N Pay-back Period Method

The period within which the initial investment of a project can be recovered fully is called **Pay-back Period.** How the pay-back period is determined in different circumstances is discussed below :

A. When an uniform cash inflow takes place every year : When an uniform cash inflow takes place every year —

$$\textbf{Pay-back period} = \frac{\textbf{Initial Investment}}{\textbf{Annual Cash Inflow}}$$

where —

	Profit after tax	***
Add :	Depreciation	***
	Annual cash inflow	***

Note : *No outflow of cash takes place for charging depreciation on asset. So, depreciation is to be added with the after tax profit in order to determine the inflow of cash.*

❑ **Example 1 :** A project requires an initial investment of ₹ 24,00,000. It is expected that the project will generate annually a profit of ₹ 5,00,000 after depreciation @ 12.5% but before tax at 40%. Determine the pay-back period.

• **Solution ⇒**

Statement of Annual Cash Inflow

Particulars		₹
	Profit before tax	5,00,000
Less :	Tax @ 40%	2,00,000
	Profit after tax	3,00,000
Add :	Depreciation $\left[\text{Rs. } 24,00,000 \times \frac{25}{2 \times 100}\right]$	3,00,000
	Annual cash inflow	6,00,000

$$\text{Pay-back period} = \frac{\text{Initial investment}}{\text{Annual cash inflow}} = \frac{24,00,000}{6,00,000} = 4 \text{ years.}$$

Hence, required pay-back period is 4 years.

B. When uniform cash inflow does not take place every year : When an uniform cash inflow does not take place from a project, the cumulative total of cash inflows in several years are to be determined. The cumulative total which is equal to the initial investment is considered as pay-back period.

❑ **Example 2 :** Om Ltd. is considering investing in a project requiring capital outlay of ₹ 4,00,000. Forecast for annual profit after depreciation but before tax is as follows :

Year	:	1st	2nd	3rd	4th	5th
Profit (₹)	:	80,000	1,00,000	1,40,000	1,10,000	90,000

If the rate of depreciation is 20% on original cost of the project and the rate of tax is 50%, calculate the pay-back period.

• **Solution ⇒**

Statement showing for Computation of Cumulative Total of Cash Inflows from the Given Project

Year	Profit before tax (₹) [I]	Tax @ 50% (₹) [II]	Profit after tax (₹) [I – II] = [III]	Depreciation (₹) [IV]	Cash inflow (₹) [III + IV]	Cumulative total of cash inflows (₹)
1	80,000	40,000	40,000	80,000	1,20,000	1,20,000
2	1,00,000	50,000	50,000	80,000	1,30,000	2,50,000
3	1,40,000	70,000	70,000	80,000	1,50,000	**4,00,000**
4	1,10,000	55,000	55,000	80,000	1,35,000	5,35,000
5	90,000	45,000	45,000	80,000	1,25,000	6,60,000

It is clear from the above table that the initial investment of ₹ 4,00,000 is recovered at the end of 3rd year. Hence, the required pay-back period is 3 years.

❑ **Example 3 :** A project requires an initial investment of ₹ 50,000. If the following amounts of cash inflows are taken place from the project in different years, determine the pay-back period.

Year	:	1	2	3	4	5
Cash Inflow (₹)	:	20,000	16,000	12,000	8,000	14,000

• **Solution ⇒** **Statement showing for Computation of Cumulative Total of Cash Inflows**

Year	*Cash inflows (₹)*	*Cumulative total of cash inflows (₹)*
1	20,000	20,000
2	16,000	36,000
3	12,000	48,000
4	8,000	56,000
5	14,000	70,000

It is clear from the above table that out of the initial investment of ₹ 50,000, ₹ 48,000 is recovered in 3rd year. So, the remaining balance of the initial investment of ₹ 2,000 is recovered in 4th year. But 4 year's cash inflow is ₹ 8,000. Thus we can say —

₹ 8,000 is recovered in 1 year

₹ 1 " " " $\frac{1}{8,000}$ "

₹ 2,000 " " " $\frac{1 \times 2,000}{8,000} = \frac{1}{4}$ year.

Thus, ₹ 48,000 is recovered in 3 years

Balance, ₹ 2,000 " " " $\frac{1}{4}$ "

Total ₹ 50,000 " " " $\left(3+\frac{1}{4}\right)$ " *or,* $3\frac{1}{4}$ *years.*

Hence required pay-back period is $3\frac{1}{4}$ ***years.***

C. **Determination of cash inflow :** In some cases, the inflows of cash are not given in the question. In such a case, the inflows of cash are to be determined in following way —

Statement of Cash Inflows

Particulars	₹	₹
Cash inflow from sales		***
Less : Operating cost including depreciation :		
— Cost of goods sold	***	
— Office & Administration overhead	***	
— Selling & Distribution overhead	***	
— Depreciation	***	
		***
EBIT		***
Less : Interest		***
EBT		***
Less : Tax		***
EAT		***
Add : Depreciation		***
Net Cash inflows		***

❑ **Example 4 :** Alpha Co. Ltd. is considering the purchase of a new machine for a proposed project. The estimated sales and costs for the project are being given below :

Annual Sales	₹ 14,00,000
Annual Costs :	
— Raw materials	₹ 4,00,000
— Direct wages	₹ 3,00,000
— Variable overheads	₹ 1,00,000
Other information :	
— Cost of the machine	₹ 10,50,000
— Estimated scrap value	₹ 50,000
— Estimated life of the machine	10 years
— Tax rate	50%

You are required to determine the pay-back period on the basis of above information.

• **Solution ⇒** **Statement of Annual Cash inflow**

Particulars		₹	₹
	Sales		14,00,000
Less :	Cost of raw materials	4,00,000	
	Direct wages	3,00,000	
	Variable overhead	1,00,000	
	Depreciation [*Note — (1)*]	1,00,000	
			9,00,000
	EBIT		5,00,000
Less :	Tax @ 50%		2,50,000
	EAT		2,50,000
Add :	Depreciation		1,00,000
	Annual Cash inflow		3,50,000

$$\text{Pay-back period} = \frac{\text{Initial investment}}{\text{Annual cash inflow}}$$

$$= \frac{10,50,000}{3,50,000} = 3 \text{ years.}$$

Hence, required pay-back period is 3 years.

Working Notes

1. Annual Depreciation

$$= \frac{\text{Cost} - \text{Scrap}}{\text{Life}} = ₹\left[\frac{10,50,000 - 50,000}{10}\right]$$

$$= ₹\ 1,00,000$$

It is assumed that all sales are made in cash and all expenses are paid in cash.

N.1. Accept-Reject Principle

Whether a proposed project will be accepted or rejected under the pay-back period method is decided in the following ways—

(i) **In case of a single project :** In case of a single project, the managers fix up a maximum pay-back period. If the pay-back period of a project is more than the maximum period fixed by the managers, then the project is rejected. On the other hand, if the pay-back period is less than the maximum period fixed by the managers, then the project is accepted.

(ii) **In case of two projects :** When one project has to be selected out of two given proposed projects, the project with lower the pay-back period is accepted.

(iii) **In case of mutually exclusive projects :** In case of mutually exclusive projects, the projects are arranged according to the ranks on the basis of their pay-back periods. The project which has shortest pay-back period will be given rank 1, the next shortest pay-back period will be given rank 2 and lowest ranking is given to a project with highest pay-back period. The project which has rank 1, will be the best project. So, that will be accepted first.

❑ **Example 5 :** Determine the pay-back periods for the following mutually exclusive projects and which project will you accept and why ?

Projects →	A	B	C	D
Initial Investments	₹ 1,00,000	₹ 2,00,000	₹ 3,00,000	₹ 4,00,000
Year ↓	*Cash inflow* ₹	*Cash inflow* ₹	*Cash inflow* ₹	*Cash inflow* ₹
1	40,000	70,000	1,00,000	1,20,000
2	30,000	60,000	90,000	1,30,000
3	20,000	60,000	80,000	1,00,000
4	20,000	40,000	40,000	50,000
5	20,000	40,000	40,000	1,00,000

• **Solution ⇒** **Statement of Cumulative Total of Cash Inflows**

Year	*Project—A* ₹	*Project—B* ₹	*Project—C* ₹	*Project—D* ₹
1	40,000	70,000	1,00,000	1,20,000
2	70,000	1,30,000	1,90,000	2,50,000
3	90,000	1,90,000	2,70,000	3,50,000
4	1,10,000	2,30,000	3,10,000	4,00,000
5	1,30,000	2,70,000	3,50,000	5,00,000

Statement of Pay-back Periods

Project	*Pay-back Periods*
A	$3 \text{ years} + \frac{10,000}{20,000} \text{ years} = \left(3+\frac{1}{2}\right) \text{ years} = 3\frac{1}{2} \text{ years}$
B	$3 \text{ years} + \frac{10,000}{40,000} \text{ years} = \left(3+\frac{1}{4}\right) \text{ years} = 3\frac{1}{4} \text{ years}$
C	$3 \text{ years} + \frac{30,000}{40,000} \text{ years} = \left(3+\frac{3}{4}\right) \text{ years} = 3\frac{3}{4} \text{ years}$
D	= 4 years

Ranking of the Project according to Pay-back Period

Project	*Pay-back period*	*Rank*
A	$3\frac{1}{2}$ years	2
B	$3\frac{1}{4}$ years	1
C	$3\frac{3}{4}$ years	3
D	4 years	4

It is clear from the above table that the Project B has least pay-back period. So, Project 'B' should be accepted.

❑ **Example 6 :** Hindusthan Chemicals Ltd. is considering the purchase of a new machine for its immediate expansion programme. There are three possible programmes. Their details are as follows :

Particulars		*Machines*		
		A	*B*	*C*
Capital cost	₹	6,00,000	9,00,000	12,00,000
Cost of raw materials	₹	4,50,000	6,00,000	7,50,000
Direct wages	₹	1,50,000	1,20,000	1,05,000
Factory overheads	₹	2,25,000	1,50,000	1,20,000
Administration overheads	₹	36,000	34,500	36,000
Selling & Distribution overheads	₹	15,000	18,000	21,000
Annual sales	₹	12,00,000	15,00,000	17,00,000
Estimated life of the machine	(Yrs.)	10	12	10
Estimated scrap value	₹	60,000	90,000	1,20,000

Other information :

(i) All payables and receivables will be settled promptly, strictly on cash basis with no outstanding from one accounting year to another.

(ii) Rate of taxation : 50%.

(iii) Rate of interest on capital : 10% p.a.

Determine the pay-back period of each machine and which machine should be installed and why ?

• **Solution ⇒** **Statement showing the Net Cash Inflows of the Three Machines A, B & C**

Particulars	*Machine—A*		*Machine—B*		*Machine—C*	
	₹	₹	₹	₹	₹	₹
Annual Sales		12,00,000		15,00,000		17,00,000
Less : Cost of raw materials	4,50,000		6,00,000		7,50,000	
Direct wages	1,50,000		1,20,000		1,05,000	
Factory overheads	2,25,000		1,50,000		1,20,000	
Administration overheads	36,000		34,500		36,000	

Selling & Distribution overheads	15,000		18,000		21,000	
Depreciation	54,000		67,500		1,08,000	
		9,30,000		9,90,000		11,40,000
EBIT		2,70,000		5,10,000		5,60,000
Less : Interest @ 10% of Capital Cost		60,000		90,000		1,20,000
EBT		2,10,000		4,20,000		4,40,000
Less : Tax @ 50%		1,05,000		2,10,000		2,20,000
EAT		1,05,000		2,10,000		2,20,000
Add : Depreciation		54,000		67,500		1,08,000
Net Cash inflow		1,59,000		2,77,500		3,28,000

Calculation Pay-back Period :

For Machine A : $\frac{6,00,000}{1,59,000}$ = 3.77 years

For Machine B : $\frac{9,00,000}{2,77,500}$ = 3.24 years

For Machine C : $\frac{12,00,000}{3,28,000}$ = 3.69 years

It is clear from the above calculation that the pay-back period of the Machine-B is least. So, the Machine-B should be installed.

Working Notes

Annual Depreciation = $\frac{\text{Cost} - \text{Scrap}}{\text{Life}}$.

∴ Depreciation of Machine A = $\frac{6,00,000 - 60,000}{10}$ = ₹ 54,000

Depreciation of Machine B = $\frac{9,00,000 - 90,000}{12}$ = ₹ 67,500

Depreciation of Machine C = $\frac{12,00,000 - 1,20,000}{10}$ = ₹ 1,08,000

It is assumed that the factory overheads do not include depreciation.

N.2. Advantages and Disadvantages of Pay-back Period Method

■ **Advantages :** The advantages of pay-back period method are —

(i) **Simplicity :** This method is very simple and it can be used easily. So, every firm irrespective of its size can follow this method.

(ii) **Easy to understand :** The concerned parties can easily understand this method due to its simplicity. So, the managers prefer this method.

(iii) **Less costly :** No costly machine, like computer, is needed for applying this method. An investment project can be evaluated manually. So, this method is suitable for the firms which are financially week and small in size.

(iv) **Very useful in case of quick replacement :** This method is very useful in evaluating those projects in which technological development takes place very rapidly and it involves the chance of quick obsolescence of the machine. Under this situation, a project having shortest pay-back period should be selected.

(v) **Liquidity :** The firms, which have cash problem, want to return the invested money very

quickly as soon as possible. So, a proposed project should be evaluated by applying this method for those types of firms. Because, under this method, that project is undertaken from which cash can be received back very quickly.

(vi) **Helps in determining the time of dividend payment :** The length of time within which the invested money can completely be realised is known with the help of the pay-back period. So, with the help of this method, a newly formed company can decide the time from which it should start paying dividend.

(vii) **Very suitable in uncertainty :** The more the lengths of time period, the more is the degree of risk and uncertainty. So, the firms which have more degree of risk and uncertainty, they should evaluate their proposed project by using this method. Because, under this method, the project which has shortest pay-back period is considered as the best one.

■ **Disadvantages :** The disadvantages of pay-back period method are —

(i) **Ignoring the return for the post pay-back period :** This method ignores the returns generated by a project after its pay-back period. So, if a project is selected on the basis of this method, then there is a possibility of mistake. Suppose, we have to select one of the following two projects :

Particulars	*Project-A*	*Project-B*
Initial Investment	₹ **15,000**	₹ **15,000**
Returns :		
1st year	₹ 5,000	₹ 4,000
2nd year	₹ 5,000	₹ 4,000
3rd year	₹ 5,000	₹ 4,000
4th year	—	₹ 4,000
5th year	—	₹ 4,000
Pay-back period	3 years	3.75 years

In this case, project A should be accepted, because it has shortest pay-back period. But it is not correct, because more return will be generated by the project B even after recovering its initial investment of ₹ 15,000. So, project B is more profitable than project A if the lifetime return is considered.

(ii) **Ignoring the time value of money :** The time value of money is not considered in evaluating a proposed project by this method. As for instance—

Particulars	*Project-A*	*Project-B*
Initial Investment	₹ **20,000**	₹ **20,000**
Returns :		
1st year	₹ 3,000	₹ 12,000
2nd year	₹ 5,000	₹ 5,000
3rd year	₹ 12,000	₹ 3,000

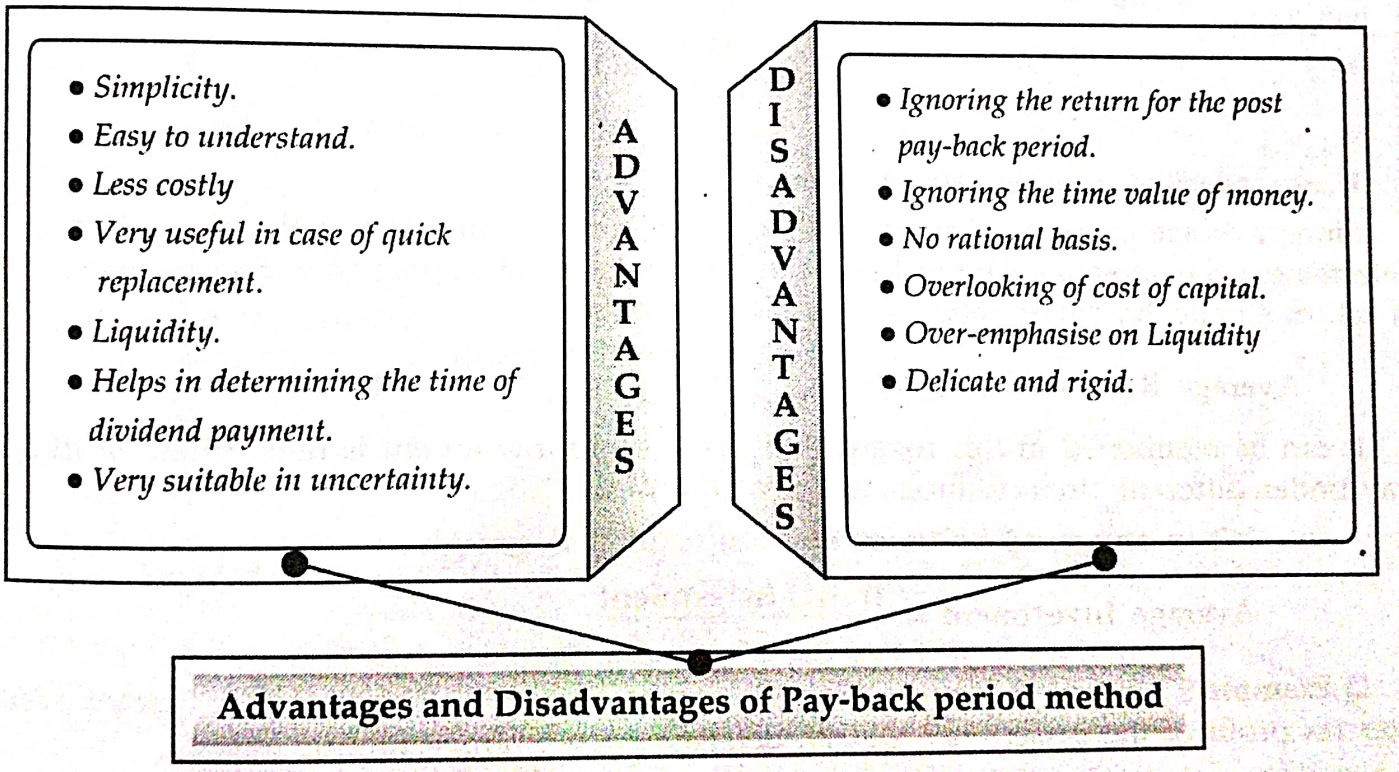
Both the projects are equally attractive according to the pay-back period method as the pay-back period of each of them is 3 years. However, project B is preferable, because in the case of project B, out of the initial investment of ₹ 20,000, ₹ 12,000 is to be recovered in the first year.

(iii) **No rational basis :** Under this method, the managers fix up a maximum pay-back period in order to take accept-reject decisions. If the pay-back period of a project is more than the maximum period, then the project is rejected, and if it is less, then the project is accepted. But there is no rational basis for fixing the maximum pay-back period. The managers fix up this standard according to their decision and it involves a good deal of subjectivity. So, if there is any mistake in fixing the standard then there will be a mistake in the selection process of project.

(iv) **Overlooking of cost of capital :** The cost of capital is an important factor in case of taking optimum investment decision. But the concept of the cost of capital is ignored completely in case of taking investment decision in this method.

(v) **Over emphasise on Liquidity :** This method over emphasises the importance of liquidity as a goal of capital expenditure. In this case, investment decision is taken with an eye to how soon the invested money can be recovered. But the profitability of the project is not considered here.

(vi) **Delicate and rigid :** If the operation cost of the firm is changed stightly for any reason, the inflows of cash will be affected. As a result, the pay-back will also be affected.



Advantages and Disadvantages of Pay-back period method