Quadrant II- Notes

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Module Name: Project classification and Investment criteria

❖ Evaluation of Investment criteria

The impact of long-term capital investment decisions is far reaching. It protects the interests of the shareholders and of the enterprise because it avoids over-investment and under-investment in fixed assets. By selecting the most profitable projects, the it facilitates the wealth maximization of equity share-holders.

There are several capital budgeting analysis methods that can be used to determine the economic feasibility of a capital investment. They include the Payback Period, Discounted Payment Period, Net Present Value, Profitability Index, Internal Rate of Return, and Modified Internal Rate of Return.

❖ **CAPITAL BUDGETING TECHNIQUES / METHODS** involves evaluation of the profitability of the alternative projects and selection of the best one. These methods are classified into two broad categories,

I) Unsophisticated or Traditional Techniques – including
   (1) Average / Accounting Rate of Return Method (ARR)
   (2) Pay Back Method (PB)

II) Sophisticated or Time Adjusted Techniques – also called as Discounted Cash Flow Techniques as they take the time factor into account. It includes
   (1) Net Present Value Method (NPV)
   (2) Internal Rate of Return Method (IRR)
   (3) Profitability Index (PI)

I) Traditional Techniques do not consider the time value of money and give equal weight to money earned in different time periods.

(1) Accounting/Average Rate of Return (ARR):

Also known as the return on investment (ROI), this method uses accounting information rather than cash flow. The ARR is the ratio of the average after tax profit divided by the average investment. There are a number of alternative

methods for calculating ARR. The two most common methods of computing ARR are i) Average investment method & ii) Original Investment Method :

i) This method of computing ARR is known as **Average investment method**, and uses the following formula:

$$ARR = \frac{\text{Average Annual Profits After Taxes}}{\text{Average Investment}} \times 100$$

Where, Average profits = $\frac{\text{Total Profits}}{\text{Life of the project}}$

The average profits after tax are determined by adding up the after-tax profits for each year of the project's life and dividing the results by the number of years. (In case of annuity, the average after-tax profits are equal to any years profits)

Average investment = $\frac{\text{Net Investment}}{2}$

The average investment is calculated by dividing the net investment by two. This averaging process assumes that the firm is using straight line method of depreciation, in which case the book value of the asset decline at a constant rate from it's purchase price to zero, at the end of it's depreciable life. This means that on the average, firms will have half of their initial purchase price in the books.

Thus, Average investment = Net Working Capital + ½ (Initial cost of machine - Salvage Value)

Consequently, if the machine has salvage value, then only the depreciable cost (cost – salvage value) of the machine should be divided by two inorder to ascertain the average net investment, as the salvage money will be recovered only at the end of the life of the project. Therefore an amount equivalent to the salvage value remains tied up in the project throughout it's life time. Hence no adjustment is required to the sum of salvage value to determine the average investment.

Likewise, if any additional net working capital is required in the initial year of project's life, which is likely to be released only at the end of the project's life,

the amount of working capital should be taken in determining relevant investment for the purpose of calculating ARR.

ii) The alternative method of computing ARR is known as **original investment method**, and uses the following formula:

$$ARR = \frac{\text{Average Annual Profits After Taxes}}{\text{Original Investment}} \times 100$$

Accept - Reject Rule:

The ARR can be used as a decision criterion to accept or reject the investment proposal. The actual ARR would be compared with a predetermined or a minimum required or cut-off rate. Thus, a project would be accepted if the ARR is higher than the minimum desired rate of return; otherwise it is rejected.

The ranking method can also be used to select or reject the proposal using ARR. Usually, projects having higher ARR would be preferred to projects having lower ARR.

Merits:

1. It is simple to calculate. Requirement is only figure of accounting profits (profits after taxes) which are easily obtainable.

2. It is based on accounting information which is readily available and familiar to businessman.

3. It considers benefit over the entire life of the project.

Demerits:

1. It is based upon accounting profit, not cash flow in evaluating projects. I.e. the calculations ignore the reinvestment potential of a project's benefits while cash flow takes into account this potential and hence the total benefits of a project.

2. It does not take into consideration time value of money. Benefits in the earlier years and later years cannot be valued at par. ARR method treats

these benefits at par and fails to take account of differences in time value of money, it suffers from a serious deficiency.

3. ARR criterion of measuring the worth of investment does not differentiate between the size of investments required for each project. Competing investment projects may have the same ARR but may require different average investment.

(2) Pay Back Period (PBP) :

The Pay Back Period (PBP) is the number of years required to recover the original cash outlay invested in a project. It is the simplest and perhaps, the most widely used quantitative method for appraising capital expenditure decision. PBP represents the time required for cash receipts to pay the original cost of the investment, normally disregarding salvage value. It is the time taken to recover initial investment. Cash receipts represent Cash Flows After Taxes (CFAT). Thus PBP measures the number of years required for the CFAT to pay back the original outlay of an investment proposal.

Methods to compute PBP:

There are two methods of calculating the PBP.

(i) The first method can be applied when the **cash flow stream is an annuity** for each year of the project's life, i.e. CFAT is uniform. In such a situation, the initial cost of the investment is divided by the constant annual cash flow. The PBP will be calculated using following formula:

$$PBP = \frac{\textit{Initial Investment}}{\textit{Constant Annual Cash Inflow}} = \frac{100000}{20000} = 5 \textit{years}$$

(For example, if an investment of Rs.1,00,000 in a machine is expected to generate cash inflow of Rs.20,000 p.a. for 10 years.)

(ii) The second method is used when a project's **CFAT are a mixed stream**, i.e. cash inflows are not equal but vary from year to year. In such a situation PBP is calculated by the process of cumulating CFAT till the time when cumulative cash flow becomes equal to the original investment outlay.

Accept-Reject Rule:

The PBP can be used as a decision criterion to select investment proposal. The projects may be ranked according to the length of PBP and the project with the shortest PBP will be selected.

Merits:

1. It is simple to understand and easy to calculate. The projects can be ranked according to their economic merits without much complications.

2. It takes consideration of factors like risk, obsolescence and liquidity and thus solvency of the firm. Thus, it focuses on reduction of the loss through obsolescence and also considers the risk element present in the future investments by emphasizing on early recovery of cash.

3. Due to its short-term approach and emphasis on liquidity, this method is useful when a firm is experiencing shortage of cash. It helps in choosing a project that will yield a quick return of cash funds regardless of its long term profitability. It emphasizes selecting a project with the early recovery of the investment.

Demerits:

1. It ignores the time value of money.

2. This method fails to consider any receipts (cash flows) after the PBP. It can lead to wrong decisions, resulting in rejecting projects that generate

substantial inflows in later years. Thus It may not be consistent with the objective of shareholders' wealth maximization.

3. It does not measure the profitability of a project. In actual practice, funds are invested not only to recover cost but also to earn profits.

II) Sophisticated / Discounted Cash Flow Techniques –

These are also known as modern or time adjusted techniques because they take into consideration the time value of money.

(a) Net Present Value (NPV):

The net present value is one of the discounted cash flow or time-adjusted technique. It recognizes that cash flow streams at different time period differs in value and can be computed only when they are expressed in terms of common denominator i.e. present value.

NPV maybe defined as the summation of the present values of the cash proceeds in each year minus the summation of the present values of the net cash outflows in each year. The NPV is the difference between the present value of future cash inflows and the present value of the initial outlay, discounted at the firm's cost of capital.

The procedure for determining the present values consists of two stages. The first stage involves determination of an appropriate discount rate. With the discount rate so selected, the cash flow streams are converted into present values in the second stage.

Method to compute NPV:

The NPV can be calculated with the help of the following equation:

NPV = Present value of Cash Inflows – Initial Investment OR,

NPV = PVCFAT - PVCO

Accept-Reject Rule:

The decision rule for a project under NPV is to accept the project if NPV is positive, and reject the project if project is negative. i.e.

- If the NPV is greater than 0, accept the project.
- If the NPV is less than 0, reject the project.

This method can be used to select between mutually exclusive projects also. Using NPV the project with the highest positive NPV would be ranked first and that project would be selected. The market value of the firm's share would increase if projects with positive NPVs are accepted.[1]

Merits:

This method is considered as the most appropriate measure of profitability due to the following merits.

1. It explicitly recognizes the time value of money.

2. It gives due emphasis on timing and magnitude of cash inflow. It takes into account all the years cash flows arising out of the project over its useful life.

3. It is a simple and an absolute measure of profitability of a project. If a firm has several mutually exclusive projects in hand, it helps management to choose the most profitable one.

4. It is consistent with the objective of shareholders' wealth maximization as it considers the entire stream of earnings of a project.

Demerits: This method has certain computational problems like:

1. Difficulty in cash flow estimation due to business uncertainties.

2. Difficulty in measuring discount rate. It requires the calculation of the required rate of return to discount the cash flows. The discount rate is the most important element used in the calculation of the present values because different discount rates will give different present values. The relative desirability of the proposal will change with a change in the discount rate.

3. It may give ambiguous results in case of mutually exclusive projects with unequal life or different cash flow pattern, different cash outlay etc. (it may not give dependable results.)

4. It is not easy to rank projects as it does not take into account size of investment outlay and net cash benefits together. Decisions based on absolute amount of NPV without considering the size of investments will certainly be incorrect and irrational.

2) Internal Rate of Return (IRR) Method

This method is also known as Time - Adjusted Rate of Return, Discounted Rate of Return Method, Trial and Error Yield Method etc. This method seeks to find the rate at which present value of cash inflows equal the amount of investment outlays. The IRR is thus defined as that rate of return which equates the present value of investment outlays with the value of net cash benefits. IRR is usually the rate of return that a project earns.

The IRR is the rate of discount which would reduce the sum of present value of net cash flows over the project life to zero. If this rate is greater than the cost, it means that the funds committed will earn more than their cost. When IRR of a project equals the cost of capital, the management would be indifferent to the project as it would not be expected to change the value of the firm.

Mathematically it can be defined as the value of r in the following equation:

$$C = \frac{R1}{(1+r)} + \frac{R2}{(1+r)} + \text{- - - - - - -} + \frac{Rn}{(1+r)}$$

Where, **C** is the present value of investment outlay, **R** denotes the present value of cash benefits in different time periods, **r** is the Internal Rate of Return (IRR), and **n** is the life of the project.

The IRR is usually found out by the trial and error process. If the Internal Rate of Return(r) is higher or equal to the minimum required rate of return i.e. cost of capital or cut off rate then the investment project is accepted and it is rejected if the Internal rate of return is less than the cost of capital or cut off rate. In the case of a number of proposals, highest rank is given to the proposal, which has the highest Rate of Return. However, these rates must be higher than the cost of capital or cut off rate.

Merits: IRR has the same merits as of NPV method.

1) It is consistent with the objective of shareholders' wealth maximization.
2) It considers the entire stream of earnings of a project.
3) It gives due emphasis on timing and magnitude of cash inflow.

Demerits: However, its serious drawbacks include

1) Under certain conditions, it becomes very difficult to take any decision. Under conditions of projects with unequal life, unequal scale of investment or unconventional cash flow patterns, IRR method may give 2 or more answers (i.e. ambiguous results).
2) IRR method assumes that the funds received at the end of the life of the projects life can be reinvested at the same rate of return which is not true in actual practice.

3) Profitability Index (PI) / Benefit - Cost Ratio

Profitability Index (PI) also known as Benefit-cost ratio (B/C ratio) is another time adjusted method of capital budgeting. It is similar to the NPV approach. PI approach measures the present value of returns per rupee invested, while NPV is based on difference between present values of future cash inflows and present value of cash outlays. It is defined as the ratio obtained by dividing the present value of future cash benefits by the present value of cash outflows of the investment. It is observed as a shortcoming of NPV that, being an absolute measure, it is not a reliable method to evaluate projects requiring different initial investments. The PI method provides solution to this kind of problem.

Thus, $$PI = \frac{\text{PV of Cash Inflows}}{\text{PV of Cash Outflows}}$$

This method is also known as B/C ratio because numerator measures benefits & denominator measures cost.

Accept-Reject Rule:

Using the PI ratio,

- Accept the project when PI>1
- Reject the project when PI<1
- May or may not accept when PI=1, the firm is indifferent to the project.

When PI is greater than, equal to or less than 1, NPV is greater than, equal to or less than 0 respectively.

The selection of the project with the PI method can also be done on the basis of ranking. The highest rank will be given to the project with the highest PI, followed by the others in the same order.

Merits:

1. Like NPV and IRR methods, PI is a sound method for appraising investment projects. It takes into consideration the time value of money.
2. It also considers the benefits arising out of projects over its entire life span.
3. At times it is a better evaluation technique than NPV in a situation of capital rationing especially. For instance, two projects may have the same NPV of Rs. 20,000 but project A requires an initial investment of Rs. 1, 00,000 whereas B requires only Rs. 50,000. The NPV method will give identical ranking to both projects, whereas PI will suggest project B should be preferred. Thus PI is better than NPV method as former evaluate the worth of projects in terms of their relative rather than absolute value.
4. It is consistent with the shareholders' wealth maximization.

Demerits:

Though PI is a sound method of project appraisal and it is just a variation of the NPV, it has all those limitation of NPV method too.

1. When cash outflow occurs beyond the current period, the PI is unsuitable as a selection criterion.
2. It requires estimation of cash flows with accuracy which is very difficult under ever changing world.
3. It also requires correct estimation of cost of capital for getting correct result.
4. When the projects are mutually exclusive and it has different cash outlays, different cash flow pattern or unequal lives, it may give ambiguous results.

Comparison between NPV & IRR

A. <u>Similarities</u>

1. Both consider the time value of money
2. Both consider all cash flows over entire life of the project.
3. Both are consistent with the objective of maximizing the wealth of shareholders.
4. Both are equivalent as regards the acceptance/ rejection of conventional investments.

B. <u>Differences</u>

1. Evaluation of non-conventional investments - Both are not equivalent as regards the acceptance/rejection of non-conventional investments.
2. Reinvestment rate.
3. Multiple/negative rates