
UNIT 13 CAPITAL BUDGETING TECHNIQUES

13.1 Introduction

13.2 Objectives

13.3 Project Valuation

13.4 Capital Budgeting Techniques

13.5 Non Discounted Techniques

13.6 Discounted Techniques

13.7 Other Factors to be considered while making Capital Budgeting Decisions

13.8 Summary

13.9 Glossary

13.10 Answer to Check Your Progress

13.11 Reference/ Bibliography

13.12 Suggested Readings

13.13 Terminal & Model Questions

13.1 INTRODUCTION

In the previous units you learnt about the concept and importance of capital budgeting decisions. This unit basically discusses about the various techniques that will help you in valuing various project proposals. Through these techniques you would be able to know that whether an investment is worth taking or not. Since, it is essential for the company to optimally utilise its resources therefore for expansion, diversification, modernisation, it is apt for the company to make critical and in-depth analysis of various alternatives available and then to choose the best among them. Hence, the main objective behind project appraisal is to maximize shareholder's wealth and thereby establishing goodwill of the company.

13.2 OBJECTIVES

After reading this unit you will be able to:

- Understand the various techniques for appraising projects.
- Apply discounted and non discounted techniques for appraising projects.
- Evaluate and rank various investment proposals.

13.3 PROJECT VALUATION

To assess the project proposals that are *prima facie* feasible and profitable, the valuation analysis is carried. The valuation analysis is based on the present data and on the basis of the projections of the returns that project may yield in the distant future. In this unit, you would learn to value projects on the basis of various techniques and hence you will be able to assess that which project is worth taking or not. Thus, these techniques will help in assessing whether the project is financially desirable or not. Before making investment in any project, it is imperative to estimate the expected returns from the project in comparison with the cash outlays. This requires that the project should be assessed and judged on the basis of cash flows expected from the project and the investment made by the firm or a company. These cash flows are assessed on the basis of investment criteria which are classified into two broad categories discounted and non-discounted.

Further, for the purposes of this unit, projects can be divided into two categories:

1. Expansion projects are the projects where companies invest in to expand their business's earnings. This could be into new products or new geographical regions or could be expansion using existing products or markets,
2. Replacement projects are the projects where companies invest in to replace old assets and maintain efficiencies. Replacement projects are taken for replacing old or damaged projects or even for undertaking projects for lowering costs.

13.4 CAPITAL BUDGETING TECHNIQUES

The evaluation of a project is carried out basically on three main dimensions, these are; a) Net Investment b) The Expected Cash Inflows c) The time period in which these benefits shall accrue. Further, there are various techniques of project evaluation and selections which are broadly categorized into discounted and non-discounted. DCF techniques are applied to discount the anticipated returns to a common ground using their present value (PV).

Non-discounted Cash Flow Criteria

- a) Payback Period
- b) Accounting Rate of Return

Discounted Cash Flow Criteria

- c) Net Present Value
- d) Internal Rate of Return
- e) Profitability Index
- f) Discounted Payback

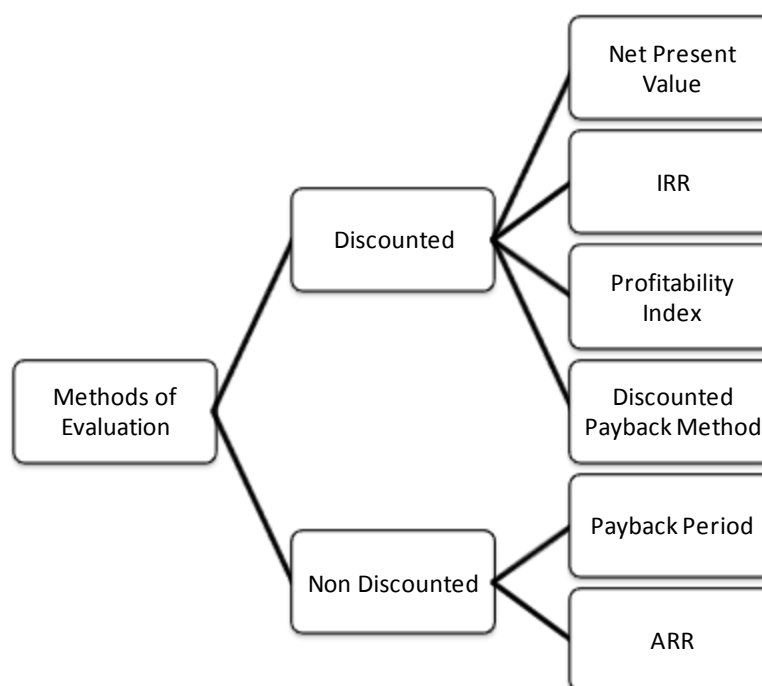


Fig 13.1 Techniques of Capital Budgeting

13.5 NON DISCOUNTED TECHNIQUES

The following are the capital budgeting techniques;

13.5.1 PAY BACK PERIOD METHOD

Payback period is the first screening method generally opted for selection of the project. Payback period is the number of years required to recover the funds from the cash inflows. Payback Period assesses the time period in which the initial cash flow is returned by the project. It is generally expressed in the years. At payback period cash inflows shall match the cash outflows. When two or more projects are compared than, the project with lower payback period is preferred. Further, the Payback as a decision rule for selecting the project from the various alternatives shall require an appropriate cutoff period to be decided by the company.

$$\text{Payback period} = \frac{\text{Initial Investment}}{\text{Constant Cash Flows}}$$

Calculation of Payback period when annual inflows are equal

For example a project requires an initial investment of Rs 15, 00,000 and is projected that the project shall generate cash inflows of Rs 5, 00,000 per year. For calculating payback period, the amount of initial investment shall be divided by cash inflows, therefore in the above example; the payback period shall be 3 years.

Calculation of Payback period when annual inflows are unequal

Illustration 1: Company Sunshine ltd. has to choose a project between Project X and Y. The initial investment for both the project is Rs 10, 00,000; however the following cash inflows are expected from the projects;

Year	1	2	3	4	5	6
Project X	2,60,000	1,00,000	4,40,000	2,00,000	2,00,000	1,00,000
Project Y	3,20,000	2,80,000	1,00,000	1,00,000	3,00,000	1,00,000

Solution:

In the above example, the payback for Project X shall be 4 years as the sum of cash inflows of first 4 years shall be 2,60,000+1,00,000+4,40,000 + 2,00,000. For Project Y, the payback shall be computed using the following formula;

$$\text{Payback} = \text{Number of years to before the full recovery} + \frac{\text{Unrecovered amount}}{\text{Cash flow during the year}} \times 12$$

$$\text{Payback} = 4 + \frac{2,00,000}{3,00,000} \times 12 = 4 + 8 = 4 \text{ years and 8 months}$$

Thus, in the above example, Project X shall be accepted by the company as payback period is less in case of project Y. Thus, it will return back the initial investment lesser duration as compared to project Y.

Advantages

1. It is simple and easy in terms of concept and application.
2. It helps in accepting only those projects which generates substantial cash flows in the initial years.
3. It helps in taking decision on the basis of liquidity of a firm.
4. Payback period is also considered as an indicator of risk as the project generating substantial cash flows in the initial years shall be generally considered as less risky as compared to the projects generating cash flows in the later years.

Disadvantages

1. It does not consider time value of money.
2. It ignores cash flows that accrue after the payback period.
3. It focuses more on liquidity than of profitability.
4. It does not consider the salvage value of an investment.

5. It does not state the overall liquidity position of a firm.

13.5.1.1 Payback Reciprocal Method

The other way of representing payback is Payback Reciprocal Method which is expressed as

$$\text{Payback period Reciprocal} = \frac{1}{\text{Payback period}} \times 100$$

Therefore, if a project has a payback period of 5 years, then the payback reciprocal period shall be 20%. This can be compared with the other projects and the project with the highest payback reciprocal shall be accepted.

13.5.2 ACCOUNTING RATE OF RETURN METHOD

Accounting Rate of Return (ARR) is the profitability of the project it shall be calculated as projected total net income divided by initial or average investment. It is also termed as average rate of return on investment, return on investment and return on capital employed. As a decision rule, the Accounting Rate of Return is compared with the ARR of the other projects and that of Industry. "ARR depicts increment in the profits due to investments by taking into account accounting profit arising from the investment as a percentage of that capital investment". (Ravi Kishore) It is method in which profitability is matched against the sum invested.

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

$$\text{ARR} = \frac{\text{Average Profit after Tax}}{\text{Average book value of the investment}}$$

$$\text{Accounting Rate of Return} = \frac{\text{Average Annual Profit after Tax}}{\text{Average or Initial Investment}} \times 100$$

$$\text{Average Investment} = \frac{\text{Initial Investment} + \text{Salvage Value}}{2}$$

Advantages

1. It is simple and easy in terms of concept and application.
2. Returns across the life of a project are assessed for this method therefore serves as a measure of profitability.
3. For achieving higher profitability, this method may be opted for evaluation.

Disadvantages

1. This method does not consider time value of money.
2. Accounting Rate of Return considers accounting profit and not cash flows; hence it cannot be used as reliable valuation method.
3. ARR is compared with some benchmark or some standard and this standard is many times arbitrarily fixed on the basis of past performances or industry's average rate of return thus ARR can give dubious results in such cases.

Illustration -2

Company Excel Ltd is considering a new project for which the following data are given;

(Rs.)

Details/Year	0	1	2	3	4
Investment	2,00,000				
Sales Revenue		60,000	90,000	80,000	1,00,000
Operating Expenses		30,000	20,000	40,000	50,000
Depreciation		10,000	10,000	10,000	10,000
Annual Income		50,000	40,000	40,000	50,000

Using the above data, let us calculate Accounting Rate of Return.

Solution:

In the above case, Average Annual Income shall be $50,000 + 40,000 + 40,000 + 50,000 / 4 = 45,000$

Further, Average Net Book value of Investment shall be $2,00,000 / 2 = 1,00,000$. Therefore, Accounting Rate of Return shall be $45,000 / 1,00,000 \times 100 = 45\%$. Excel Ltd. shall accept the project, if the benchmark or standard rate is less than 45%.



Check Your Progress-A

Q1. Name the various capital budgeting techniques.

Q2. 'Payback Period is a method for assessing liquidity and not profitability'. Comment

Q3. How do you calculate Accounting Rate of Return?

Q4. Fill in the blanks using appropriate word or words.

- a) _____ techniques should be capable enough for ranking various investment alternatives.
- b) _____ is the number of years required to recover the funds from the cash inflows.
- c) _____ is also termed as average rate of return on investment, return on investment and return on capital employed.
- d) _____ are projects companies invest in to expand the business's earnings.

13.6 DISCOUNTED TECHNIQUES

The following are discounted techniques of capital budgeting;

13.6.1 NET PRESENT VALUE METHOD (NPV)

Net Present Value (NPV) is equal to sum of discounted cash inflows minus initial cash outflow. It adheres to the rule that a rupee earned today has more worth than a rupee earned after one or more years. The present values of future cash flows of a project are deducted from the initial investment to compute Net Present Value. Higher NPV is preferred and an investment is only viable if its NPV is positive.

A project will be accepted if the NPV is positive and the projects with the negative NPV shall be rejected. In case of project where NPV is exactly equal to zero then the company can be indifferent in accepting or rejecting such projects. The project with positive NPV contributes in magnifying net wealth of shareholders. While assessing mutually exclusive projects, project with higher NPV shall be selected.

Net Present Value = Present value of Cash Inflows - Initial Investment

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

$$NPV = \frac{C_1}{(1+r)^1} + \frac{C_2}{(1+r)^2} + \frac{C_3}{(1+r)^3} + \dots + \frac{C_n}{(1+r)^n} - C_0$$

Advantages

1. It recognizes the time value of money.
2. It considers cash inflows and outflows throughout the life of a project.
3. Maximizing NPV support the objective of investment decision making that is maximization of shareholder's wealth.

Disadvantages

1. Calculation of NPV is at times difficult for non financial executives.
2. It is also difficult in estimating the discount rate.
3. NPV may give ambiguous results in case of mutually exclusive projects or projects with unequal lives.
4. It is expressed in absolute terms; hence it does not factor in the scale in investment.

Properties of NPV

1. Net Present Value of different projects can be added. For example NPV of Project X can be added with the NPV of project Y, therefore as per value additivity principle, **(Pandey I.M)** NPV of both the projects i.e. NPV (Project X and Project Y) shall be equal to NPV of Project X + NPV of Project Y
2. The cash flows that occur between the initial investment and end of the project get reinvested at the discount rate.
3. NPV can be calculated when there are changes in the discount rate from one period to another.

Hence, if a company invests in the proposal with negative NPV or 0 NPV then the proposal shall not contribute to the shareholder's wealth. Accordingly, NPV Technique recognizes the net contribution of a project to the shareholder's wealth maximization.

Illustration-3

To illustrate the computation of NPV, consider a company Indian Star Ltd. which is comparing the two Project Alternatives A and B and the company is in dilemma regarding the acceptance of any one project. They wanted to finalise the project alternative using net present value of the two projects. The discount rate of the company is 10%.

	Project A	Project B
Initial Investment	30,000	40,000
Estimated Life	5 Years	5 Years

The Profits before Depreciation and After Taxes (Cash flows) are as follows;

Years	1	2	3	4	5
Project A	Rs. 7,000	Rs. 12,000	Rs. 12,000	Rs. 5,000	Rs. 4,000
Project B	Rs.22,000	Rs.12,000	Rs. 7,000	Rs. 5,000	Rs. 4,000

Solution:

The net present value for Project X can be calculated by using present value table (Annexed at the end of the last block).

$$NPV_A = \frac{Rs7,000}{(1+.10)^1} + \frac{Rs12,000}{(1+.10)^2} + \frac{Rs12,000}{(1+.10)^3} + \frac{Rs5,000}{(1+.10)^4} + \frac{Rs4,000}{(1+.10)^5} - Rs. 30,000$$

$$NPV_B = \frac{Rs22,000}{(1+.10)^1} + \frac{Rs12,000}{(1+.10)^2} + \frac{Rs7,000}{(1+.10)^3} + \frac{Rs5,000}{(1+.10)^4} + \frac{Rs4,000}{(1+.10)^5} - Rs. 40,000$$

$$NPV_A = Rs7,000(PVF_{1,.10}) + Rs12,000(PVF_{2,.10}) + Rs12,000(PVF_{3,.10}) + Rs5,000(PVF_{4,.10}) + Rs4,000(PVF_{5,.10})$$

$$NPV_B = Rs22,000(PVF_{1,.10}) + Rs12,000(PVF_{2,.10}) + Rs7,000(PVF_{3,.10}) + Rs5,000(PVF_{4,.10}) + Rs4,000(PVF_{5,.10})$$

$$NPV_A = Rs7,000 \times .909 + Rs12,000 \times .826 + Rs12,000 \times .751 + Rs5,000 \times .683 + Rs4,000 \times .621 - Rs.30,000 = 6363 + 9912 + 9012 + 3415 + 2484 - 30,000 = Rs.31186 - Rs30,000 = Rs.1,186$$

$$NPV_B = Rs22,000 \times .909 + Rs12,000 \times .826 + Rs7,000 \times .751 + Rs5,000 \times .683 + Rs4,000 \times .621 - Rs40,000 = 19998 + 9912 + 5257 + 3415 + 2484 - Rs40,000 = Rs.41066 - Rs40,000 = Rs.1,066$$

Project A's Net Present Value of Cash Inflows is greater than the Net Present Value of Project B therefore, Project A shall add more wealth to the shareholders, hence Project A should be accepted.

13.6.2 INTERNAL RATE OF RETURN

Internal Rate of Return (IRR) is the discount rate at which net present value of the project becomes zero. It is the discount rate which equates the present value of cash flows with the initial cash outlays or outflows. Under IRR, discounting rate that makes NPV zero shall be found out. If the IRR of a project is greater than its opportunity cost of capital then such projects are accepted, that means if r is greater than k ($r > k$), then such projects are accepted and if IRR of a project is lower than its opportunity cost of capital then such projects shall be rejected. Further, if the IRR is equal to the opportunity cost of capital then firm may be indifferent to such projects. Such projects may be accepted depending upon the willingness of the top level management.

Advantages

1. It recognizes time value of money.
2. It also considers all the cash inflows and outflows that occur in the life of a project.
3. It also supports the objective of investment decision making that is maximization of shareholder's wealth.

Disadvantages

1. In case of mutually exclusive projects, IRR may give dubious results.
2. Value additivity principle is not applicable in case of IRR.
3. IRR ignores benefit of economies of scale.
4. Without calculating cost of capital, the profitability capability of any project can be assessed.
5. In case of non-normal cash flow, problem of multiple IRRs may result.
6. It is very difficult to calculate because it requires tedious calculations.

When cash flows are equal

A company is evaluating a project proposal costing Rs. 2,00,000. The annual cash inflows are expected to be Rs 50,000. To calculate the IRR for equal cash flows, first of all an approximation shall be made with reference to payback period. In the above example it shall be 4 years, and then you have to find the value nearest 4 in the 6th year row of the PVAF table. The nearest figure to 4 are given in 12% (4.111) and the 13% (3.998). Thus IRR will lie between 12% and 13%. The NPV shall be calculated using both the rates;

NPV using 12% = $(50000 \times 4.111) - 2,00,000 = 5550$

NPV using 13% = $(50,000 \times 3.998) - 2,00,000 = -100$

The rate shall be computed at which NPV shall be zero which will lie in between of 12 % and 13%. At 12%, the NPV is Rs 5550 which is positive and NPV at 13% shall be (-Rs.100), therefore the following formula shall be used for computation;

$$\text{IRR} = \text{Lower Discount Rate} + \frac{\text{NPV at Lower discount rate}}{\text{NPV at Lower discount rate} + \text{NPV at the Higher discount rate}} (\text{Higher Discount Rate} - \text{Lower Discount Rate})$$

$$= 12\% + \frac{5550}{5550} \times (13-12) = 12.98\%$$

Note: *You need to ignore negative sign while adding NPV at the Higher discount rate to the NPV at the Lower discount rate. Else you can write as NPV at Lower discount rate – (– NPV at the Higher discount rate)

When cash flows are unequal

The initial outlay for the project is Rs 2, 00,000 and project is expected to generate cash flows of Rs 60,000, Rs 80,000, Rs 70,000 and Rs 60,000 in next four years respectively. First of all weighted average of cash flows shall be computed

Year	Cash Inflow	Weights	Cash Inflows X Weights
1	60,000	4	240000
2	80,000	3	240000
3	70,000	2	140000
4	60,000	1	60000
		10	6,80,000

Weights shall be given in reverse order

Weighted Average = 680000/10 = Rs 68000 Now, calculate payback period using weighted average cash flows

The payback period using weighted average shall be 2,00,000/68000=2.9411

On the basis of the above, an approximation shall be made with reference to payback period. You have to find the value nearest 2.9411 in the PVAF table. The nearest figure to 2.9411 are given in 13% (2.974) and the 14% (2.914). Thus IRR will lie between 13% and 14%. The NPV shall be calculated using both the rates

Year	Cash Inflow	PV of cash inflows using 13%	PV of cash inflows using 14%
1	60,000	=60000x.885	=60000x.877

2	80,000	=80,000x.783	=80,000x.769
3	70,000	=70,000x.693	=70,000x.675
4	60,000	=60,000X.613	=60,000X.592

NPV at 13%=1030

NPV at 14%=(-)3090

As of above, the IRR shall be computed using interpolation

IRR= Lower Discount Rate+ $\frac{NPV \text{ at Lower discount rate}}{NPV \text{ at Lower discount rate} + NPV \text{ at the Higher discount rate}}$ (Higher Discount Rate-Lower Discount Rate)

$$= 14\% + \frac{1030}{4120} \times (14-13) = 14.25\%$$

13.6.2.1 Modified Internal Rate of Return

MIRR is a concept which assumes that the reinvestment of intermittent cash flow would occur at a rate equivalent to cost of capital of the firm (instead at a rate equivalent to IRR, according to implicit assumption of IRR). It assumes that all intervening cash inflows that occur during the life of a project are reinvested at a rate equal to the required rate of return for the rest of the life of a project. The total cumulative values of all cash inflows are the n discounted back to be equal to the present value of all cash outflows. The rate of discount which makes Present value of cash inflows equal to present value of total cumulative cash inflows is termed as MIRR(Rustagi, 2011).. Hence MIRR can be calculated as;

$$= \text{Cumulative Terminal Value of all Inflows} / (1 + \text{MIRR})^n$$

$$\text{Or } = \sum_{i=0}^n \frac{COF_i}{(1+k)^i} = \sum_{i=1}^n \frac{\text{Cash Inflows}_i (1+k)^{n-i}}{(1+\text{MIRR})^n}$$

COF= Cash outflow in i^{th} year

k= required Rate of return

n=Life of the project

MIRR=Modified Internal Rate of Return

The projects where MIRR is greater or equal to minimum acceptable rate of return then such projects shall be accepted and the projects less than minimum acceptable rate of return shall be rejected.

13.6.3 PROFITABILITY INDEX

Profitability Index is a technique which is an extension of Net Present Value Method. It is also known as Benefit Cost Ratio or Present value Index.

In this method present value of cash inflows are divided by initial investment or cash outlays.

$$\text{Profitability Index (PI)} = \frac{\text{Present Value of cash inflows}}{\text{Initial Investment or Initial cash outlays}}$$

$$= \sum_{t=1}^n \frac{C_t}{(1+k)^t} \div C_0$$

The project having Profitability Index greater than one shall be accepted whereas project with PI less than 1 shall be rejected. Further, the projects with PI equal to 1 may be accepted or rejected depending upon other factors influencing capital budgeting decisions. In case of mutually exclusive projects, projects with highest profitability index shall be accepted.

Advantages

1. It considers time value of money while evaluating projects
2. It matches with the core objective of shareholder wealth maximization.
3. It is a reactive assessment of profitability of a project.

Disadvantages

1. In some situations NPV and PI may give contradictory decisions.
2. This method cannot be used for the projects which require initial investment for more than one year.
3. Estimation of discount rate is difficult for NPV as well as for Profitability Index method.

Taking the example of Company Indian Star Ltd., the Profitability Index of Project A and Project B shall be computed as below;

$$\text{Profitability Index of Project A} = \frac{Rs7,000}{(1+.10)^1} + \frac{Rs12,000}{(1+.10)^2} + \frac{Rs12,000}{(1+.10)^3} + \frac{Rs5,000}{(1+.10)^4} + \frac{Rs4,000}{(1+.10)^5} \div Rs. 30,000$$

$$\text{Profitability Index of Project B} = \frac{Rs22,000}{(1+.10)^1} + \frac{Rs12,000}{(1+.10)^2} + \frac{Rs7,000}{(1+.10)^3} + \frac{Rs5,000}{(1+.10)^4} + \frac{Rs4,000}{(1+.10)^5} \div Rs. 40,000$$

$$\begin{aligned} \text{PI}_A = & Rs7,000 \times .909 + Rs12,000 \times .826 + Rs12,000 \times .751 + Rs5,000 \times .683 + \\ & Rs4,000 \times .621 \div Rs. 30,000 = 6363 + 9912 + 9012 + 3415 + 2484 \div 30,000 = 1.04 \end{aligned}$$

$$PI_B = \frac{Rs22,000 \times .909 + Rs12,000 \times .826 + Rs7,000 \times .751 + Rs5,000 \times .683 + Rs4,000 \times .621}{Rs40,000} = \frac{19998 + 9912 + 5257 + 3415 + 2484}{Rs40,000} = \frac{Rs.41066}{Rs40,000} = 1.03$$

As per the acceptance rule of PI, both the projects yield profitability index greater than one. Therefore, as per the rule both the projects may be accepted. However, Project A's Profitability Index is slightly greater than Profitability Index of Project B. Therefore, keeping all other factors as constant, project A can be accepted.

13.6.4 DISCOUNTED PAYBACK METHOD

Discounted Payback Method considers time value of money while calculating payback period. In this method all cash flows are first discounted using present values. These present values are then compared with initial investment in order to assess till which year initial investment shall be recovered. This method takes into account main drawback of payback period, however it does not take into account those cash inflows that occur after the payback period.

In the above example as of Company Indian Star Ltd., if the decision is based on discounted payback period, then the following steps may be used for selecting the project;

Discounted Payback of Project A =

Present Value in Year 1 $Rs7,000 \times .909 = 6363$

Present Value in Year 2 $Rs12,000 \times .826 = 9912$

Present Value in Year 3 $Rs12,000 \times .751 = 9012$

Present Value in Year 4 $Rs5,000 \times .683 = 3415$ and

Present Value in Year 5 $Rs4,000 \times .621 = 2484$

$$DPB_A = 4 \text{ Years} + \frac{1298}{2484} \times 12 = 4 + 6.2 = 4 \text{ years and 6 months}$$

Discounted Payback of Project B =

Present Value in Year 1 $Rs22,000 \times .909 = 19998$

Present Value in Year 2 $Rs12,000 \times .826 = 9912$

Present Value in Year 3 $Rs7,000 \times .751 = 5257$

Present Value in Year 4 $Rs5,000 \times .683 = 3415$ and

Present Value in Year 5 $Rs4,000 \times .621 = 2484$

$$DPB_B = 4 \text{ Years} + \frac{1418}{2484} \times 12 = 4 + 6.8 = 4 \text{ years and 7 months}$$

As per discounted payback also, Project A shall yield initial investment little early than Project B.

In general, NPV and IRR are mostly opted criteria for evaluating projects. They are closely related to each other and both consider time value of money. But under certain situations they may also give conflicting results. In case of projects which are conventional in nature that is the cash outflows are negative and all cash inflows are positive, NPV and IRR shall give same accept or reject decisions particularly if they are economically independent. However, in case of non conventional investments cash outflows are mingled in the cash inflows throughout the span of the Project. **(Pandey I.M)** Projects with positive net present value would have higher IRR than the required rate of return.

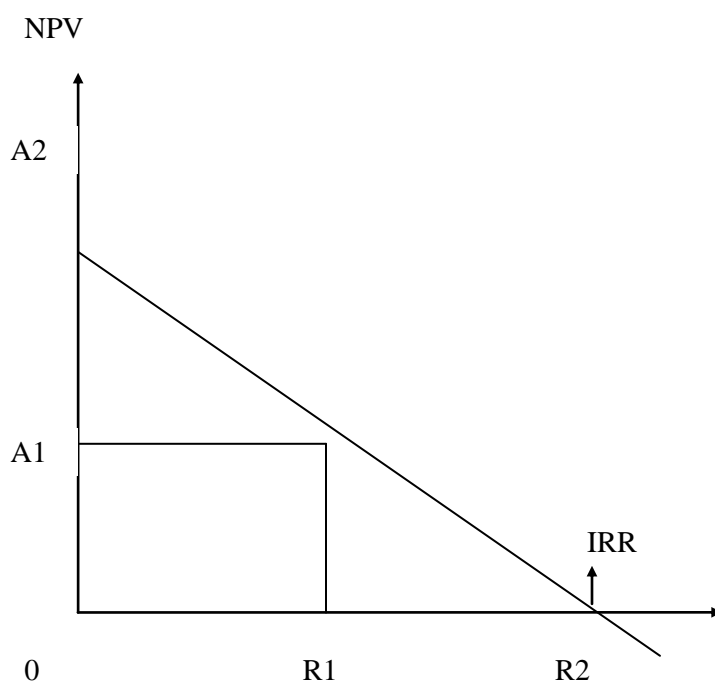


Fig-13.2 IRR

In the above figure-11.2 , at A2 NPV of the project is highest at zero discount rate which is difference between cash inflows and outflows. At R2 discount rate, NPV is zero and R2 is Internal Rate of Return

Further, the NPV and IRR will give conflicting ranking to the projects under the following conditions;

- a) There is a difference in the cash flow pattern of the project. The cash flow of one project may increase over time and cash inflows of the other may decrease or vice versa.

- b) There is a difference in initial investment.
- c) There is a difference in the expected life of projects.



Check Your Progress-B

Q1. Differentiate between Net Present Value and Profitability Index.

Q2. What are the advantages and disadvantages of Internal Rate of Return?

Q3. Fill in the Blanks with appropriate word or words.

- a) _____ is the profitability of the project calculated as projected total net income divided by initial or average investment.
- b) Net present value of different projects can be _____.
- c) _____ is a concept which assumes that the reinvestment of intermittent cash flow would occur at a rate equivalent to cost of capital of the firm.

Q4. While evaluating two or more projects, project giving a _____ Profitability Index would be preferred.

- a) More than one
- b) Less than one
- c) Equal to one
- d) Equal to payback period

Q5. Which of the following is the discount rate at which net present value of the project becomes zero?

- a) Internal Rate of Return (IRR)

- b) Discount Rate
- c) Cost of Capital
- d) Profitability Index

13.7 OTHER FACTORS TO BE CONSIDERED WHILE MAKING CAPITAL BUDGETING DECISIONS

Capital Rationing

It is a situation in which company has a limited funds and a limit is placed upon the capital expenditures during a particular period. Capital rationing refers to the selection of project proposal in a situation where constraint has been levied on the funds either external or self imposed and hence firm find it difficult to opt for the projects that yields positive NPV or projects which are acceptable as per other discounted and non discounted techniques. Kishore (2009) defines capital rationing as selection of investment proposals in a situation of constraints on availability of capital funds to maximize the wealth of the company by selecting those projects which will maximize overall NPV of the Concern. Here, decision maker have to opt for any one project and remaining projects may be viable are rejected. Capital rationing may arise due to external factors when there are imperfections in the market or market information is not available regarding availability of capital. It may also arise if government has imposed some restrictions. Further, in case of internal factors, company is not interested to raise additional funds from debt or equity. It is also possible if Management of the company has fixed some arbitrarily limit as they cannot managed increased scale of operations and the likes. In such a situation, profitability index is adopted to rank the projects and choosing the optimal combination or the best project. However, PI may fail to give results in case of multi-period constraints and project indivisibility.

Mutually Exclusive Projects

Mutually exclusive projects refer to a set of projects, from which only a single project can be accepted for implementation by a company or organization. Mutually exclusive projects are also assumed to be designed to fulfill the same task, and accordingly choosing one affects the cash availability for other projects. In mutually exclusive projects, best project is accepted; however, in some cases NPV and IRR give conflicting results. The conflict either arises due to the relative size of the project or due to the different cash flow distribution of the projects

Risk Adjustment

A project also faces risk and therefore it should also be adjusted while valuing projects. Risk arises in the investment evaluation as it is difficult to predict about the future.

It may be adjusted with the following techniques;

a) Expected Net Present value-The expected net present value may be calculated by multiplying the cash flows by their probabilities. It adjusts for uncertainty by calculating NPVs under different scenarios and probability-weighting them to get the most likely NPV.

Expected Net Present value= Sum of Present Value of expected net cash flows

b) Risk Adjusted Discount Rate- Risk adjusted discount rate is a blend of time preference and risk preference. It is equal to Risk Free rate plus Risk premium. Accordingly, the discounted techniques shall be calculated as narrated above using the adjusted discount rate.

c) Certainty Equivalent- The Certainty Equivalent (CE) method adopts the concept of utility theory. In this approach, the decision maker must first evaluate a cash flow's risk and then specify how much money, to be received with certainty, it will make him or her indifferent between the riskless and the risky cash flows. The certainty equivalent coefficient shall be determined as under;

$$\alpha = \frac{\text{Certain Net Cash Flows}}{\text{Risky Net Cash Flow}}$$

NPV shall accommodate certainty equivalent coefficient in computation;

$$NPV = \sum_{t=0}^n \frac{\alpha_t NCF_t}{(1+k_f)^t} - C_0$$

Where,

NCF= Projections of net cash flows without risk adjustment

α_t = Certainty equivalent coefficient

k_f =Risk free rate assumed to be constant

13.8 SUMMARY

In this unit, you learnt how techniques of capital budgeting are important for project selection, expansion and replacement decisions. You also learned that it is important for a company to evaluate proposed project accurately using various methods and techniques. You also came to know about how to estimate cash flows for a project which is again an important step in evaluating project proposals. In the next unit, you will be studying about issues in Capital Budgeting Capital Rationing, Decision Tree, Stimulation, Sensitivity Analysis and CAPM methods.

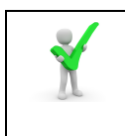


13.9 GLOSSARY

Payback period is the number of years required to recover the funds from the cash inflows.

Accounting Rate of Return (ARR) is the profitability of the project calculated as projected total net income divided by initial or average investment.

Initial Investment is the cash outflows at the time of establishment of a project.



13.10 ANSWERS TO CHECK YOUR PROGRESS

Check Your Progress –A

Q4. Fill in the blanks using appropriate word or words.

- a) Capital budgeting
- b) Payback period
- c) Accounting Rate of Return.
- d) Expansion projects

Check Your Progress –B

Q3. Fill in the Blanks with appropriate word or words.

- a) Accounting Rate of Return (ARR)
- b) added.
- c) MIRR

Q4. Ans-a

Q5 . Ans-a



13.11 REFERENCES

- Kishore Ravi M.(2009), “Chapter 12 Capital Budgeting Techniques” in Financial Management, Seventh Edition, Taxmann Publication (p) Ltd., pp 363-396

- Khan, M.Y. and Jain, P.K. (1992), “Chapter 10 Capital Budgeting I : Principles and Techniques” in Financial Management Text and Problems. New Delhi: Tata McGraw Hill Publishing Company Limited. pp 10.3-10.63
- Pandey, I.M. (2010), “Chapter 8 Capital Budgeting Decisions” in Financial Management, Tenth Edition, Vikas Publishing House Pvt. Ltd., New Delhi, pp 141-165
- Rustagi R.P. (2011), “Chapter 7 Capital Budgeting: Techniques of Evaluation” in Financial Management- Theory, Concepts and Problems, Fifth Revised Edition, Taxmann Publications (P) Ltd. pp 204-255
- Sristava Rajiv and Mishra Anil (2016) “Chapter 11 Capital budgeting-I, Financial Management, Oxford University Press, New Delhi, pp269-295
- Van Horne, James C. and Wachowicz, John M. Jr (2009), Chapter 13vCapital budgeting Techniques”, Fundamentals of Financial Management, 13th edition, Pearson Education Limited, pp 323-350

Web Linked Referred

- NPV, Open Textbook for HongKong, Available under Creative Commons-ShareAlike 4.0 International License, retrieved from <http://www.opentextbooks.org.hk/ditatopic/15785>, last accessed 10/2/2020
- Kulatilaka Nalin and Marcus Alan J., Project Valuation Under Uncertainty: When Does DCF Fail?, Retrieved from <http://onlinelibrary.wiley.com/doi/10.1111/j.1745-6622.1992.tb00229.x/full>, last accessed 10/2/2020
- http://www.prd.uth.gr/uploads/discussion_papers/2003/uth-prd-dp-2003-17_en.pdf
- NPV vs IRR, Retrieved from <http://accountingexplained.com/managerial/capital-budgeting/npv-vs-irr> last accessed 10/2/2020
- What Are Mutually Exclusive Projects?, Retrieved from <https://www.reference.com/business-finance/mutually-exclusive-projects-99ecf7953eeb15a8>, last accessed 10/2/2020
- <http://elearning.linnbenton.edu/mod/resource/view.php?id=237807>



13.12 SUGGESTED READINGS

1. “Prasanna Chandra”, Projects-Planning Analysis, Selection, Financing, Implementation and Review, 6th edition, 2006.
2. “Gopalakrishnan”, Project Management, TMH, 2007.

3. "H.R.Machiraju", Introduction to Project Finance, Vikas Publications, 2005.
4. "Bhaves M.Patel", Project Management, Vikas Publication, 2007.
5. "Samuel J.Montel, Jack.R.Meredith and Scott.M.Shafer Margaret .M.sutton with M.R.Gopalan", Project Management, 1st edition, Wiley India, 2006.
6. "Narendra Singh", Project Management Control, 4th Revised edition, Himalaya Publishing House, 2007.
7. "Narendra Singh", Problems & solutions in Project Management and Control, 3rd edition, "Himalaya Publishing House, 2007.
8. "Prasanna Chandra", Project Management, TMH, 2007.
9. "Chowdry", Project Management, TMH, 2007.
10. "Clifford.F.Gray, Erik.W.Larson", Project Management the Managerial Process, 3rd edition
11. Basic Financial Management: M. Y. Khan and P.K. Jain, New Delhi, TMH 2000.
12. Financial Management: I.M. Pandey.
13. Financial Management: Theory and Practices- Prasanna Chandra.
14. Financial Management: Khan and Jain.



13.13 TERMINAL QUESTIONS

- Q1. How do you calculate Internal Rate of Return? What are its merits and demerits?
- Q2. What do you mean by Net Present Value?
- Q3. Differentiate between Net Present Value and Profitability Index.
- Q4. Discuss the methods for ranking investment proposals. What are the methods commonly used for incorporating risk in capital budgeting decisions?
- Q5. What are mutually exclusive projects?
- Q6. X Ltd. is implementing a project with an initial capital outlay of Rs. 7,600. Its cash inflows are as follows;

Years	1	2	3	4
Cash Inflows	Rs. 6,000	Rs. 2,000	Rs. 1,000	Rs. 5,000

The expected rate of return on the capital invested is 10%. Calculate the discounted payback period of the project. Present value of Re1 @10% is 0.909 for first year, 0.826 for second year, 0.751 for third year and 0.683 for fourth year and 0.621 for fifth year.

Q7. The Management of X Ltd. is considering the purchase of a new plant. Two alternatives Plants A and B are available, each costing Rs. 10, 00,000. The expected life of each Plant is 5 years. The cash flows are expected to be as follows;

Year	1	• 2	3	4	5
Plant A	2,60,000	1,00,000	5,50,000	3,00,000	2,00,000
Plant B	2,20,000	1,80,000	5,00,000	1,00,000	60,000

In respect of the above information calculate which Plant will be preferable using Net Present Value Method .While calculating the present values of cash flows, use a discount rate of 10%.