraisal methods. The PV table makes these techniques are very easy to apply and simple to understand.

There are three basic constraints underlying all quantitative analytical techniques: investment, return, and time. Estimating future returns form the basis of all investment appraisal techniques and there is a significant room for errors in this process. However, several statistical and sensitivity analyses have been developed to minimize the probability of error.

Further Reading:

- ✓ ***Martina Röhrich, (2007), Fundamentals of Investment Appraisal: An Illustration Based on a Case Study***
- ✓ ***UweGötze, Deryl Northcott, Peter Schuster, (2008), Investment Appraisal: Methods and Models***