UNIT-7

CAPITAL BUDGETING II

In the previous unit, we have seen the two methods of investment decision making – i.e. ARR and Payback. They are only elementary methods and are not considered very scientific and, therefore, can lead to wrong conclusions. In this Unit we are going to study the scientific and, therefore, more appropriate methods of capital budgeting. These methods come under what is called discounted cash flow approach. The first and the most commonly used one is called Net Present Value Method.

NET PRESENT VALUE :- It is net present value of all the cash flows that occur during the entire life span of a project: The outflows will have negative values while the inflows will have positive values. Obviously, if the present value of inflows is greater than outflows, we get a positive NPV and if the present value of outflows is greater than inflows, we get a negative NPV. The positive NPV means a net gain in value maximization and, therefore, any project which gives a positive NPV is an acceptable project and if it gives a negative NPV, then the project should not be accepted. NPV can be expressed as follows;

$$NPV = \sum_{t=1}^{n} \frac{A_t}{(1+i)^t} - \text{Initial investment}$$

Where

A_t= cash flow at time t

i =The rate of interest or cost of capital at which funds are to be discounted

Investment= The initial amount spent on a project

If initial investment is also treated as a cash flow then it can be written as follows

$$NPV = \sum_{t=0}^{n} \frac{A_t}{(1+i)^t}$$

Acceptance Rule & Ranking Rule

The acceptance rule for NPV is that, if it is positive, then the proposal should be accepted and if it is negative then it can not be accepted. In case of same size projects, the higher the value of NPV the higher would be the ranking of a project.

Illustration (7.1):-A firm is considering an investment proposal worth Rs.80,000. The CFATs (cash flows after tax) are expected to be as follows. The rate of discount is 10%. Find out whether the project is worthwhile or not.

Year	CFATs (Rs.)
1	15,000
2	22,000
3	27,000
4	29,000
5	21,000

Solution

$$NPV = \sum_{t=1}^{n} \frac{A_t}{(1+i)^t} - C_0$$

$$= \frac{15,000}{1.1} + \frac{22,000}{(1.1)^2} + \frac{27,000}{(1.1)^3} + \frac{29,000}{(1.1)^4} + \frac{21,000}{(1.1)^5} - 80,000$$

= 13,636.36 + 18,181.82 + 20,285.50 + 19807.39 + 13039.43 - 80,000

= 84,950.50 - 80,000 = **Rs. 4,950.50**

In this project the PV of inflows is Rs. 84950.50 while the PV of outflows is Rs. 80,000. Hence the NPV is Rs. 4950.50 which makes the project an acceptable project because NPV is positive.

Interpretations of NPV: - NPV is the absolute value of a net gain in future. This may be treated as a net addition to the value of the firm and therefore, is also called unrealized capital gain.

Another interpretation of NPV is that it represents the maximum price that a firm should pay for foregoing the right to undertake the project or to sell the project to some other party.

It also represents the amount that a firm could raise from the market at given rate of inertest, in addition to the initial cost of the project, and ensure that this will be paid off from the receipts of the project. For example; A firm is undertaking a project at a cost of Rs. 50,000 with a positive NPV of Rs. 10,000. In this case, the firm can not borrow merely Rs. 50,000 to meet the initial cost, but can also raise Rs. 10,000 (for any other purpose) and be rest assured that this sum with interest can be paid off from the proceeds of the given project.

Properties of NPV: - The NPV method is a very scientific and appropriate technique of capital budgeting and is therefore, widely used for investment decision making. The following properties can be identified.

It is based on cash flows over the entire life of project.

(i) It considers time value of money.

(ii) It is an absolute value.

(iii) It possesses the property of additions, i.e. the total NPV of two projects is the summation of their individual NPVs.

(iv) NPV for different rates of interest can be found separately, and

(v) It allows different rates of interest for different time period in the life of a project.

Limitations of NPV

It gives the absolute value and therefore, comparison between two different projects is not easy, especially when they are of different sizes.

(i) Many a times, it is not possible to know in advance the rate of interest at which discounting is to be done. Similarly a given NPV may not be appropriate if the rate of interest has changed.

(ii) It may lead to wrong decision making especially when limited funds are available and we have to choose between different options.

PROFITABILITY INDEX (P.I.)

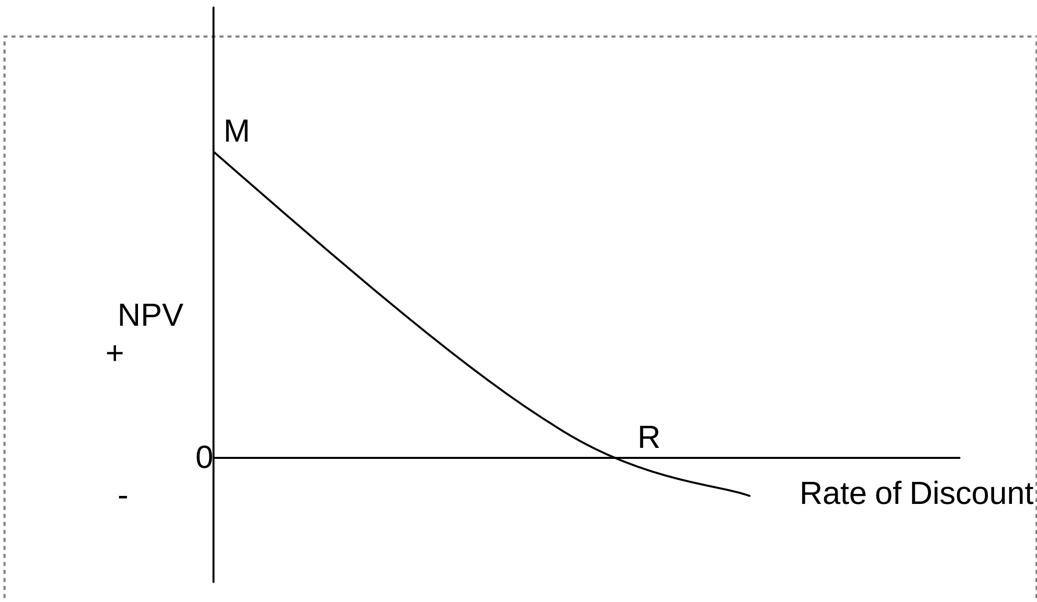
NPV is an absolute value and therefore is not appropriate for comparing the relative profitability between different projects. In order to overcome this limitation of NPV, we make one modification in it to make it a relative measurement. This is called Profitability Index (P.I.) or Benefit Cost Ratio (B-C Ratio). The P.I. is as follows.

$$P.I. = \frac{\text{Present value of inflows}}{\text{Present value of outflows}}$$

Acceptance and Ranking Rule: - If the P.I. is greater than I, then the project is to be accepted and if it is less than I then it is to be rejected. However, if we have, several projects then the project with a higher P.I. or B.C. ratio should have a higher ranking.

INTERNAL RATE OF RETURN (IRR): - The NPV and PI are both based on a given rate of discount and, therefore, the NPV and PI values change as soon as the rate of discount is changing. Hence, any project which is acceptable at, say, 10% rate of discount may not be the same at, say, 12% rate. Therefore, there is need to find out a technique which is autonomous in it self and not dependent upon any externally determined rate of interest. The relationship between, the rate of discount and the NPV can be presented in the following diagram.

Rate of discount and NPV relationship



Relationship between NPV and rate of discount

The above diagram shows an inverse relationship between NPV and rate of interest. At zero rate of interest the NPV is maximum at M level. As the rate of interest increases, the NPV gradually falls. At R rate of interest the NPV is zero and beyond this, it is even negative. The rate R in the above case is called the Internal Rate of Return (IRR). We may, therefore, say that IRR is that rate of discount at which NPV is zero. It can be expressed as follows.

$n \qquad A_t$

$$0 = \sum_{t=0} \frac{}{(1+i)^{t}}$$

The rate of interest at which the above equation holds good is the IRR.

The relationship between discount rate and rate of discount for the previous illustration of NPV (7.1) is calculated as follows.

Rate %	NPV (Rs.)
9	7320.67
10	4950.50
11	2677.54
12	496.06
13	- 1600.02
14	- 3611.29

This table shows that as the discount rate increase the NPV goes on diminishing. It can therefore be understood that a project which is acceptable at a given rate of discount, say 11% may not be accepted at 13% or 14%. It is therefore essential to know, the cut-off rate where positive NPV converts into a negative

NPV. This cut off rate is the Internal Rate of Return (IRR) where NPV is zero. It can be expressed as follows

The Internal Rate of Return IRR can be calculated by use of log or by a scientific calculator or by computer instantly. However, the following method can be used for the purpose.

$$IRR = r + \frac{x}{x - y}$$

Where r = the closest rate at which NPV is positive

x = value of positive NPV at that level

y = value of negative NPV at next higher rate

For example, in the above illustration, the value of r = 12%, the value of x = 496.06 and the value of y = - 1600.02. Hence the IRR is

$$= 12 + \frac{496.06}{2096.08}$$

= 12 + .2367 = 12.2367%

Acceptance and Ranking Rule for IRR: - The IRR should be greater than the given discount rate (cost of capital) to make a project acceptable. If IRR is less than the cost of capital then, the proposal can not be accepted as it will lead to a negative NPV.

Since, IRR is a rate of return, the project with a higher IRR should be ranked higher than the other project which has a lower IRR.

Virtues of IRR:-

I. It considers cash flows of projects in their entirety.

II. It takes into account time value of money.

III. It is useful in ranking of projects because it is a rate and not any absolute value.

IV. It is independent of any externally determined rate (discount rate or cost of capital), and hence ranking of projects will not change with variation in cost of capital.

V. It is particularly useful as it helps a businessman and also a financer in assessing the margin of safety in a project.

VI. It is more appealing to the businessmen who are used to thinking in terms of cost and return.

NPV Vs IRR

Both NPV and IRR are considered scientific techniques of a project's financial appraisal and both are commonly used. The NPV is an absolute value of a gain or loss, while IRR is a rate of return from a given investment and, therefore, more appropriate for comparison between different project proposals as well as between a given IRR and different costs of capital. In this respect IRR seems to be having an advantage. This, however, may not always be so.

1. The biggest problem with IRR is that it is not uniquely defined and we may get more than one IRR in some cases. For this purpose we may divide projects in two categories- conventional projects and non-conventional projects. Conventional projects are those projects where there is only one change of sign for the cash flows. There are initial outflows followed by continuous inflows. The non conventional projects, on the other hand, are those projects in which there is more than one change of sign i.e. initial cash outflow followed by some inflows, followed by some outflow followed by inflows and so on. It is only in cases of non conventional projects that we may have more than one IRR. However, it is not essential that every non conventional project has more than one IRR. This depends upon the quantum and pattern of cash flows. So a project being non-conventional is only a necessary but not a sufficient condition for multiple IRRs.

Conventional Project

	-	+	+	+	+	+
Cashflows-	0 1	2	3	4	5	

Time period

Non conventional project

	-	+	+	-	+	-
Cashflows	0	1	2	3	4	5

Time period

Illustration (7.2):-There is a project proposal with the following pattern of cash flows.

Year	Cashflows (Rs.)
0	-500
1	+1450
2	-1000

If we calculate its NPV at 10% rate of discount

$$\text{NPV at 10\%} = -500 + \frac{1450}{1.1} - \frac{1000}{(1.1)^2}$$

$$= -500 + 1318.18 - 826.45 = -8.26$$

$$\text{at 15\% NPV} = -500 + \frac{1450}{1.15} - \frac{1000}{(1.15)^2}$$

$$= -500 + 1260.87 - 756.14 = +4.73$$

In the above non conventional project if we calculate IRR we get two IRRs.

$$-500 + \frac{1450}{\quad} - \frac{1000}{\quad} = 0$$

(1+i) (1+i) ^{2}

If we consider $\frac{1}{(1+i)} = x$, this equation becomes

$$-500+1450x-1000x^2=0$$

Or $-1000x^2 + 1450x - 500 = 0$

This is a quadratic equation in which the value of x can be found

by the following formula

$$X = \frac{-b \pm v\ [b^2-4ac]}{2a}$$

In which the value of a = - 1000, b = 1450, & c = - 500

Putting these values we get

$$x = \frac{-1450 \pm v\ [1450^2 - 4(-1000)(-500)]}{2(-1000)}$$

$$= \frac{-1450 \pm v\ [21,02,500 - 20,00,000]}{-2000}$$

$$= \frac{-1450 \pm v\ [1,02,500]}{-2000}$$

If we take positive value of v 102500, then x = .5649

If we take negative value of v 102500, then

x = .8851

If x = .5649, i = 77% (approximately)

If x = .8851, i = 13% (approximately)

The diagrammatic presentation would be as follows.

Multiple IRRs

This presents a problem of interpretation and decision making. However, if we use the NPV technique at a given rate of discount we get a definite value and decision can be taken accordingly.

2. Another problem in using IRR is that it does not distinguish between lending and borrowing. For example, in following illustration we have two projects A and B, with their cash flows as

<u>Illustration</u> (7.3):-

Year	Cash Flows A	Cash Flows B
0	- 400	+ 400
1	600	- 700

Project A is lending (investing) project while project B is borrowing (financing) project. The NPV of A and B at 10% discount rate is

$$A = -\ 400 + \frac{600}{1.1} = -\ 400 + 545.45 = 145.45$$

$$B = +400 - \frac{700}{1.1} = 400 - 636.36 = -236.36$$

If we calculate IRR of these proposals it is 50% and 75% respectively, indicating that the project B is better. The reality is that A has a positive NPV while B is having negative NPV.

3. Using NPV and IRR may again create problems, when the patterns of each cash flows is different. For example

Illustration (7.4):-

Year	Cash flows	
	A	B
0	- 3000	- 3000
1	750	2000
2	1500	1500
3	2000	450

NPV at 10% for A is 424.11 while for B it is Rs. 395.94. Thus, A gives a higher NPV. However if we calculate IRR for the two projects, it is 16.75% and 19.18% respectively for projects A and B. This creates a dilemma.

The conflict between the two techniques is mainly due to the differences in the timings of the cash-flows.

In project A higher amounts are occurring in the later years of the projects and its NPV will fall faster in respect of increase in discount rates. In project B the major cash flows occur initially hence its rate of fall is slower.

4. A comparison between NPV, PI and IRR shows that NPV is the best capital budgeting technique because of its conceptual charity and methodology of calculation. It is even better then PI in some respects. For example:

<u>Illustration</u> (7.5):-

Projects	**Cash flows** 0	1	2	**NPV at 10%**	**PI**	**IRR**
X	- 10,000	7,000	6,000	2,454	1.245	20%
Y	- 1,00,000	60,000	60,000	14,545	1.145	13.07%

In the above case project X seems to be superior both in respect to IRR and PI, while project Y is better if we go by NPV. In such a situation, decision should be taken on the basis of NPV, (even if other projects have a higher rate of return). This is because the objective of firm is wealth maximization. Project Y creates extra wealth of Rs. 14545 while project X creates wealth of Rs. 2454 only. Hence, NPV rule is always the best when we have to make decision about a specific project or number of projects and when fund constraint is no problem, i.e. funds can be obtained from the market by paying its cost. However, when funds availability is a constraint, i.e. limited funds are available and we have to choose among different alternatives, then obviously NPV can not work. This is a case of Capital Rationing which we discuss in the next pages.

MODIFIED INTERNAL RATE OF RETURN (MIRR):

Internal rate of return is a good measure of profitability of a given project proposal. However, it suffers from an important drawback. It assumes that a project's cash inflows are reinvested at the projects IRR. This may actually not be true. It is more reasonable to assume that a project's cash flows are reinvested either at the cost of capital or any other rate at which opportunities of investment are available (which is usually lower than the IRR). With this assumption a modification in IRR is often suggested and this rate is called Modified Internal Rate of Return or MIRR; In this method we first calculate the terminal value of cash inflows at the cost of capital (or some other more realistic rate) and then discount it at a rate which will equalize its value with the present value of initial investment.

The following illustration has the given pattern of cashflows.

<u>Illustration</u> (7.6):-

Year	CFATs
0	- 1200
1	300
2	350
3	450
4	500

Assuming the cost of capital at 10%

The NPV of the proposal

$$NPV = \frac{300}{1.1} + \frac{350}{(1.1)^2} + \frac{450}{(1.1)^3} + \frac{500}{(1.1)^4} - 1200$$

$$= 1241.58 - 1200$$

$$= 41.58$$

Now we calculate NPV at different rates to find its IRR

At 11% the NPV = Rs. 12.76

At 12% the NPV = Rs. - 25.05

$$\text{Hence IRR} = 11 + \frac{12.76}{12.76 + 25.05} = 11 + \frac{12.76}{37.81}$$

$$= 11.34\%$$

The Modified Internal Rate of Return (MIRR) is calculated as follows.

Terminal values of inflows

$$= 300(1.1)^3 + 350(1.1)^2 + 450(1.1) + 500$$

$$= 1817.80$$

Discounted at 10%, its present value is 1241.58

Discounted at 11%, its present value is 1197.44

$$\text{MIRR} = 10 + \frac{41.58}{1241.58 - 1197.44} = 10 + \frac{41.58}{44.14}$$

$$= 10.94\%$$

CAPITAL RATIONING

Capital Rationing is a situation, when there is some ceiling on the availability of funds. This may be externally imposed, e.g. the financial institutions fix a limit of Rs. 10 lacs that can be given for a project or projects, or it may be internally imposed also, e.g. the company has decided to utilize only the internally available funds and the availability of funds is Rs. 5 lac. When capital is rationed, the NPV rule needs modification. This is because, in the absence of Capital Rationing, all the proposals, giving a positive

NPV are acceptable without any limit. When a ceiling of funds is imposed, this cannot be done because we may not be in a position to accept all the acceptable proposals if initial investment amount exceeds the ceiling amount.

Illustration (7.7):- A company is considering the following proposal for which initial investment and PV of inflows has been calculated as follows, and only Rs. 5,00,000 are available for investment.

Project	**Initial Investment (Rs.)**	**Present value of inflows (Rs.)**	**NPV (Rs.)**
J	2,00,000	2,30,000	30,000
K	50,000	70,000	20,000
L	3,00,000	3,33,000	33,000
M	2,50,000	3,00,000	50,000
N	1,00,000	1,05,000	5,000

In the above example all the projects are acceptable because they yield positive NPV. If we calculate funds required for these projects it is Rs. 8 lacs, which is clearly beyond the ceiling. Hence, all of them can not be accepted and, therefore, selection has to be done from the given alternative proposals based on relative profitability.

Since, NPV is not the correct method to judge the profitability, especially when the projects are of unequal size, we have to take the help of a method which can judge the relative profitability of different proposals and rank them accordingly. Both, PI and IRR techniques can be used for the purpose. However, PI is considered a more suitable technique for this purpose because of its closeness to NPV method.

Now, in the above illustration, we will find out the PI of each proposal and rank them accordingly.

Project	Initial Investment	PI	Ranking
J	2,00,000	$\frac{2,30,000}{2,00,000}$ =1.15	III
K	50,000	$\frac{70,000}{50,000}$ =1.40	I
L	3,00,000	$\frac{3,33,000}{3,00,000}$ =1.11	IV
M	2,50,000	$\frac{3,00,000}{2,50,000}$ =1.20	II
N	1,00,000	$\frac{1,05,000}{1,00,000}$ =1.05	V

Now we will start from I and go to the lower ranks till our funds are available. We find that only projects K+M+J (50,000+2,50,000+2,00,000=5,00,000) are adoptable within the existing ceiling and only they will be accepted. Projects L and N even though profitable can not be adopted because of funds' constraint. However, if more funds become available even they can be adopted. The NPV for the adopted projects (K+M+J is Rs. 20,000+50,000+30,000=1,00,000) is the highest and no other combination of projects can give this level of NPV. In this way the objective of value maximisation is also satisfied.

PROJECT SELECTION UNDER CONDITION OF UNCERTAINTY

In the pages above we were discussing and analyzing project selection on basis the of an assumption, that the cash flows that have been estimated are certain. This, however, is not correct. Inspite of the best techniques that may be adopted for estimating cashflows, it is not possible to ensure that the actual cashflows turn out to be exactly, what they were estimated to be. Every project is a future oriented activity and, therefore, uncertainty can not be avoided, inspite of the best efforts on our part.

The uncertainty may be on account of both internal and external conditions. The external conditions are - change in market condition, introduction of another product by a competitor, import liberalisation, change of tastes and fashions, government policy on taxation etc. The internal conditions are breakdown of machinery, labour turnover, internal managerial problems etc. These uncertainties may result in a profitable project to be a loss making one and if this happens, the whole objective of project appraisal is defeated.

How to overcome this problem?

Since uncertainty can not be estimated, we discuss here some methods to create safeguards and reduce the risk in our decision making.

(1) **Conservative Estimates:-** The simplest method is to use conservative estimates. Since initial outflows are fairly certain, the real problem is in estimating future inflows. Here the strategy is to take conservative estimates and make calculations accordingly. For example, in a project, the three persons assigned with making estimates, make following estimates of inflows.

X -------Rs.15,000

Y -------Rs.16,000

Z -------Rs.14,000

In normal course, we take a mean of Rs.15000 and then make our estimates accordingly. While making a conservative estimate, we will take a figure of Rs.14000 only. In this way, we will make conservative estimates for each year and then calculate NPV, IRR, PI; Payback etc. The NPV so calculated will automatically have a safety margin. Some small variations from a normal (mean) estimates will not jeopardize our project and it will continue to be profitable.

(2) **Certainty Equivalent Coefficient: -** Another method to create a safety margin or a cushion is called the certainity equivalent coefficient (CEC) which when multiplied by the given cashflows, gives a certain cash flow. For example, if the estimated cash flows are Rs10,000 and the certainity equivalent coefficient is .8, then this Rs.10,000 worth of cash flow should be treated equivalent to Rs.8,000 only.

The advantage of a certainity equivalent coefficient is that it can be made a scaled one also, e.g. based on time. A cash flow in period 1 may be given a CEC of .95 and a cashflow in period 2 may be giving a CEC of .8 and so on. This will automatically ensure that cashflows in later years have a lower weightage, than the cashflows of earlier years.

Illustration (7.8):-A company wishes to make investment of Rs. 1,00,000 for a 5 year project. The cash flows and certainty equivalent coefficients for different years are as follows:

Year	Cashflow (Rs.)	Certainty Equivalent Coefficient
0	-1,00,000	1.0
1	20,000	0.9

2	30,000	0.8
3	40,000	0.7
4	45,000	0.6
5	25,000	0.5

Find out NPV under normal situation and with certainty equivalent coefficient at 10% rate of discount?

SOLUTION:

$$NPV = \frac{20{,}000 \times 0.9}{1.1} + \frac{30{,}000 \times 0.8}{(1.1)^2} + \frac{40{,}000 \times 0.7}{(1.1)^3} + \frac{45{,}000 \times 0.6}{(1.1)^4} + \frac{25{,}000 \times 0.5}{(1.1)^5} - 1{,}00{,}000$$

=16363.63 + 19834.71 + 21036.81 + 18441.36 + 7761.56 - 1,00,000

= - 16,561.93

Whereas without certainty equivalent coefficient, the NPV is:

$$NPV = \frac{20{,}000}{1.1} + \frac{30{,}000}{(1.1)^2} + \frac{40{,}000}{(1.1)^3} + \frac{45{,}000}{(1.1)^4} + \frac{25{,}000}{} - 1{,}00{,}000$$

$(1.1)^5$

=18181.81 + 24793.39 + 30052.59 + 30735.60 + 15523.13 -

1,00,000

=19286.51

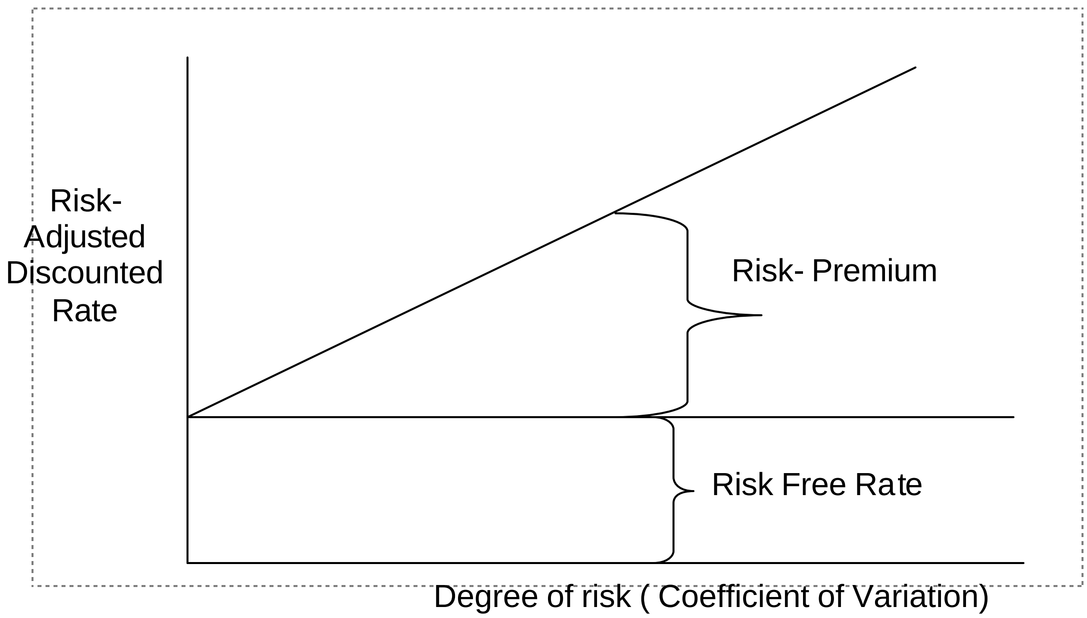
Thus, we find that a project when calculated without considering risk gives a positive NPV becomes a loss making once we incorporate risk into its cashflow estimates. It is better to keep off such projects.

The problem with the above method is that there is no scientific method for calculating certainty equivalent coefficient and it is largely the subjective judgment of person concerned to make such estimation. Using this method is, therefore, fraught with problems.

(3) <u>Risk-adjusted Discount Rate:</u>

In order to create a cushion in our capital budgeting decision, we may use a discount rate which has been adjusted for the riskiness of the project. If a project is risky we use a higher interest rate to discount our cashflows. The reason behind this approach is that a more risky investment should have a higher required rate of returns and this is logically consistent with the shareholders objective of maximizing the returns. Since the investors are inherently risk averse, the risky project should carry a higher required rate as a risk premium. The greater degree of risk, the greater will be the required rate or the discount rate. The relationship between the risk and the required rate/ risk adjusted discount rate has been shown in the following exhibit:

Risk and discount rate



The accept reject rule in case of risk adjusted discount rate is dependent upon which method we use. If we are calculating NPV, then the simple rule is that if NPV calculated at the risk-adjusted discount rate is positive, the project is acceptable. If we are using IRR, then the acceptance rule is that IRR, should be greater than risk adjusted discount rate otherwise the proposal should be rejected. In the illustration given above (under certainty equivalent approach) the NPV at risk free rate (10%) is Rs. 19286.51. Suppose the risk premium is 2% and therefore the risk adjusted discount rate would be 12%. At this rate the NPV value will be-

$$NPV = \frac{20,000}{1.12} + \frac{30,000}{(1.12)^2} + \frac{40,000}{(1.12)^3} + \frac{45,000}{(1.12)^4} + \frac{25,000}{(1.12)^5} - 1,00,000$$

=17857.14 +21353.83 + 28471.78 + 28598.66 + 14186.00 - 1,00,000

= 10,467.41

If the risk is greater, still higher discount rate should be used and even after this higher rate if the NPV is positive the project should be accepted.

In using these methods, it should be ensured that only one of the above methods should be used. E.g. if we are using conservative estimates, we should not used the certainty equivalent coefficient or the risk adjusted discount rate. Similarly in using certainty equivalent approach, neither the conservative estimates be used nor the risk adjusted discount rate should be applied. We should use only a risk free rate of discount. If more than one method is used simultaneously; it will lead to double counting of risk and will lead to wrong conclusions.

The Capital Asset Pricing Model (CAPM) is a scientific method to calculate the risk premium and the risk adjusted discount rate. Although it was initially developed for portfolio analysis, but it can be applied to capital budgeting decision making also. Apart from the above simple methods to incorporate risk in capital budgeting analysis, the other more elaborate and more scientific methods are Sensitivity Analysis, Probability Distribution Analysis and the Decision Tree Approach. A detailed understanding of these methods as well as CAPM analysis can be done from the reference books given at the end of this unit.

CAPITAL BUDGETING IN PRACTICE

Capital budgeting and methods and practices are not exactly the same as have been explained in these pages. They differ quite widely between companies and countries. However, some common tendencies have been identified in different studies and they have been briefly explained in the following lines.

First, let us take the question of generation of investment ideas. It has been generally found that small proposals of cost reduction or replacement or rejuvenation of plant and equipment do originate at the plant level and they go upwards for their approval. The proposals need to be supported by justification for the expenditure in terms of likely benefits from this expenditure. On the basis of this proposal, the top management takes its decision after proper review / vetting at several levels. The proposals for diversification and expansion originate at the top level and are finally accepted or rejected after a due process of appraisal and consultations at various levels.

So far as cash flow estimation is concerned, the practices are not as perfect and scientific as described in the previous pages. The executives often do not have clarity about the concept of cash flows and the principles of estimating cash flows such as taking incremental, after tax cash flows, taking the opportunity cost and ignoring the sunk cost. The need for additional working capital is often ignored.

Another problem with processing cash flows is that it is not easy to give a forecast of next 10 years because the future is uncertain and no body wishes to make estimates for such a long period, lest they go wrong. Although, cash outflows on plant machinery, installation etc. appear to be relatively curtain but in actual practice, big projects often take 2-3 years of time in their completion and time and cost overruns are not uncommon. This makes the job of cashflow forecasting still more difficult. The evaluation of cash flows and their adjustment for time value is again a formidable task, because the rate of discount or weighted average cost of capital can not be easily calculated at the proposal stage itself. In the absence of a given rate of discount the evaluation of cash flows can not be done easily.

Let us now take the method of evaluation. It has been repeatedly pointed out that payback, and ARR are not scientific and NPV, IRR and PI are the best. However, in reality payback and ARR are very commonly used in practice. This is true both in India and abroad.

Payback is used in practice very commonly for several reasons. Firstly, it is simple to understand and easy to calculate. Secondly, it involves estimation of cash flows in first few years only (which it may be possible to do) rather than over the entire life of an asset (which it may not be possible to do because the working life of a machine may be 10-15 years). Thirdly, since the payback is insisting on early recovery of capital, it is automatically taking care of risk factor. It has been found that in small value investments, the decision is invariably on payback basis, while in large investments other more elaborate and scientific methods are used.

ARR is also often used because of several factors. Firstly, people are more accustomed to Income Statement, P& L a/c etc. rather than cashflow statement; Secondly, it may be projected for future on the basis of first few years, whereas NPV calculation needs data for the entire life of an asset including its scarp value at the end. Thus, calculating ARR seems relatively easy, Thirdly it is more appealing to the executives, because the objective of a firm is to increase profit and ARR is a measure of profitability. Moreover, the practice of many financial institutions, requiring the prospective borrowers to give a projected P&L a/c and Balance Sheet for the next few years, has strengthened the need for projected accounting data. Many financial institutions also want a projected 'Return on Capital Employed' (ROCE) for the next few years, as a measure of future profitability.

The scene is however, changing and due importance is being given to the modern techniques, often as supplement to the traditional methods. The financial institutions also now ask for the IRR of the proposed project proposal, before accepting it for further examination. NPV may, then, be calculated on the basis of cost of capital. Infact, instead of relying upon any one method, the practice is to test a proposal from several techniques and then decide accordingly.

Risk consideration in practice is very difficult. One simplest method, as described above is to insist on shorter payback. Other methods are conservative estimates and sensitivity analysis. While the objective of shorter payback and conservative estimates is to create a safety margin or a cushion, in sensitivity analysis, the objective is to see the impact of change of key variables, like the discount rate, output level, price, cost etc. and then take decision accordingly. Risk adjusted discount rate is also used for capital budgeting of risky projects. We must understand that no one method can be taken as perfect in all the situations and adjustment in methodology and key variables may be required to be done in some cases.

Thus, capital budgeting in practice is quite different from the theoretically best methods. This is probably because the real world is much more difficult than we assume it to be while developing a model. The ideal course is to know all the theoretically best methods and then try to apply them as far as possible, and practicable. Use of multiple methods is also a safeguard against excessive reliance on any one method. This is the golden rule.

Activity

1. Visit two public sector corporations and find out their system of appraisal of capital expenditures.

2. Visit two private companies and make an evaluation of capital budgeting systems. Compare it with that of public sector units.

Key Words

Net Present Value: - It is the net present value of investment decision, calculated by present value of cash inflows minus present value of cash outflows. Discounting to be done at the cost of capital.

Profitability Index: - It is the ratio between PV of inflows and PV of outflows. Also called Benefit Cost Ratio (B/C ratio).

Internal Rate of Return :- It is the rate of discount that equalizes the PV of inflows with the PV of outflows.

Conventional Project:- A project where we initially have cash outflows followed by inflows.

Non Conventional Project :-A project where major expenditure has to be done in between the project period or at the end of the project life.

Modified IRR: - It is the ratio of return in which we first find terminal value of cash inflows and then discount it to bring it equal to initial investment. This rate of discount is the MIRR.

Capital Rationing: - A situation when funds are limited and a choice has to be done between different projects.

Uncertainty: -Where the projected cash flows are not certain.

Self Assessment questions

1. What is Net Present Value and how does it change by variation in discount rate.
2. Distinguish between NPV and PI. Which of these you consider better?
3. Calculate, the NPV and PI of the following project proposal.
4. Do you think Modified Internal Rate of Return (MIRR), is a more refined method as compared to IRR?
5. What is Capital Rationing? How Decision making should be done under Capital Rationing?
6. What is a Non-conventional Project and how does it lead to multiple IRRs? Explain with a suitable example.
7. "Capital Budgeting methods in practice are quite different from the theoretical methods". Do you agree?
8. What are the limitations of using the NPV and IRR methods in practice? Give your assessment.
9. Calculate the NPV and PI from the following information:-

(i)	Cost of Machinery	Rs. 1,50,000
(ii)	Cost of Installation	Rs. 30,000

(iii) Life of Machine 6 years

(iv) Working Capital Investment Rs. 20,000

(v) The additional sales revenue generated by this equipment and the additional operating costs are as follows.

Year	Sales Revenue (Rs.)	Operating Expenses (Rs.)
1.	50,000	10,000
2.	60,000	12,000
3.	60,000	12,000
4.	60,000	13,000
5.	70,000	13,000
6.	90,000	15,000

(vi) The cost of capital (discount rate) is 8% and the tax rate 50%.

10. Calculate the IRR and modified IRR from the following cash flows at 10% cost of capital.

Year	CFATs (Rs.)
0	- 90,000

1	20,000
2	25,000
3	27,000
4	30,000
5	35,000

Solutions

Q.No.9

$$\text{Annual Depreciation} = \frac{1,50,000 + 30,000}{6} = 30,000$$

Calculation of CFATs

Year / (Rs.)	1	2	3	4	5	6
Additional Revenue	50,000	60,000	60,000	60,000	70,000	90,000
Additional Expenditure	10,000	12,000	12,000	13,000	13,000	15,000
Depreciation	30,000	30,000	30,000	30,000	30,000	30,000
PBT	10,000	18,000	18,000	17,000	27,000	45,000
Tax	5,000	9,000	9,000	8,500	13,500	22,500
PAT	5,000	9,000	9,000	8,500	13,500	22,500
CFATs	**35,000**	**39,000**	**39,000**	**38,500**	**43,500**	**52,500**

35,000 39,000 39,000 38,500 43,500 52,500

$$NPV = \frac{\quad}{1.08} + \frac{\quad}{(1.08)^2} + \frac{\quad}{(1.08)^3} + \frac{\quad}{(1.08)^4} + \frac{\quad}{(1.08)^5} + \frac{\quad}{(1.08)^6}$$

$$+ \frac{20,000}{(1.08)^6} - (1,50,000 + 30,000 + 20,000)$$

=32407.41 + 33436.21 + 30959.75 + 31973.54 + 28925.34 +

33083.37 + 12603.19 - 2,00,000

= 2,03,388.80 - 2,00,000

= **3,388.80**

$$\textbf{P.I} = \frac{2,03,388.80}{2,00,000} = \textbf{1.017}$$

Q. No. 10.

$$\text{NPV at 14\%} = \frac{20,000}{1.14} + \frac{25,000}{(1.14)^2} + \frac{27,000}{(1.14)^3} + \frac{30,000}{(1.14)^4} + \frac{35,000}{(1.14)^5} - 90,000$$

= 17,543.86 + 19,236.69 + 18,244.77 + 17,763.04

+ 18,177.09 - 90,000

= 945.46

$$\text{NPV at 15\%} = \frac{20,000}{1.15} + \frac{25,000}{(1.15)^2} + \frac{27,000}{(1.15)^3} + \frac{30,000}{(1.15)^4} + \frac{35,000}{(1.15)^5}$$

= 17,391.30 + 18,903.59 + 17.752.65 + 17,152.66

+ 17,400 - 90,000

= - 1,399.00

$$\textbf{IRR} = 14 + \frac{945.46}{2{,}344.45} = 14.40\ \%$$

Terminal value of cash inflows at 10% = $20{,}000(1.1)^4 + 25{,}000(1.1)^3 + 27{,}000(1.1)^2 + 30{,}000(1.1) + 35{,}000$

= 1,63,227

P V of 1,63,227 at 12% = 92,621.57

P V of 1,63,227 at 13% = 88,594.77

$$\text{Rate of discount} = 12 + \frac{2{,}621.57}{4{,}026.8} = 12.65\%$$

MIRR = 12.65%

References (Units 6-7)

1. Financial Management and Policy by James C. Van Horne – Prentice Hall of India.
2. Financial Management by I. M. Pandey – Vikas Publishing House Pvt. Ltd.
3. Financial Management by Prasanna Chandra- Tata McGraw Hill.
4. Financial Management by P.V. Kulkarni and B. G. Satyaprasad – Himalaya Publishing House.

5. Financial Management- Text and Problems by Khan and Jain. Tata McGraw Hill.
6. Financial Decision Making- Concepts, Problems and Cases by John J. Hampton- Prentice Hall of India.
7. Project Management by K. Nagarajan- New Age International (P) Ltd. Publishers.