MODULE 7-INVESTMENT ANALYSIS

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What is Investment Analysis?

- Investment analysis involves **researching and evaluating a security or an industry to predict its future performance and determine its suitability to a specific investor**.
- Investment analysis may also involve evaluating or creating an overall financial strategy.
- Types of investment analysis include bottom-up, top-down, fundamental, and technical.

Time Value of Money (TVM)

['tīm 'val-(ˌ)yü əv 'mə-nē]

The concept that a sum of money is worth more now than the same sum will be at a future date due to its earnings potential in the interim.

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Time Value of Money

- Investors prefer to ***receive money today*** rather than the same amount of money in the future because a sum of money, once invested, grows over time.
- For example, money deposited into a savings account earns interest. Over time, the interest is added to the principal, earning more interest.
- If you hide Rs 2000 in a mattress for three years, you will lose the additional money it could have earned over that time if invested. It will have even less buying power when you retrieve it because inflation reduces its value.

Time Value of Money

- $FV = PV(1+i/n)^{n \times t}$
- **where:** FV=Future value of money
- PV=Present value of money
- i=Interest rate
- n=Number of compoundin g periods per year
- t=Number of years

$$FV = \$10,000 \times \left(1 + \frac{10\%}{1}\right)^{1\times1}$$
$$= \$11,000$$

$$PV = \left[\frac{\$5,000}{\left(1+\frac{7\%}{1}\right)}\right]^{1\times1}$$
$$= \$4,673$$

Effect of Compounding

- Quarterly Compounding:

$$FV = \$10,000 \times \left(1 + \frac{10\%}{4}\right)^{4\times1} = \$11,038$$

- Monthly Compounding:

$$FV = \$10,000 \times \left(1 + \frac{10\%}{12}\right)^{12\times1} = \$11,047$$

- Daily Compounding:

$$FV = \$10,000 \times \left(1 + \frac{10\%}{365}\right)^{365\times1} = \$11,052$$

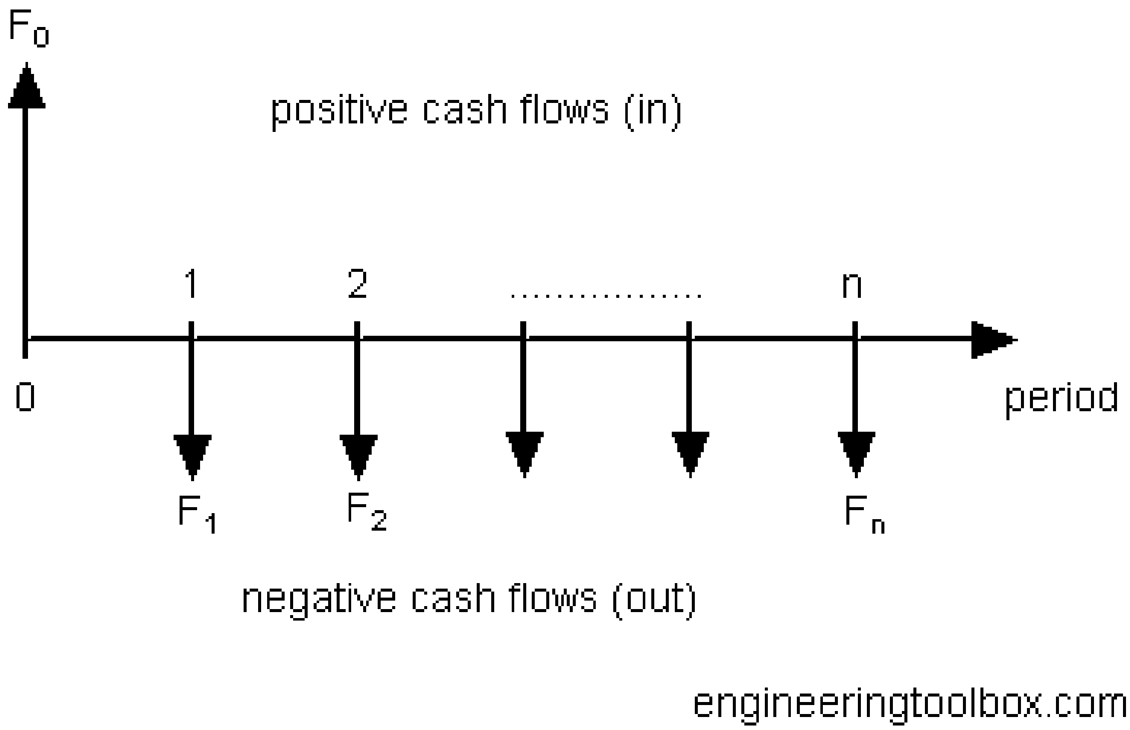
This shows that the TVM depends not only on the interest rate and time horizon but also on how many times the compounding calculations are computed each year.

The effects of compounding strengthen as the frequency of compounding increases. Assume a one-year time period. The more compounding periods throughout this one year, the higher the future value of the investment, so naturally, two compounding periods per year are better than one, and four compounding periods per year are better than two.

Time value of money can help guide investment decisions.

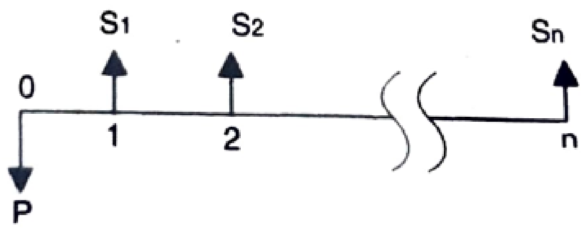
- If an investor must choose between two projects: Project A and Project B. They are identical except that Project A promises Rs 1 crore cash payout in year one, whereas Project B offers Rs 1 crore cash payout in year five.
- The payouts are not equal. The Rs 1 crore payout received after one year has a higher present value than Rs 1 crore payout after five years.

CASH FLOW DIAGRAM



Capital Recovery Factor

Let P be the present amount invested at zero ($n = 0$) time at the interest rate of i per year and S_n future value at the end of n years as shown below.



Then, at the end of one year the time value of P will be

$$S_1 = P + iP = P(1+i)$$

At the end of second year P becomes

$$S_2 = S_1 + iS_1 = P + iP + i(P + iP)$$

$$= P(1+i) + Pi(1+i) = P(1+i)^2$$

For every annual effective interest rate (i), there is corresponding effective discount rate (d) i.e.

$$d = \frac{i}{1+i} \quad \text{or} \quad 1 - d = id$$

Similarly, at the end of third and nth year will be

$$S_3 = P(1+i)^3 \qquad \text{and} \qquad S_n = P(1+i)^n$$

Assuming S_n to be S, then S_n can be written as

$$S = P(1+i)^n$$

Here, $S > P$ for $i > 0$, compound interest law

$$S = P\,F_{PS}$$

Future value = (present value). (Compound-interest factor)

Equation (14.1a) can be rewritten as

$$P = S/(1+i)^n$$

or

$$P = S(1+i)^{-n}$$

This shows that the future amount (at nth year) is reduced when converted against the calendar to the present value (at zeroth time), assuming i to be positive.

$$P = S\,F_{SP} \qquad (14.5a)$$

Present value = (future value). (present value factor)

where F_{SP} (table 14.1) is designated as $F_{SP,i,n}$ and is given by

$$F_{SP,i,n} = \frac{1}{(1+i)^n} = (1+i)^{-n} \tag{14.5b}$$

From Equations (14.1b) and (14.5b), F_{PS} and F_{SP} can be related as

$$F_{PS}.F_{SP} = 1$$

From Equations (14.1a) and (14.5a) the future value S of initial investment P, and vice versa, can b calculated

$$S = P(1+i)^n, \text{ moving with the calendar}$$

and

$$P = S(1+i)^{-n}, \text{ moving against the calendar}$$

Above equations can be combined as

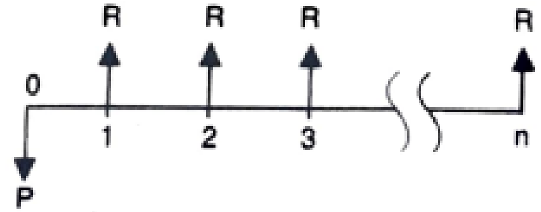
$$A_{t2} = A_{t1}(1+i)^n \quad (14.$$

Amount at time 2 = Amount at time 1 (Compound-interest operator)

14.2.2 Uniform Annual Cost (Unacost)

In solving engineering economic problems it is convenient to diagram expenditures and receipts as vertical lines positioned along a horizontal line representing time. Expenditures and receipts can point in opposite directions. By using this concept, a uniform annual amount will be discussed.

Consider a uniform end-of-year annual amount R (unacost) for a period of n years. The diagram for this is as shown,



where R is referred to as unacost.

Let P be a single present value at initial time (i.e. $n = 0$). Then by using Equation (14.5a), we get

$$P = R\left[\frac{1}{1+i} + \frac{1}{(1+i)^2} + \cdots\cdots + \frac{1}{(1+i)^n}\right] \tag{14.7}$$

Further

$$P = R\sum_{1}^{n} \frac{1}{(1+i)^n}$$

Equation (14.7) is a geometric series which has $1/(1+i)$, as the first term and $1/(1+i)$ as the ratio of n successive terms.

The summation of geometric series in Equation (14.7) can be evaluated as,

$$\sum_{1}^{n} \frac{1}{(1+i)^n} = \frac{1}{1+i} \frac{1-\left(\frac{1}{1+i}\right)^n}{1-\frac{1}{1+i}} = \frac{(1+i)^n - 1}{i(1+i)^n}$$

Then Equation (14.7) becomes,

$$P = R\frac{(1+i)^n - 1}{i(1+i)^n}$$

or,

$$P = RF_{RP,i,n} \tag{14.8a}$$

Present value = (unacost). (unacost present value factor)

where,

$$F_{RP,i,n} = \frac{(1+i)^n - 1}{i(1+i)^n} \tag{14.8b}$$

which is referred to as the equal-payment series present value factor or annuity present value factor (Table 14.1).

Equation (14.8a) can also be written as,

$$R = P\frac{i(1+i)^n}{(1+i)^n - 1}$$

$$R = PF_{PR} \tag{14.9a}$$

Unacost = (present value). (capital recovery factor)

where, F_{PR} (Table 14.1) is designated as

$$F_{PR,i,n} = \frac{i(1+i)^n}{(1+i)^n - 1} \tag{14.9b}$$

It is also known by capital recovery factor in short, as CRF.

From Equations (14.8b) and (14.9b), it can be seen that,

$$F_{RP,i,n} = \frac{1}{F_{PR,i,n}}$$

olar water heating systems have the following cost comparison. Which system is more economical money is worth 10 percent per year.

Economic Components	System (A)	System (B)
First cost (Rs.)	30,000	15,000
Uniform end-of-year maintenance per year (Rs.)	2,000	5,000
Overhaul, end of the third year (Rs.)	–	3,500
Salvage value (Rs.)	4,000	1,000
Life of the system (years)	5	5
Benefit from quality control as a uniform end-of-year amount per year (Rs.)	1,000	–

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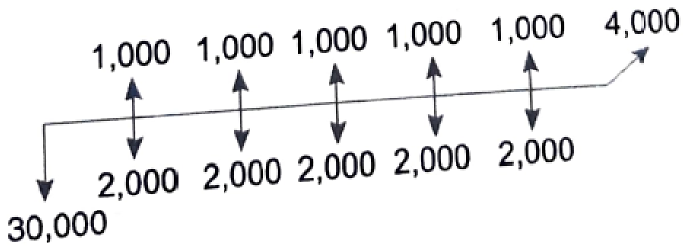
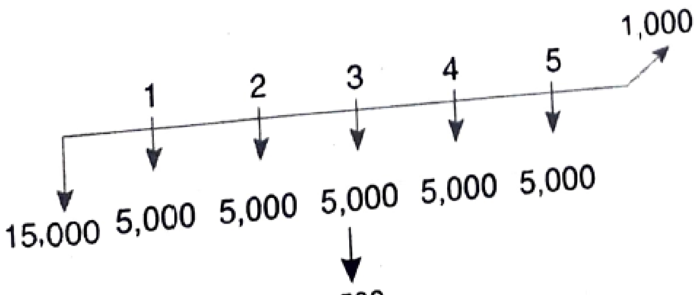
-flow diagram for each system have been shown as follows:

em A



tem B



The present value of the costs for system A can be obtained by using, Equations (14.5a) and (14.8a) as

$$P_{AS} = 30,000 + (2,000 - 1,000)F_{RP},\ F_{RP.10\%.5} - 4,000F_{SP.10\%.5} = 30,000 + 1,000(3.7908)$$
$$-4,000(0.62092) = \text{Rs.}31,307.12$$

The present value of the costs for system B can be obtained by using, Equations (11.5) and (11.8) as follows:

$$P_{BS} = 15,000 + 5,000F_{RP.10\%.5} + 3,500F_{SP.10\%3} - 1,000F_{SP.10\%.5}$$
$$= 15,000 + 5,000 \times 3.7908 + 3,500 \times 0.75131 - 1,000 \times 0.62092$$
$$= 15,000 + 18,954 + 2,629.55 - 620.92 = \text{Rs.}35,962.63$$

From above calculations, it is clear that system A is more economical than system B.

CAPITAL BUDGETING

- Capital budgeting is the process a business undertakes to evaluate potential major projects or investments.
- Construction of a new plant or a big investment in an outside venture are examples of projects that would require capital budgeting before they are approved or rejected.

- As part of capital budgeting, a company might assess a prospective project's lifetime cash inflows and outflows to determine whether the potential returns that would be generated meet a sufficient target benchmark.
- The capital budgeting process is also known as investment appraisal.

Methods

- The payback period (PB),
- Internal rate of return (IRR) and
- Net present value (NPV) methods are the most common approaches to project selection.

PAYBACK PERIOD

- The payback period calculates the length of time required to recoup the original investment.
- For example, if a capital budgeting project requires an initial cash outlay of $1 million, the PB reveals how many years are required for the cash inflows to equate to the one million dollar outflow.
- A short PB period is preferred as it indicates that the project would "pay for itself" within a smaller time frame.

Investment	Inflows				
Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
-1,000,000	300,000	300,000	300,000	300,000	300,000

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DISCOUNTED PAYBACK

- **Payback Period vs. Discounted Payback Period**
- The payback period is the amount of time for a project to break even in cash collections using nominal dollars.
- Alternatively, the discounted payback period reflects the amount of time necessary to break even in a project, based not only on what cash flows occur but when they occur and the prevailing rate of return in the market.

- Assume that Company A has a project requiring an initial cash outlay of $3,000. The project is expected to return $1,000 each period for the next five periods, and the appropriate discount rate is 4%.
- The discounted payback period calculation begins with the -$3,000 cash outlay in the starting period. The first period will experience a +$1,000 cash inflow.
- Using the present value discount calculation, this figure is $1,000/1.04 = $961.54. Thus, after the first period, the project still requires $3,000 - $961.54 = $2,038.46 to break even.
- After the discounted cash flows of $1,000 / $(1.04)^2$ = $924.56 in period two, and $1,000/$(1.04)^3$ = $889.00 in period three, the net project balance is $3,000 - ($961.54 +$924.56 + $889.00) = $224.90.
- Therefore, after receipt of the fourth payment, which is discounted to $854.80, the project will have a positive balance of $629.90. Therefore, the discounted payback period is sometime during the fourth period.

NET PRESENT VALUE

- Net present value (NPV) is **the difference between the present value of cash inflows and the present value of cash outflows over a period of time**.

$$NPV = \frac{\text{Cash flow}}{(1+i)^t} - \text{initial investment}$$

where:

i = Required return or discount rate

t = Number of time periods

If analyzing a longer-term project with multiple cash flows, then the formula for the NPV of a project is as follows:

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

where:

R_t = net cash inflow-outflows during a sin

i = discount rate or return that could be ea

t = number of time periods

- A project that costs $1,000 and will provide three cash flows of $500, $300, and $800 over the next three years. Assume that there is no salvage value at the end of the project and that the required rate of return is 8%. Calculate the NPV

$$NPV = \frac{\$500}{(1+0.08)^1} + \frac{\$300}{(1+0.08)^2} + \frac{\$800}{(1+0.08)^3} - \$1000$$
$$= \$355.23$$

INTERNAL RATE OF RETURN

- Internal Rate of Return, or IRR, is the **rate of return** at which a project breaks even and is used by management to evaluate potential **investments**.
- The internal rate of return (or expected return on a project) is the discount rate that would result in a net present value of zero.

- The IRR rule is as follows:

IRR > Cost of Capital = Accept Project

IRR < Cost of Capital = Reject Project

- Cost of capital is a company's calculation of the minimum return that would be necessary in order to justify undertaking a capital budgeting project, such as building a new factory.

BENEFIT TO COST RATIO

- The benefit-cost ratio (BCR) is **an indicator showing the relationship between the relative costs and benefits of a proposed project, expressed in monetary or qualitative terms**.
- If a project has a BCR greater than 1.0, the project is expected to deliver a positive net present value to a firm and its investors.
- If a project's BCR is less than 1.0, the project's costs outweigh the benefits, and it should not be considered.

- Benefit-cost ratios (BCRs) are most often used in capital budgeting to analyze the overall value for money of undertaking a new project.
- However, the cost-benefit analyses for large projects can be hard to get right, because there are so many assumptions and uncertainties that are hard to quantify.

- **Limitations of the BCR**

The primary limitation of the BCR is that it reduces a project to a simple number when the success or failure of an investment or expansion relies on many factors and can be undermined by unforeseen events.

Simply following a rule that above 1.0 means success and below 1.0 spells failure is misleading and can provide a false sense of comfort with a project.

The BCR must be used as a tool in conjunction with other types of analysis to make a well-informed decision.