2. Pay-back Period Method

This method is perhaps the most popular and widely recognised traditional technique employed by industrial practitioners for evaluating capital investment projects.

Pay-back Period may be defined as the time required to recover the initial investment in a project.

Merits :-

i) It is easy to calculate and simple to understand.

ii) Pay-back method provides further improvement over the ARR method.

iii) Pay-back method reduces the possibility of loss on account of obsolescence.

Demerits :-

i) It ignores the time value of money.

ii) It ignores all cash inflows after the pay-back period.

iii) It is one of the misleading evaluations of capital budgeting.

(a) When annual cash inflows are uniform or equal

Formula -

$$\text{Pay-back Period (PB)} = \frac{\text{Initial Investment}}{\text{Constant Annual Cash Flow}}$$

E.g. A project requires an investment of ₹ 2,00,000. It yields an annual cash flow of ₹ 40,000 for 9 years. Find out the pay-back period of the project.

Soln: Pay-back Period (PB) = $\frac{\text{Initial Investment}}{\text{Constant Annual Cash Inflow}}$

$= \frac{2,00,000}{40,000}$

= 5 years.

Therefore, the initial investment in the project will be recovered in 5 years.

E.g. A project costs ₹ 20,00,000 and yields annually a profit of ₹ 3,00,000 after depreciation @ 12·5% but before tax at 50%. Calculate the pay-back period of the project.

Soln:

Profit after depreciation	= ₹ 3,00,000
Less: Tax @ 50%	= ₹ 1,50,000
Profit after tax	= ₹ 1,50,000
Add: Depreciation [20,00,000 × 12·5%]	= ₹ 2,50,000
Cash Inflow After Tax (CIAT)	= ₹ 4,00,000

∴ Pay-back Period = $\frac{\text{Initial Investment}}{\text{CIAT}}$

$= \frac{20,00,000}{4,00,000}$

= 5 years.

Decision Criteria

i) For a single project if the actual Pay-back Period is less than the predetermined pay-back period, the project would be accepted. If not, it would be rejected.

ii) In case of mutually exclusive projects (i.e. alternative proposals), the project having the shortest pay-back period will be selected.

(b) When annual cash inflows are not uniform or unequal

If the annual cash inflows from an investment project varies from year to year, then the PB period can be calculated by cumulating the annual cash inflows till the time when the cumulative cash inflows become equal to the initial investment.

Illustration 9.

HP Ltd. is offered two options for investment with the following cash flows pattern. Its decision criterion is a pay back period of 4 years.

Particulars	Project A	Project B
Initial investment required	₹ 55,000	₹ 55,000
Estimated annual cash inflows after tax :	₹	₹
1st Year	5,000	9,000
2nd Year	8,000	12,000
3rd Year	10,000	15,000
4th Year	14,000	20,000
5th Year	18,000	21,000
6th Year	20,000	18,000

Which option would you prefer as a finance manager ?

Solution :

Here annual cash inflows pattern are not uniform and therefore, we have to calculate the cumulative cash inflows as follows :

Year	Project A		Project B	
	Cash Inflows [*CIAT*]		Cash Inflows [*CIAT*]	
	Annual	Cumulative	Annual	Cumulative
	₹	₹	₹	₹
1	5,000	5,000	9,000	9,000
2	8,000	13,000	12,000	21,000
3	10,000	23,000	15,000	36,000
4	14,000	37,000	20,000	56,000
5	18,000	55,000	21,000	77,000
6	20,000	75,000	18,000	95,000

It is evident from the above table that initial investment of ₹ 55,000 will be recovered within 5 years in case of project A. However, for project B, the cumulative cash inflow at the beginning of the fourth year amounts to ₹ 56,000, which exceeds the initial cost of investment of ₹ 55,000. Hence for project B, the pay back period lies somewhere between the 3rd and 4th year. Now by applying ***simple interpolation technique,*** we can find out the PB period (say, x) for project B as follows :

$$\frac{x-3}{4-3} = \frac{₹\ 55,000 - ₹\ 36,000}{₹\ 56,000 - ₹\ 36,000} \left[\frac{\text{Partial difference}}{\text{Total difference}}\right]$$

or, $\quad \frac{x-3}{1} = \frac{19,000}{20,000}$

or, $\quad x - 3 = 0{\cdot}95$

or, $\quad x = 3{\cdot}95$ years

Since the maximum acceptable payback period is 4 years, the project B (3·95 years) will be accepted over project A (5 years).

Post Pay-back Profitability Method

One of the major limitations of PB period method is that it does not consider the cash inflows earned after pay-back period and thus the real profitability of the project cannot be assessed. To improve over this method, it can be made by considering cash inflows earned after the pay-back period. Such returns are called 'post pay-back profits'.

Illustration 10.

An Engineering Company is considering the purchase of a new machine for which two possible options are available to them. You are requested to advise management as to the profitability of investment on the basis of post pay back profitablity :

	Machine X	Machine Y
Initial outlay	₹ 2,00,000	₹ 3,00,000
Estimated life (years)	10	14
Annual cash inflow after tax	₹ 25,000	₹ 30,000

[C.U.B.Com(H), 2012]

Solution :

Calculation of Pay Back Period (PB) :

$$PB = \frac{\text{Initial Investment}}{\text{Constant Annual Cash Inflow}}$$

$$\text{For Machine X} = \frac{₹2,00,000}{₹25,000} = 8 \text{ years}$$

$$\text{For Machine Y} = \frac{₹3,00,000}{₹30,000} = 10 \text{ years.}$$

Post Pay Back profitability :

	Machine X	Machine Y
Estimated life (in years)	10	14
Pay back period (in years)	8	10
Post Payback period (in years)	2	4
Constant annual cash inflow (after tax) [*CIAT*]	₹ 25,000	₹ 30,000
Post Pay Back Profitability	₹ 25,000 × 2	₹ 30,000 × 4
[Constant cash inflow p.a. × post payback period]	= ₹ 50,000	= ₹ 1,20,000
Post Pay Back Profitability Index		
$\left[\frac{\text{Post Payback Profitability}}{\text{Intial investment}} \times 100\right]$	$\frac{₹\ 50,000}{₹\ 2,00,000} \times 100$	$\frac{₹\ 1,20,000}{₹\ 3,00,000} \times 100$
	= 25%	= 40%

◗ Advise to the management :

It is quite clear from the above that if the company follows post pay back profitability method, Machine Y should be purchased as it gives more profit after pay back period.

However, it may be observed that if the company follows traditional pay back period method then Machine X should be purchased as it would appear more profitable due to shorter payback period than that of Machine Y. But after pay back period Machine Y contributes ₹ 70,000 (i.e., ₹ 1,20,000 – ₹ 50,000) more in respect of recovering its initial outlay. Hence, the company should go for Machine Y as it is more profitable to invest.

The above method for computing post payback profitability is applicable when annual cash inflows are uniform or equal. But when cash flows are not uniform, the following formula may be used for computing post payback profitability :

	₹
All expected cash inflows generated during the entire life of the project, including the recovery of working capital and scrap sale, if any	***
Less : Initial Investment of the project	(–) ***
Pay Back Profitability or Post Pay Back Profitability	***

Illustration 11.

Mahindra company is considering the purchase of a new Machine X, the price of which is ₹ 2,00,000. Cash inflows expected to be as under. Calculate Post Payback Profitability of Machine X.

Cost price	₹ 2,00,000
Effective life	4 years
Scrap value	Nil
Additional working capital required	₹ 20,000
Estimated cash inflows after tax :	
End of year 1	₹ 55,000
End of year 2	₹ 70,000
End of year 3	₹ 85,000
End of year 4	₹ 75,000

Solution :

All expected cash inflows generated in 4 years by Machine X is as follows :

₹ 55,000 + ₹ 70,000 + ₹ 85,000 + (₹ 75,000 + ₹ 20,000 i.e., recovery of working capital) = ₹ 3,05,000

Less : Initial investment (₹ 2,00,000 + ₹ 20,000) = ₹ 2,20,000

Post Payback Profitability ₹ 85,000

Here, Post Payback Profitability Index can be computed as follows :

$$= \frac{\text{Post payback Profitability}}{\text{Initial Investment}} \times 100$$

$$= \frac{₹\ 85,000}{₹\ 2,20,000} \times 100 = 38{\cdot}64\%$$

Illustration 22.

Pay back period for mutually exclusive projects where annual cash inflows are uniform.

ITC Ltd. has decided to purchase a machine to augment the company's installed capacity to meet the growing demand for its products. There are three machines under consideration of the management. The relevant details including estimated yearly expenditure and sales are given below :

All sales are on cash. Corporate Income Tax rate is 40%

	Machine 1	Machine 2	Machine 3
	₹	₹	₹
Initial investment required	3,00,000	3,00,000	3,00,000
Estimated annual sales	5,00,000	4,00,000	4,50,000
Cost of Production (estimated) :			
Direct materials	40,000	50,000	48,000
Direct Labour	50,000	30,000	36,000
Factory Overheads	60,000	50,000	58,000
Administration Costs	20,000	10,000	15,000
Selling and distribution costs	10,000	10,000	10,000

The economic life of Machine 1 is 2 years, while it is 3 years for the other two. The scrap values are ₹ 40,000, ₹ 25,000 and ₹ 30,000 respectively.

You are required to find out the most profitable investment based on 'Pay Back Method'.

[I.C.W.A. Inter, June, 1997]

Solution :

Statement showing calculation of Pay Back Period of three alternative machines

Particulars	Machine No.		
	1	2	3
	₹	₹	₹
Annual Cash Inflows :			
Estimated annual sales .....(A)	5,00,000	4,00,000	4,50,000
Estimated Costs :			
— Direct materials	40,000	50,000	48,000
— Direct Labour	50,000	30,000	36,000
— Factory Overhead	60,000	50,000	58,000
— Depreciation $\left[\frac{\text{Original Cost-Scrap Value}}{\text{Life of Machine}}\right]$	1,30,000	91,667	90,000
— Administration Cost	20,000	10,000	15,000
— Selling and Distribution Costs	10,000	10,000	10,000
Total Cost ..... (B)	3,10,000	2,41,667	2,57,000
Profit / Earnings Before Tax (*EBT*) [(A) – (B)]	1,90,000	1,58,333	1,93,000
Less : Tax @ 40 %	76,000	63,333	77,200
PAT / EAT	1,14,000	95,000	1,15,800
Add : Depreciation	1,30,000	91,667	90,000
Annual Cash Inflow After Tax (*CIAT*)	2,44,000	1,86,667	2,05,800
Initial Investment	3,00,000	3,00,000	3,00,000
Pay Back Period (Years) $\frac{\text{Initial Investment}}{\text{Annual Cash Inflow}}$	1·23	1·61	1·46
Rank	1st	3rd	2nd

Machine 1 has the lowest pay back period, hence it would be preferred to the other two machines.