BASES FOR COMPARISON OF ALTERNATIVES

Bases for Comparison of Alternatives

Following are the bases for comparing the worthiness of Projects;

a) Present Worth Method
b) Future Worth Method
c) Annual Equivalent Method
d) Rate of Return Method

Present Worth Method of Comparison

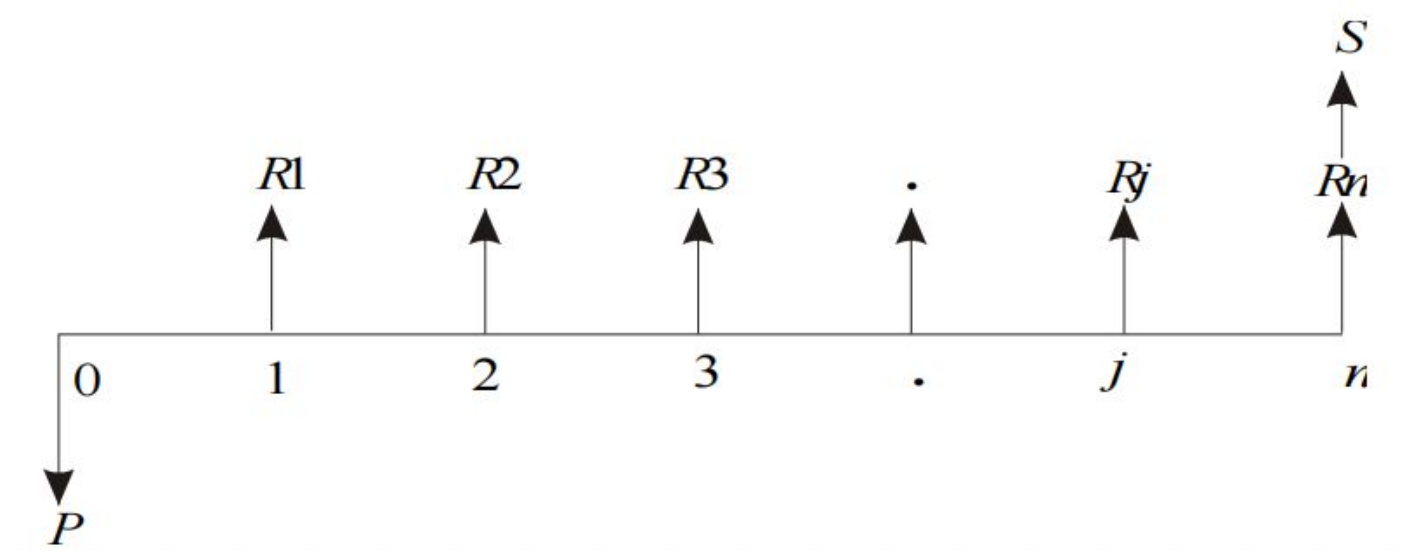
- The cash flows of each alternative will be reduced to time zero by assuming an interest rate i.
- Then, depending on the type of decision, the best alternative will be selected by comparing the present worth amounts of the alternatives.
- The sign of various amounts at different points in time in a cash flow diagram is to be decided based on the type of the decision problem.
- Two type of **Present Worth Cash Flow Daigram**

i. revenue/profit-dominated cash flow

ii. cost dominated cash flow

REVENUE-DOMINATED CASH FLOW

- In a revenue/profit-dominated cash flow diagram, the profit, revenue, salvage value (all inflows to an organization) will be assigned with positive sign.
- The costs (outflows) will be assigned with negative sign



- P represents an initial investment and Rj the net revenue at the end of the jth year. The interest rate is i, compounded annually. S is the salvage value at the end of the nth year

$$PW(i) = -P + R1[1/(1+i)^1] + R2[1/(1+i)^2] + \ldots + Rj[1/(1+i)^j] + Rn[1/(1+i)^n] + S[1/(1+i)^n]$$

- Expenditure is assigned a negative sign and revenues are assigned a positive sign.
- If we have some more alternatives which are to be compared with this alternative, then the corresponding present worth amounts are to be computed and compared.
- Finally, the alternative with the maximum present worth amount should be selected as the best alternative.
- If it is a uniform Series or equal-payment Series, the Present Worth of the annual series formula will be aplied

Example-1

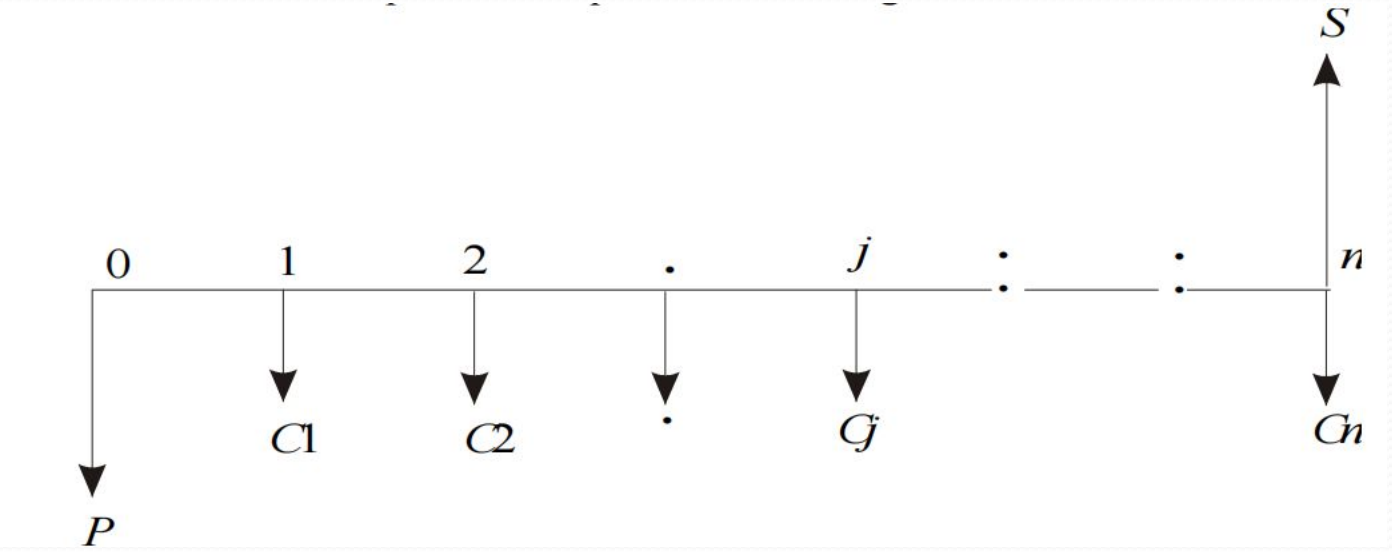
- Alpha Industry is planning to expand its production operation. It has identified three different technologies for meeting the goal. The initial outlay and annual revenues with respect to each of the technologies are summarized in the following table. Suggest the best technology which is to be implemented based on the present worth method of comparison assuming 20% interest rate, compounded annually.

	Initial Outlay (in Rs.)	Annual Revenue (in Rs.)	Life (Years)	
Technology 1	1200000	400000	10	
Technology 2	2000000	600000	10	
Technology 3	1800000	500000	10	

Solution

Cost dominated cash flow

- The costs (outflows) will be assigned with positive sign and the profit, revenue, salvage value (all inflows), etc. will be assigned with negative sign.
- In case the decision is to select the alternative with the minimum cost or the least present worth amount will be selected.



- Prepresents an initial investment, Cj the net cost of operation and maintenance at the end of the jth year, and S the salvage value at the end of the nth year.

$$PW(i) = P + C1[1/(1+i)^1] + C2[1/(1+i)^2] + \ldots + Cj[1/(1+i)^j] + Cn[1/(1+i)^n] - S[1/(1+i)^n]$$

- The expenditure is assigned a positive sign and the revenue a negative sign. If we have some more alternatives which are to be compared with this alternative, then the corresponding present worth amounts are to be computed and compared.
- Finally, the alternative with the minimum present worth amount should be selected as the best alternative.
- If it is a uniform Series or equal-payment Series, the Present Worth of the annual series formula will be aplied

Example-2

- An engineer has two bids for an elevator to be installed in a new building. The details of the bids for the elevators are as follows:

Bid	Engineer's Estimate		
	Initial Cost (Rs.)	Service Life (Yrs)	Annual Operations & Maintenance Cost (Rs.)
Alpha Elevator Inc.	450000	15	27000
Beta Elevator Inc.	540000	15	28500

Determine which bid should be accepted, based on the present worth method of comparison assuming 15% interest rate, compounded annually.

Example-3

- A granite company is planning to buy a fully automated granite cutting machine. If it is purchased under down payment, the cost of themachine is Rs. 16,00,000.
- If it is purchased under installment basis, the company has to pay 25% of the cost at the time of purchase and the remaining amount in 10 annual equal installments of Rs. 2,00,000 each. Suggest the best alternative for the company using the present worth basis at i = 18%, compounded annually.

Example-4

- A project involves an initial outlay of Rs. 30,00,000 and with the following transactions for the next five years. The salvage value at the end of the life of the project after five years is Rs. 2,00,000. Draw a cash flow diagram of the project and find its present worth by assuming i = 15%, compounded annually.

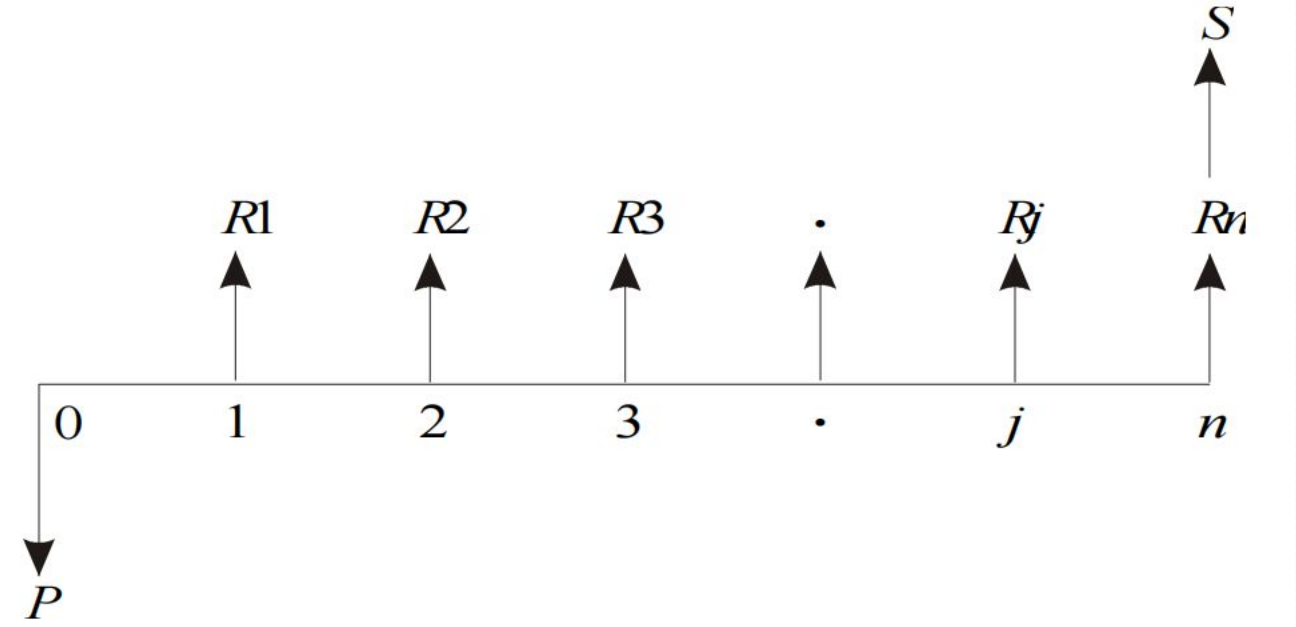
End of year	*Maintenance and operating expense* (Rs.)	*Revenue* (Rs.)
1	2,00,000	9,00,000
2	2,50,000	10,00,000
3	3,00,000	12,00,000
4	3,00,000	13,00,000
5	4,00,000	12,00,000

Example-5

- The details of the feasibility report of a project are as shown below. Check the feasibility of the project based on present worth method, using i = 20%.
- Initial outlay = Rs. 50,00,000
- Life of the project = 20 years.
- Annual equivalent revenue = Rs. 15,00,000
- Modernizing cost at the end of the 10th year = Rs. 20,00,000
- Salvage value at the end of project life = Rs. 5,00,000.

Future Worth Method

- The alternative with the maximum future worth of net revenue or with the minimum future worth of net cost will be selected as the best alternative for implementation.
- REVENUE-DOMINATED CASH FLOW



- P represents an initial investment, Rj the net-revenue at the end of the jth year, and S the salvage value at the end of the nth year.

$$FW(i) = -P(1 + i)^n + R1(1 + i)^{n-1} + R2(1 + i)^{n-2} + \ldots + Rj(1 + i)^{n-j} + \ldots + Rn + S$$

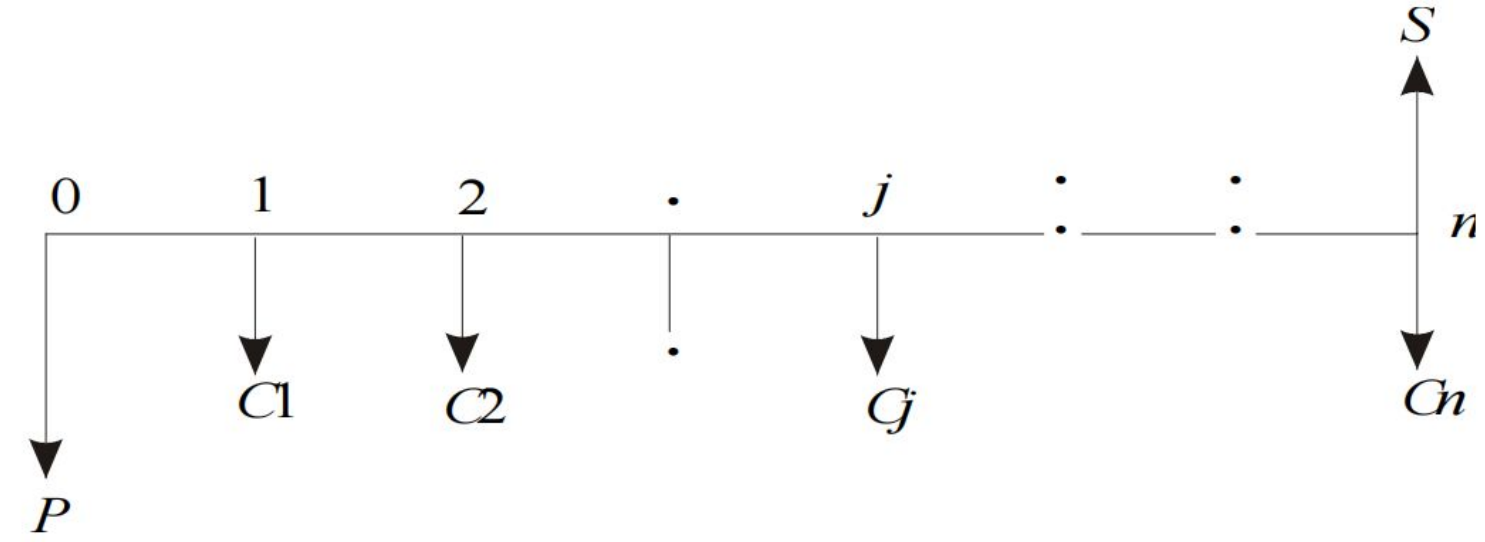
- The expenditure is assigned with negative sign and the revenues are assigned with positive sign.
- The alternative with the maximum future worth amount should be selected as the best alternative.
- If it is a uniform Series or equal-payment Series, the Future Worth of the annual series formula will be aplied

Example-1

- Given the following two mutually exclusive alternatives, select the best one based on future worth method of comparison assuming i = 12%.

Alternative	Cash Flow at the end of Year (Rs.)				
	0	1	2	3	4
A	- 4000000	1000000	1000000	1000000	1000000
B	- 4500000	800000	800000	800000	800000

- COST-DOMINATED CASH FLOW



- P represents an initial investment, Cj the net cost of operation and maintenance at the end of the jth year, and S the salvage value at the end of the nth year.
- $FW(i) = P(1+i)^n + C_1(1+i)^{n-1} + \ldots + C_j(1+i)^{n-j} + \ldots + C_n - S$
- The expenditures are assigned with positive sign and revenues with negative sign.
- The alternative with the minimum future worth amount should be selected as the best alternative

Exapmle-2

- A man owns a corner plot. He must decide which of the several alternatives to select in trying to obtain a desirable return on his investment. After much study and calculation, he decides that the two best alternatives are as given in the following table:

	Build gas station	*Build soft ice-cream stand*
First cost (Rs.)	20,00,000	36,00,000
Annual property taxes (Rs.)	80,000	1,50,000
Annual income (Rs.)	8,00,000	9,80,000
Life of building (years)	20	20
Salvage value (Rs.)	0	0

Evaluate the alternatives based on the future worth method at i = 12%.

Example-3

- A suburban taxi company is considering buying taxis with diesel engines instead of petrol engines. The cars average 50,000 km a year, with a useful life of three years for the taxi with the petrol engine and four years for the diesel taxi. Other comparative information are as follows:

	Diesel	*Petrol*
Vehicle cost	Rs. 5,00,000	Rs. 4,00,000
Fuel cost per litre	Rs. 9.00	Rs. 24.00
Mileage, in km/litre	30	20
Annual insurance premium	Rs. 500	Rs. 500
Salvage value at the end of vehicle life	Rs. 70,000	Rs. 1,00,000

Determine the more economical choice based on the future worth method of comparison if the interest rate is 15%, compounded annually.

Annual Equivalent Method

Formula:

EAW (Equivalent Annual Worth) of present worth =

$$A = PW(i)\ \frac{i(1+i)^n}{(1+i)^n - 1}$$

Equal Payment Series Capital Recovery Factor

- If EAW > 0, the Project can be accepted; If EAW < 0, the Project needs to be rejected and If EAW = 0, one should remain indifferent towards the Project.
- The Alternative with the maximum annual equivalent revenue should be selected as the best alternative.
- The Alternative with the minimum annual equivalent cost should be selected as the best alternative.

Student loan Analysis

- Loan per Year (for full education):
- Interest Rate (When it is calcualted from starting of education):
- Interest Rate (When it is calculated after completing the education):
- Repayment Starting period:
- Monthly Repayment after education:

- The annual equivalent worth of cost/revenue of Future Worth

$$A = F\frac{i}{(1+i)^n - 1}$$

- equal-payment series sinking fund factor

Example-1

- A company is planning to purchase an advanced machine centre. Three original manufacturers have responded to its tender whose particulars are tabulated as follows:

Manufacturer	*Down payment* (Rs.)	*Yearly equal installment* (Rs.)	*No. of installments*
1	5,00,000	2,00,000	15
2	4,00,000	3,00,000	15
3	6,00,000	1,50,000	15

- Determine the best alternative based on the annual equivalent method by assuming i = 20%, compounded annually.

Example-2

- A company provides a car to its chief executive. The owner of the company is concerned about the increasing cost of petrol. The cost per litre of petrol for the first year of operation is Rs. 21. He feels that the cost of petrol will be increasing by Re.1 every year. His experience with his company car indicates that it averages 9 km per litre of petrol. The executive expects to drive an average of 20,000 km each year for the next four years. What is the annual equivalent cost of fuel over this period of time?. If he is offered similar service with the same quality on rental basis at Rs. 60,000 per year, should the owner continue to provide company car for his executive or alternatively provide a rental car to his executive? Assume i = 18%. If the rental car is preferred, then the company car will find some other use within the company.