3.9 FUTURE WORTH COMPARISON

The equivalence concept that a present worth can be translated to a future worth at any given time at a given interest rate. Because a primary objective of all time value of money is to maximize the future wealth of the owners of a firm. The future worth criterion has become increasingly popular in recent years. The future worth of an alternative can be calculated in view of the MARR and compared with do-nothing option. If FW > 0 the alternative would be recommended.

Attention to secure cash flows may yield more accurate estimates of receipts and distersements because thinking tender to be in current Rs. Because the purchasing power of a unit of currency is eroded by inflation. Future-worth calculations are frequently utilized in escalation analyses, for evaluating the effects of inflation. The future worth at any time can be calculated by

$$FW = PW\ (F/P,\ i\ N)$$

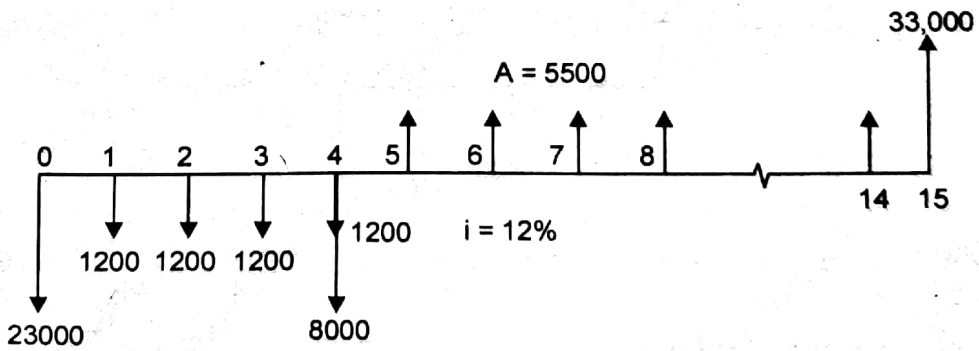
$$FW = PW\ (1 + i\ N)$$

The FW ranking of alternatives has to be the same as the ranking based on a PW analysis.

Problems

1. A small company purchased now for 23000 will lose. 1200 each year the first 4 years. An additional 8000 invested in the company during the fourth year will result in a profit 5500 each year from the 5th year through the 15th year at the end of 15 years. The company can be sold for Rs. 33,000/- MARR = 12%.

Solution:



FW = –23000 (F/P, 12%15) – [(8000 (P/F, 12%4)] (F/P, 12%15) – [(1200 (P/A, 12%4)] (F/P, 12% 15) + (5500 (CF/A, 12% 11) + 33000

$$= -125892.8 - 27827.8 - 19950.9 + 113600.9 + 33000$$

$$FW = -27070.6$$

2. Monthly amounts of Rs. 200, each are deposited into an account that earns 12% nominal interest, compounded quarterly. After 48 deposits of Rs. 200 each, what is the future equivalent worth of the account? State your assumptions.

Solution:

Monthly deposited = Rs. 200

i = 12% = monthly 1%

N = 48 months.

$\therefore$ FW = A (F/A, i% N)

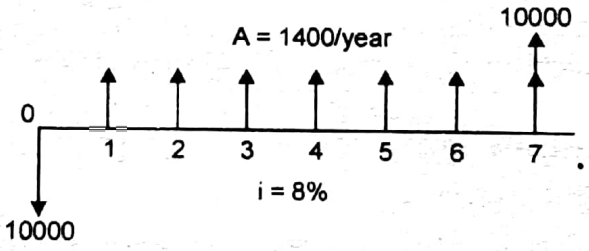
= 200 (F/A, 1%, 48)

$$= 200\left[\frac{(1+0.01)^{48}-1}{0.01}\right] = 200 \times 61.22$$

$$\boxed{FW = 12244.5}$$

3. Find the future worth in each of these situations.

(*a*)



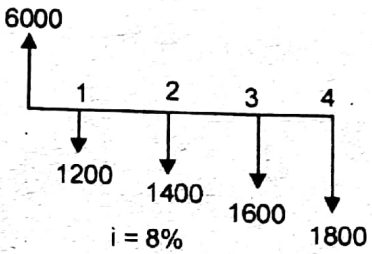
$$FW = -10000 (F/P, 8\% 7) + 1400 (F/A, 8\% 7) + 10000$$

$$= -10000 \times 1.7138 + 1400 \times 8.9228 + 10000$$

$$= -17138 + 12491.9 + 10000$$

$$FW = 5353.9$$

(*b*)



$$FW = 6000 (F/P, 8\% 4) - 1200 (F/P, 8\%4) - 1400 (F/P, 8\% 3) - 1600 (F/P, 8\%2) - 1800$$

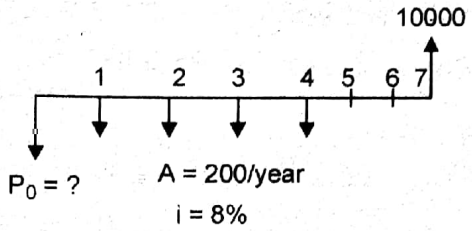
using table

$$= 6000 \times 1.3605 - 1200 \times 1.3605 - 1400 \times 1.2597 - 1600 \times 1.1864 - 1800$$

$$= 8163 - 1632.6 - 1763.6 - 1898.3 - 1800$$

$$\boxed{FW = 1068.5}$$

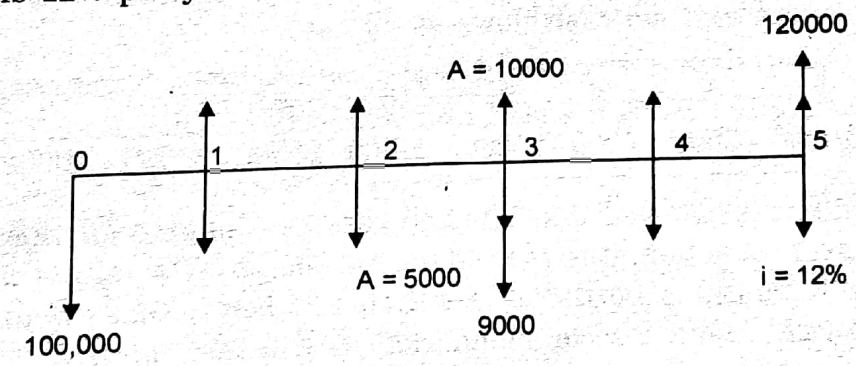
(c)



$$P_0 = A(P/A, i\%, N)$$
$$= 200(P/A, 8\%, 4)$$
$$= 200(3.3121)$$
$$P_0 = 662.42$$
$$FW = P_0(F/P, i\%, N)$$
$$= 662.42\ (F/P, 8\%, 7) + 10000$$
$$= 662.4 \times 1.7138 + 10000$$

$$\boxed{FW = 8864.8}$$

4. You purchased a building five years ago for 100,000. Its annual maintenance cost has been Rs. 5000 per year. At the end of 3 years, you have spent 9000 on roof repairs. At the end of five years, you sell the building for 120,000. During the period of ownership, you rented the building for 10000 per year paid at the beginning of each year use the future worth method to evaluate this investment when your MARR is 12% per year.



$$FW = -100000\ (F/P, 12\%\ 5) - 5000(F/A, 12\%5) - 9000\ (F/P, 12\%2) + 10000\ (F/A, 12\%5) + 120000$$
$$= -100000\ (1.7624) - 5000\ (1.7624) - 9000\ (1.2544) + 10000\ (6.3529) + 120000$$
$$= -176240 - 8812 - 11289.6 + 63524 + 120000$$

$$\boxed{FW = -12817.6}$$

5. A refining company entered into a contract for raw materials with an agreement to pay 600,000 now and 150000 per year beginning at the end of the fifth year. The contract was made for 10 years. At the end of the third year because of unexpected profits. The company requested that it be allowed to make a lumpsum payment in advance for the rest of the contract. Both, parties agreed that 7 percent compounded annually was a fair interest rate. What was the amount of the lumpsum?

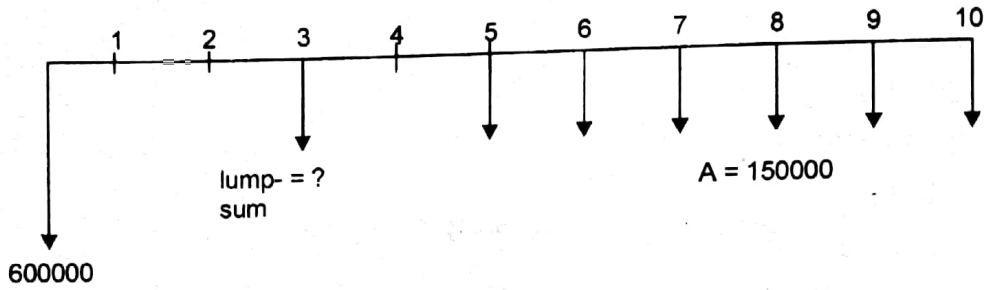
Solution:

Contract deal now = 600000

remaining payments = 150000

Beginning from 5th year

N = 10 years.



Lump sum amount = [A(P/A, i% N)] [(P/F, i%N)]

= [150000 × (P/A, 7%6)] (P/F, 7%1)

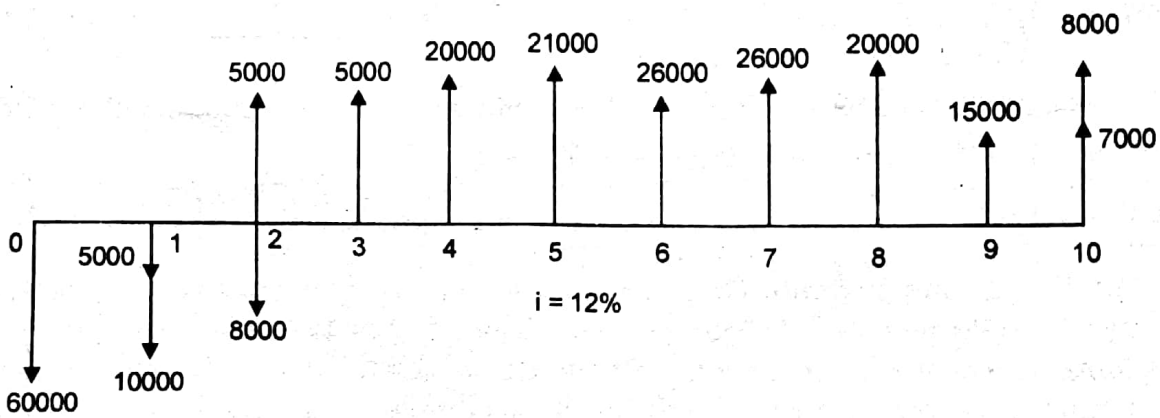
= (150000 × 4.7666) (0.9346)

Lumpsum amount = 668,229.7

6. In order to enter the market to produce a new toy for children, a manufacturer will have to make an immediate investment of Rs. 60,000 and additional investments of Rs. 5000 at the end of 1 year and 3000 more at the end of 2 years. Competing toys now are being produced by two large manufacturers, from a fairly extensive. study of the market it is believed that sufficient sales can be achieved to produce year-end before tax, net-cash flows as follows:

Year	1	2	3	4	5	6	7	8	9	10
Cash flow	–10000	5000	5000	20000	21000	26000	26000	20000	15600	7000

In addition, while it is believed that after 10 yeas the demand for the toy will no longer be sufficient to justify. Production, it is estimated that the physical assets would have a scrap value of about 8000. If capital is worth not less than 12% before taxes would you recommend undertaking the project? Make a recommendation with future method.



$$FW = -60000\,(F/P, 12\%10) - 10000\,(F/P, 12\%9) - 5000\,(F/P, 12\%9) - 8000\,(F/P, 12\%8) + 5000\,(F/P, 12\%8) + 5000\,(F/P, 12\%7) + 20000\,(F/P, 12\%\,6) + 21000\,(F/P, 12\%5) + 26000\,(F/P, 12\%\,4)\ 26000\,(F/P, 12\%3) + 20000\,(F/P, 12\%\,2) + 15000\,(F/P, 12\%1) + 7000 + 8000$$

$$= -186354 - 27731 - 13865.5 - 19802.9 + 12377 + 11053.5 + 39476.4 + 37010.4 + 40913.6 + 36527.4 + 25213.5 + 16800 + 15000$$

$$= -13511.4$$

The project is not recommended.

3.10 PAY BACK COMPARISON

The pay back method is an extremely simple method used to obtain a rough estimate of the time that an investment will take to pay for itself.

All methods used so far shows profitability of a proposed alternative for a study period of N. The pay back method, mainly indicates a projects liquidity rather than its profitability. The pay back method has been used as a measure of a project's riskness since liquidity deals with how fast an investment can be recovered. Pay back method calculates the number of years required for positive cash flows to equal the total investment.

The formula for obtaining a rough measure of the time an investment takes to pay for itself is simple to use and understand.

$$\text{Pay back period} = \frac{\text{Required investment}}{\text{Annual receipts} - \text{annual disbursements}}$$

$$= \frac{\text{First cost}}{\text{Net annual savings}}$$

In actual practice, the simple pay back formula is sometimes modified to recognize capital recovery through depreciation changes and to include without elaborations.

For example:

An investment of Rs. 1000 promises to return Rs.250 per year during its economic life of 5 years and yields.

$$\text{Pay back period} = \frac{1000}{250} = 4 \text{ years}$$

If the results of pay back calculations are questionable, wey are they used? There are at least two apparent reasons. First, they are simple calculations. Here, the depreciation and interest effects are ignored and the calculations are quick and easy and the results are intuitively logical.

Second, the other reason stems from a Bi-occupation with the flexibility of capital. If the money spent on an improvement is recovered rapidly the funds can be allocated again to other desired projects. Since, the pay back period criterion has serious weakneses, it should never be applied alone, it should only be applied as an aid in decision making.

Pay back method can also be calculated as follows : In this method it tells the no of years for an investment to pay for itself.

$$\text{Pay Back} = \frac{\text{Investment} - \text{salvage}}{\text{Operating Advantage / year}} = \frac{I - S}{OA / \text{year}}$$

The OA reflects the improvements in the flow either from increased income or decreased expenses or both but it does not yet *have a depreciation expenses—deducted* from it. Pay back measures how quickly the saving will recoup the investment amount. In its simplest form for the pay *back does not consider salvage values and taxes.*

However, when salvage and tax considerations apply, they should be included in the analysis. The investment should be reduced by the value of any salvage expected and the operating advantage should be after the tax advantages.

OA/Year after taxes = O/A/year – taxes/year

Problem 1. *The lake city bank is considering a purchase of a data processing storage unit which will cost Rs. 20,000 and will last 20 years and then have a guaranteed salvage value of Rs. 2000. It will generate savings of Rs. 4000/year before depreciation but necessioctes that Rs. 1000 of the savings must be paid in taxes. If management insists on a 5 year pay off period. Does this investment qualify.*

Solution:

Given Investment I = Rs. 20000

Expected life = 20 years

Salvage life 'S' = Rs. 2000

O.A/Years = Rs. 4000/years

Taxes paid = Rs. 1000/years

O/A/years. after taxes = OA/year – taxes = 4000 – 1000 = Rs. 3000

Pay off period = 5 yrs.

$$\text{W.K.T. Pay back period} = \frac{I - S}{OA/\text{year}} = \frac{20000 - 2000}{3000}$$

$$\text{P.B.} = \frac{18000}{3000} = 6 \text{ years}$$

Conclusion: The investment does not meet the management criteria as the pay back period is more than the required one. (*i.e.*,) 5 years

Problem 2. *The Manager of a manufacturing for a large m/c shop is considering an investment with the following flow:*

Year	1	2	3	4	5	6	7	8	9	10	11	12
The Flows	0	25	100	200	500	500	500	500	400	300	200	1000

The project will cost Rs. 450, the pay back ltd for the firm is 3 years. Should be accept or reject the proposal. What shortcomings in the pay back method does this problem illustrate.

Solution: Investment 'I' = Rs. 450

In this problem, we have to see in how many years we will get the capital invested back.

First year cash flow = 0

2nd year cash flow = Rs.25

3rd year cash flow = Rs.100

4th year cash flow = Rs.200

Total Rs. 325

But we need our capital Rs.450 back which is still short of Rs.125 in 4 years. So now we will see in how much time we will get back the remaining amount.

After 4th year, we are getting Rs. 500 in 5th year.

So Rs. 500 we get in 1 year

Re. 1 we will get in $\frac{1}{500}$

Rs. 125 we will get in $\frac{1}{500} \times 125 = 0.25$ years.

That means we will get our Rs. 450 back within 4.25 years. which is greater than the required pay back.

The operating advantage or cash flow after the pay back period are more than the pay back period. It is the major disadvantage.

Problem 3. *A Rs. 40,000 extrusion machine is expected to be obsolete after 10 years with no salvage value during its life time, it should generate on Rs. 8000/yr. of which Rs. 3000 must be paid in taxes. What is the pay off period.*

Solution:

Given I = Rs. 40,000

S = 0

Expected life = 10 years

O.A/year = Rs. 8000

Taxes/year = 3000 Rs.

O.A/year after taxes = 8000 – 3000 = Rs. 5000

$$\text{Pay back period} = \frac{I - S}{\text{O.A / year}} = \frac{40,000 - 0}{5,000} = 8$$

$\therefore$ Pay back period = 8 years.

Problem 4. *A new Rs.16,400 automatic m/c will have operating cost of Rs. 0.30/unit produced whereas the existing m/c costs are Rs. 0.70/unit. The existing m/c has a market value of Rs. 8700 now and has another 5 years. of life. It would cost Rs. 500 to remove the existing machine and install the new one. If the firm requires 3 years pay back period, how many units must be produced annually to justify new m/c disregard taxes. Given Data.*

Solution:

New m/c	*Old m/c*
Cost of new m/c = Rs.16,400	Cost of old m/c = Rs.8700
Operating costs = 0.30/unit	Operating costs = 0.70/unit
	Life = 5 years
Removing and Installation charges of old m/c	= Rs. 500
Pay back period	= 3 years.
Units produced annually	= ?

To Justify new m/c, means to go in for the new m/c

cost of the new m/c	= Rs. 16,400
Market value of old m/c	= Rs. 8,700
Investment	= Rs. 7,700

But, Removing & installation of old & new m/c

Cost = Rs. 500

∴ Net investment 'I = Rs. 8,200 (7700 + 500)

Net operating advantage/unit = (0.7–0.3) = 0.4/unit

If there are N units, total operating advantage = 0.4 × N

$$\text{Now, Pay back} = \frac{I-S}{OA} = \frac{8200-0}{0.4\times N}$$

$$3 = \frac{8200}{0.4\ N}$$

∴ N = 6,833 units/year are no. of units produced annually.

Advantages of Pay Back Method

1. Simple and quick to calculate.
2. Easy to understand.
3. A measure of time required, to return on original investment.

Disadvantages

1. If does not consider the economic life of investment.
2. Does not consider the total return on the investment.
3. Simple pay back does not consider the time value of money.

3.11 EXERCISE PROBLEMS

1. 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 project after five years is Rs.2,00,000. Draw a cash flow diagram of the project and find its present worth by as using i = 15% compounded annually.

End of years	*Maintenance & 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

2. Find the present worth of the following cash flow series. Assume i = 15% Compounded annually

End of	0	1	2	3	4	5
Cash flow Rs.	–10,000	30,000	30,000	30000	30000	30000

3. 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%.