

CHAPTER 5

CAPITAL BUDGETING / INVESTMENT APPRAISAL UNDER CERTAINTY (FUNDAMENTAL)

This topic is one that can confidently be referred to as the foundation or backbone of financial management around the world, and the reason for this is not farfetched. Financial management deliberates on the judicious use of the organisation's funds on a worthwhile or profitable investment. The question therefore is, how can you possibly determine a profitable investment without first appraising it? I am sure you are getting my drift of the importance of this topic.

In this chapter, I only wish to lay a solid foundation on different concepts of capital budgeting with specific emphasis on ensuring that rookie or newbie gets the core knowledge needed to ace this course. Then when the foundation has been well laid, we shall now progress to the advance stage of capital budgeting. By advance, I don't mean 'advanced advanced', since it will be way beyond the scope of this book and may end up jeopardizing the purpose of simplicity. So, the fundamental stage is for a fresher in the university, while the advanced stage is for MBA students, got that?. Alright, lets ride!

5.1 CONCEPT OF CAPITAL BUDGETING

Most times, organisations are engaged in different investment activities that revolve around replacement of machinery, development and innovation of new products, establishment of new plants or research and development. These projects are usually funded by the organisation's long term funds (debt, equity or even retained earnings), since these projects usually have a life span that exceeds one year. So, when an organisation undertakes a planning process that involves determining whether it should invest in any of these projects [as mentioned above], by appraising the feasibility of such project(s) on the basis of the ability of those investments to increase the net worth of that organisation or to increase the wealth of shareholders, that organisation is said to be engaged in capital budgeting or investment appraisal.

Capital budgeting may be defined as the investment of financial resources on a project with the aim of realizing benefits (profits) in the future over a period of time. It may also be defined as the process of conceiving, analyzing, evaluating and selecting the most profitable project for investment.

Ever wonder why it is called capital budgeting under certainty? Well, it is so called because it is assumed that the investor who is budgeting for capital has a foreknowledge of the market conditions, is aware of investment opportunities, or can even determine or accurately predict expected returns from each of the investment.

5.2 INVESTMENT DECISION PROCESS

The process of investment decision are:

1. Identify potential or possible investment projects.
2. Identify alternatives to the projects.
3. Source for data /information on projects.
4. Evaluate data based on available projects.
5. Select the best project.
6. Implement the project.
7. Project monitoring and control.

5.3 TYPES OF INVESTMENT DECISIONS

These are varying types of investment decisions, the most common being:

1. Expansion of existing business.

2. Creation of new business.
3. Replacement and modernization.
4. Automating a process.
5. Market development and new product introduction.

5.4 CHARACTERISTICS OF A GOOD CAPITAL BUDGETING DECISION

1. They involve a commitment of a huge amount of funds.
2. They are mostly irreversible.
3. It should state projects to be accepted or rejected.
4. It can be applied to all capital budgeting decisions.
5. It should recognize the time value of money.
6. It should help in the ranking of projects.
7. The project must realize future benefits over a reasonable long period into the future.
8. It should aid the decision maker in choosing the best project from competing projects.

5.5 PROJECTS CLASSIFICATION

1. **Independent projects:** projects are said to be independent if the acceptance or rejection of one project does not affect the acceptance or rejection of the other. Let me explain further, it means if I decide to accept project A, it does not disturb me from accepting project B, especially if both projects A and B have positive NPVs or if I have the capital to execute both projects. It means if I accept project A, I can also accept project B, on the condition that they are not competing projects, if projects A and B is positive and if I have the financial muscle to muster both projects.

2. **Mutually exclusive projects:** unlike independent project, mutually exclusive projects constrain or confine someone to a choice. Projects are said to be mutually exclusive if the acceptance of one project only leads us to the rejection of the other. It means even if we have enough capital to accept both projects and they both have positive NPVs, it is one and only one project that can be accepted, that is, the better project. In that case, the other must be rejected. Let me paint a clearer picture. Imagine two cities A and B that intends to start trading with each other but are divided by a lagoon. They have the choice of either building a bridge across the lagoon or making a boat to aid transportation of their goods, but not to do both. Inadvertently, both cities are involved in mutually exclusive projects.

However, there is one important information I want you to take home, that is if you are not reading this book at home already (laughs). Please note that when you hear of the conflict existing between NPV and IRR, always know that the root cause of that conflict as regards which is better, is due to the fact that both projects are mutually exclusive. If they were independent projects there wouldn't be a need for conflict, since both project can be selected. I will discuss extensively on this much later in the "advance capital budgeting topic" subsequently.

3. **Conventional or Normal cash flow projects:** Put succinctly, these are projects that initial have outlays or outflows, and are then followed by inflows in the successive years without any interruption of outflows. They have a high degree of certainty or generating positive cash flows over a short period of time. e.g.

Period	0	1	2	3	4	5
Cash flows	-1,000	200	500	900	300	750

Or

Period	0	1	2	3	4	5
Cash flows	-1,000	-200	500	900	300	750

4. **Non-Conventional or Non-Normal cash flow projects:** These are projects that have outflows even after inflows have begun. It is an admixture of both inflows and outflows in no particular order e.g.

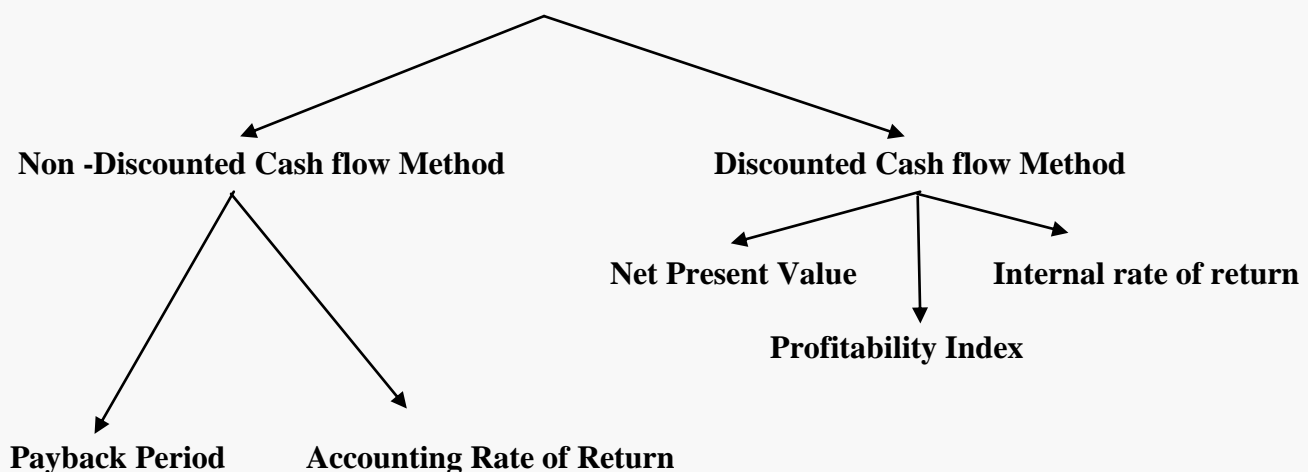
Period	0	1	2	3	4	5
Cash flows	-1,000	200	500	900	300	-750

Or

Period	0	1	2	3	4	5
Cash flows	-1,000	-200	500	-900	300	750

Just like the mutually exclusive project, they also have their own down sides. On a good day, a project can only have one NPV and one IRR. But for the non-conventional or non-normal projects the reverse seems to be the case. Non-conventional projects have the tendency of providing ‘multiple IRRs’ for one project”. See advance capital budgeting topic for example and explanation.

TECHNIQUES FOR EVALUATING PROJECTS



Note: The Payback period and the Accounting rate of return are called the traditional method.

5.6 PAYBACK PERIOD

It is defined as the time required by an investor or an organization to recover the total capital outlay invested from the stream cash flows. This technique seeks to determine the period (in years or the number of years), it will take a project to recover or repay the initial cost or outlay invested in that

project. It should be noted that if a project has a fixed cash inflows , then the payback period will be expressed as:

$$= \frac{\text{Project cost or outlay}}{\text{Annual Cash inflows}}$$

5.7 ADVANTAGES OF P.B.P

1. It is used when the degree of risk is high.
2. It shows how soon it will take to recover the cost of purchasing an asset.
3. It is simple to use and understand.
4. It acts as a yardstick for comparing the profitability of two projects.

5.8 DISADVANTAGES OF THE P.B.P

1. It does not consider the time value of money.
2. It does not state if the wealth of the shareholders is being maximized.
3. It does not consider the total cash flows of the project.
4. It does not take into account the cash flows that may arise from the scrap value at the end of the project's life, particularly if the scrap value is very significant.
5. It fails to realize that actual profitability is based on the number of years it will keep operating after the payback period.

ILLUSTRATION 1

Mr. John Smith is considering an investment project costing \$100,000. The cash inflows for the project are estimated at \$25,000 annually for 7 years. How long will it take for the initial outlay to be repaid if the payback period (P.B.P) is used to appraise the project?

SOLUTION

How to solve

METHOD 1

$$\text{P.B.P} = \frac{\text{Project cost or outlay}}{\text{Annual Cash inflows}}$$

$$= \frac{\$100,000}{\$25,000}$$

Payback period = 4 years.

Note: The 7 years given in the question is immaterial in this case, since there is a constant cash flow.

DECISION

Mr. John Smith should accept the project since he will be able to recover the initial outlay in 4 years time.

Note: I must warn you that this formula can only be applied or used when the annual cash flows are the same or constant all through. Let's check out this other method.

METHOD 2

Draw four columns in the following order:

Column 1 = Period

Column 2 = Cash Inflows

Column 3 = Payment.

Column 4 = Balance/ Year Ended.

The first step is to input the number of years in the period column starting from 0. The zero represents the time or beginning when the outlay or cost of the project was taken out of the pocket or account and set aside for the purpose of investment.

Period/year	Cash inflows \$	Payment \$	Bal/year ended \$
0			
1			
2			
3			
4			
5			
6			
7			

The next step is to input the cash inflows in the second column as provided in the question. i.e. 25,000 each year for 7 years, now the 7 years becomes relatively material or important in this context.


Period/year	Cash inflows \$	Payment \$	Balance/year ended \$
0	-		(100,000)
1	25,000		
2	25,000		
3	25,000		
4	25,000		
5	25,000		
6	25,000		
7	25,000		

You will notice that in period 0, in the cash inflows column what you have there is a dash meaning that there was no cash inflow but outflows, which has to be paid for. This goes into the balance column and will be bracketed indicating cost.


A+ in Financial Management

The next step is to start “paying back” the outlay with each year’s respective cash inflows, then writing its balance in the 4th or balance column. See below for more explanation.


For year 1 below, he paid \$25,000 from a cost of \$100,000 the balance is \$75,000. See below:

Period/year	Cash inflows \$	Payment \$	Bal/year ended \$
0	-	-	(100,000)
1 	25,000	25,000	(75,000)
2	25,000		
3	25,000		
4	25,000		
5	25,000		
6	25,000		
7	25,000		

For year 2 below, he paid \$25,000 again from a cost of \$75,000 the balance is \$50,000. See below:

Period/year	Cash inflows \$	Payment \$	Balance/year ended \$
0	-	-	(100,000)
1	25,000	25,000	(75,000)
2 	25,000	25,000	(50,000)
3	25,000		
4	25,000		
5	25,000		
6	25,000		
7	25,000		

For year 3 below, he paid \$25,000 again from a cost of \$50,000 the balance is \$25,000. See below:

Period/year	Cash inflows \$	Payment \$	Balance/year ended \$
0	-	-	(100,000)
1	25,000	25,000	(75,000)
2	25,000	25,000	(50,000)
3 	25,000	25,000	(25,000)
4	25,000		
5	25,000		
6	25,000		
7	25,000		

For year 4 below, he paid \$25,000 again from a cost of \$25,000 the balance left is now 0. Meaning he paid back the initial cost outlay of \$100,000 after 4 years. The remaining cash flows therefore become his. So, since he can pay back his initial outlay, the project should be accepted.


Period/year	Cash inflows \$	Payment \$	Balance/year ended \$
0	-	-	(100,000)
1	25,000	25,000	(75,000)
2	25,000	25,000	(50,000)
3	25,000	25,000	(25,000)
4	 25,000	25,000	-
5	25,000		
6	25,000		
7	25,000		

ILLUSTRATION 2

James Brown invested in a new business machinery costing \$500,000. The annual cash flows of the machinery are as follows:

Year 1	\$100,000
Year 2	\$150,000
Year 3	\$80,000
Year 4	\$80,000
Year 5	\$90,000
Year 6	\$85,000

Determine the viability of the project using payback period for the project.

SOLUTION

How to solve

The previous processes followed will be used in solving this question.

Period/year	Cash inflows \$	Payment \$	Balance/year ended \$
0	-	-	(500,000)
1	100,000	100,000	(400,000)
2	150,000	150,000	(250,000)
3	80,000	80,000	(170,000)
4	80,000	80,000	(90,000)
5	90,000	90,000	-
6	85,000		

The P.B.P = 5 years. The years with the dash (-).

Decision: Accept project because the initial outlay can be paid back in 5 years time.

EXPLANATION

The total outlay for the project was \$500,000 in the balance column. If he paid \$100,000 that came in as the cash inflow for the 1st year, the balance now becomes \$400,000. i.e. The amount owing or left to be paid. Furthermore, \$150,000 was paid from the balance of \$400,000 in the first year, leaving him with a balance of \$250,000. In the same vein, \$80,000 was paid in the 3rd year from a previous balance of \$250,000 that gave a new balance of \$170,000. Again, he paid the second \$80,000 in the 4th year from the previous balance of \$170,000 to leave him with a balance of \$90,000. The final balance of \$90,000 was paid with the cash inflow of the 5th year, leaving with no balance. It therefore means that it took James Brown 5 years to payback the initial outlay. Therefore, James Brown is advised to accept the project on the basis of payback period.

ILLUSTRATION 3


Janet Pierce was advised by her brother to invest in a certain lucrative project gulping \$50,000. The annual returns on investment are given as follows:

YEAR	RETURN (\$)
1	30,000
2	15,000
3	12,000
4	8,000

Use the payback period to determine the feasibility of the project.

SOLUTION

How to solve

Period/year	Cash inflows \$	Payment \$	Balance/year ended \$
0	-	-	(50,000)
1	30,000	30,000	(20,000)
2	15,000	15,000	(5,000)
3	 12,000		
4	8,000		

If you take a very critical look at the balance of the 2nd year, you will notice that it's \$5000. However, funny enough, the cash inflow for the subsequent year is \$12,000, quite confusing you might say i.e. the amount or balance she has left to pay is less than the cash inflows to be used for it's payment.

Don't worry, you will learn how this is done right away. Anytime you see this type of situation, all you need do is to put the balance to be paid as numerator and the cash inflows to be used for payment in that year as the denominator, in the payment column for that year, as shown below:

Period/year	Cash inflows \$	Payment \$	Balance/year ended \$
0	-	-	(50,000)
1	30,000	30,000	(20,000)
2	15,000	15,000	(5,000)
3	12,000	<u>5,000</u> ← = 0.42 12,000	-
4	8,000		

Therefore, the payback period is 2 years + 0.42 years = 2.42 years. Some authors/lecturers will prefer that you express your answers in years and months. To achieve this, all you need to do is to multiply the last calculation by 12 months. See below:

Period/year	Cash inflows \$	Payment \$	Balance/year ended \$
0	-	-	(50,000)
1	30,000	30,000	(20,000)
2	15,000	15,000	(5,000)
3	12,000	<u>5,000</u> ← x 12 12,000 = 5	-
4	8,000		

P.B.P = 2 years + 5 months

Therefore, the payback period is approximately 2 years 5 months. The question now is should Janet Pierce accept the or reject the project? Janet Pierce will accept the project since she can pay back the capital outlay.

ILLUSTRATION 4

Kenneth Kuffor is faced with a major executive decision about the choice of a project from two competing projects costing \$120,000 each. The criteria for the choice of a better project are based on the payback period. The following data are related to these individual projects that are MUTUALLY EXCLUSIVE.

	PROJECT A \$	PROJECT B \$
Yr1	40,000	100,000
Yr2	50,000	80,000
Yr3	60,000	40,000
Yr4	70,000	30,000

You are required to determine a better profit using P.B.P.

SOLUTION

How to solve

I guess you now know the meaning of mutually exclusive, from the explanation made earlier. I must also state here that since there are two projects (A and B) they will be calculated separately.

Let's start our calculations.

Project A				Project B			
Period	Cash flows \$	Payment \$	Balance \$	Period	Cash flow \$	Payment \$	Balance \$
0	-	-	(120,000)	0	-	-	(120,000)
1	40,000	40,000	(80,000)	1	100,000	100,000	(20,000)
2	50,000	50,000	(30,000)	2	80,000	<u>20,000</u> 80,000 = 0.25	
3	60,000	<u>30,000</u> 60,000 =0.5	-	3	40,000		
4	70,000			4	30,000		

A's P.B.P is $2 + 0.5 = 2.5$ years or 2 years 6 months

B's P.B.P is $1 + 0.25 = 1.25$ years or 1 year 3 months

From the above we can deduce that both projects can payback their outlays, but the better of the two must be selected, since they are mutually exclusive.

So what do you think Mr. Kenneth Kuffor should do? He should accept Project B, and this is based on the fact that it has an earlier or shorter payback period than project A.

5.9 USING THE CUMULATIVE METHOD FOR PAYBACK PERIOD

Another popular method that can be used for solving payback period is using the cumulative method.

ILLUSTRATION 5

Using a previously solved example, James Brown invested in a new business machinery costing \$500,000. The annual cash flows of the machinery are as follows:

Period	Cash inflows
Year 1	\$100,000
Year 2	\$150,000
Year 3	\$80,000
Year 4	\$80,000
Year 5	\$90,000
Year 6	\$85,000

Determine the payback period of the project.

SOLUTION

How to solve

Draw three columns in the following order:

Column 1 = Period

Column 2 = Cash Inflows

Column 3 = Cumulated cash flows

The first step is to input the number of years in the period column starting from 1.

Period/year	Cash inflows \$	Cumulated Cash flows \$
1		
2		
3		
4		
5		
6		

The second step is to input the cash inflows in the second column as provided in the question. See table below:

Period/year	Cash inflows \$	Cumulated Cash flows \$
1	100,000	
2	150,000	
3	80,000	
4	80,000	
5	90,000	
6	85,000	

The third step is to cumulate the cash flows:

Period/year	Cash inflows \$	Cumulated Cash flows \$
1	\$100,000	\$100,000
2	\$150,000	\$250,000
3	\$80,000	\$330,000
4	\$80,000	\$410,000
5	\$90,000	\$500,000
6	\$85,000	\$585,000

The fourth step, look for the period where the cumulated value is equal to the initial outlay of \$500,000 to know the payback period.

In this example, the payback period is 5 years .

You can use any method approved in your school, but the first method is commonly used.

ILLUSTRATION 6

Kenneth Kuffor is faced with a major executive decision about the choice of a project from two competing projects costing \$120,000 each. The criteria for the choice of a better project are based on the payback period. The following data are related to these individual projects that are **MUTUALLY EXCLUSIVE**.

	PROJECT A	PROJECT B
	\$	\$
Yr 1	40,000	100,000
Yr 2	50,000	80,000
Yr 3	60,000	40,000
Yr 4	70,000	30,000

Recommend the better project using the Payback period.

SOLUTION

How to solve

Step 1: Cumulate the individual projects' cash flows

Period/year	Cash inflows A	Cumulated A	Cash inflows B	Cumulated B
	\$	\$	\$	\$
1	40,000	40,000	100,000	100,000
2	50,000	90,000	80,000	180,000
3	60,000	150,000	40,000	220,000
4	70,000	220,000	30,000	250,000

Step 2: Check the cumulative columns of project A and B for any one that has the outlay of \$120,000

NOTE: If you check the cumulated cash flows columns for A and B, you will notice that there is no point where any value is exactly equal to the initial outlay of \$120,000.

So we compute accordingly. Solving for Project A.

1. Look at the cumulated column of A for the value that is closest to \$120,000 i.e. the initial outlay. Note that the value has to be lesser than the initial outlay. For cumulative column of project A the value that is closer to the initial outlay is \$90,000, occurring in period 2.
2. Deduct this \$90,000 from the initial outlay. $(\$120,000 - \$90,000) = \$30,000$.

Period/year	Cash inflows A	Cumulated A	
	\$	\$	
1	40,000	40,000	
2***	50,000	90,000	$120,000 - 90,000 = 30,000$
3	60,000	150,000	
4	70,000	220,000	

- Now make this \$30,000 the numerator of the next immediate cash flow in “Cash inflows A” column i.e. \$60,000 multiplied by 12 months. See below:

$$= \frac{\$30,000}{\$60,000} \times 12 \text{ months} = 6 \text{ months}$$
- The payback period is the period where the closest value to the initial outlay occurred i.e. period 2, the one asterisk above + the months calculated.

The payback period for Project A = 2 years 6 months.

Solving for Project B

- Look at the cumulated column of project B for the value that is the closest to \$120,000 i.e. the initial outlay. Note also that the value has to be lesser than the initial outlay. For cumulative B, the value is \$100,000, occurring in period 1.
- Deduct this \$100,000 from the initial outlay. $(\$120,000 - \$100,000) = \$20,000$

Period/year	Cash inflows B \$	Cumulated B \$	
1***	100,000	100,000	$120,000 - 100,000 = 20,000$
2	80,000	180,000	
3	40,000	220,000	
4	30,000	250,000	

- Now make this \$20,000 the numerator of the next immediate cash flow in the “Cash inflows B” column i.e. \$80,000 multiplied by 12 months.

$$= \frac{\$20,000}{\$80,000} \times 12 \text{ months} = 3 \text{ months}$$
- The payback period is the period where the closest value to the initial outlay occurred i.e. period 1 asterisked above + the months calculated.

The payback period for Project B = 1 year 3months

Now comparing both projects (A and B’s) payback periods, the better project is the one with the lesser payback period i.e. Project B.

ILLUSTRATION 7

Professor Bush is planning to invest in a project costing \$75,000. The life span of the project is 4 years, and has the following information:

Year	Cash flow \$
1	35,000
2	15,000
3	10,000
4	10,000

Using the payback period determine the viability of the project.

SOLUTION

Period/year	Cash inflows \$	Payment \$	Balance/year ended \$
0	-	-	(75,000)
1	30,000	(35,000)	(40,000)
2	15,000	(15,000)	(25,000)
3	10,000	(10,000)	(15,000)
4	10,000	(10,000)	(5,000)

Notice anything funny about this solution? At the end of the 4th year, we still have a balance of \$5,000 yet unpaid. In this case, all we need do is to reject the project since the outlay cannot be paid, “we cannot recoup our investment”.

Note: there is a concept known as the **discounted payback period**. Please check that out under the topic “capital budgeting under uncertainty” in the later part of this book.

5.10 DISCOUNTED CASH FLOW METHOD

It is a capital budgeting technique which considers the time value of money and the total benefit accrued to that project during the period of its existence. Now, let’s chit-chat a bit about discounted cash flow. Since you are just learning this I need to explain it as much as possible. The cash flows provided for the purpose of appraising project under this technique are usually the **after-tax cash flows**. This means, we are not using profit or cash flows that include tax. Furthermore, the cash flows are future value cash flows or cash flows at the end of each period, that is why it is certainty in the first place.

Since, cash flows provided are futuristic, we therefore need to discount these cash flows to the present values or “the now, this instant, as in this moment”, bringing the future to the now. So when we use the cost of capital to discount or “reduce” the future value to the present value, then we have discounted the cash flows.

I am sure at some point in your class, you would have heard something like “should I give you \$100 now or give you the same \$100 in 12 months time, puzzled right? Well, it is better you take that \$100 now, because you can invest that money in an account that can grow it to \$109 at the end of the 12 months period. Besides that, uncertainty of the future may render the future \$100 worthless. What if inflation rate rises astronomically, it obviously affects the \$100 negatively by reducing its actual value. On the other hand, what if the person promising you the \$100, dies on or before the agreed date, you lose all your stakes. So, can you now see the importance of time value of money? The major discounted cash flow methods are:

- 1. NPV = Net Present Value.
- 2. IRR = Internal Rate of Return.
- 3. PI = Profitability Index.

5.11 NET PRESENT VALUE

The Net Present Value or the NPV as is popularly called is an investment appraisal technique used to assess the worth, viability or profitability of a project by finding the difference between the present value of cash outflows and the present value of cash inflows over a period of time. The edge this technique has over other techniques is based on the fact that it takes the **time value of money** into consideration, it also considers all the after-tax cash flows and not profit. This technique is the best for

capital investment appraisal. It has been argued that whenever there is a conflict or rivalry amongst the techniques in terms of superiority, then the NPV will be selected **because it has the characteristics of adding value.** Most importantly, note that the NPV is an absolute investment appraisal technique while the IRR is a relative appraisal technique.

Decision rule:

If calculated NPV > 0 = Accept the project.

If calculated NPV < 0 = Reject the project.

If calculated NPV = 0, then it is no more NPV but IRR.

5.12 ADVANTAGES OF THE NET PRESENT VALUE

- 1 It takes the time value of money into account.
- 2 It tells if the shareholders' wealth is maximized or not.
- 3 It considers all the after-tax cash flows of the whole project.
- 4 It aid or eases the comparison of two projects.

5.13 DISADVANTAGES OF THE NET PRESENT VALUE.

- 1 It assumes that the discount rate is known and constant.
- 2 Its result cannot be termed the best when there are more than one projects with different outlays.
- 3 It does not render an accurate picture in case of alternative projects or where projects with limited funds have unequal lives.
- 4 It is prone to forecasting error.

ILLUSTRATION 1

Kunle Amusan is considering a project whose capital outlay is \$20,000. If the cash flows to be generated for the next 4 years are \$10,000, \$20,000, \$15,000, and \$8,000 respectively. Using a 10% cost of capital, calculate the Net Present Value (NPV) of the project suggesting whether the project be accepted or rejected.

SOLUTION

How to solve

$$NPV = \sum \frac{A_t}{(1+r)^t} - Co$$

Where A_t = cash flow per period

t = period or year

r = cost of capital or discount rate

Co = capital outlay

Method 1

1. Write down the cash flows horizontally with a (+) sign in between them minus the initial outlay. See below:

$$\begin{array}{cccc} \text{Yr 1} & \text{yr2} & \text{yr3} & \text{yr4} \\ (10,000 + 20,000 + 15,000 + 8,000) - 20,000 \end{array}$$

2. Divide each of the cash flows by the discounting factor.
 $(1 + r)^t = (1 + 10\%) = (1 + 0.10) = (1.1)$

$$\begin{array}{cccc} \text{Yr 1} & \text{yr2} & \text{yr3} & \text{yr4} \\ \frac{10,000}{(1.1)} + \frac{20,000}{(1.1)} + \frac{15,000}{(1.1)} + \frac{8,000}{(1.1)} - 20,000 \end{array}$$

Note the '1' that comes before the 10% in point 2 above is always constant and the 'r' represents the cost of capital given in the question.

3. Now the next step is to raise the denominators or discounting factors to the power of their respective years as shown below:

$$\begin{array}{cccc} \text{Yr 1} & \text{yr2} & \text{yr3} & \text{yr4} \\ \frac{10,000}{(1.1)^1} + \frac{20,000}{(1.1)^2} + \frac{15,000}{(1.1)^3} + \frac{8,000}{(1.1)^4} - 20,000 \end{array}$$

4. Then we use scientific calculator to get the value of the project. If you divide correctly you should have.

$$\begin{array}{cccc} \text{Yr 1} & \text{Yr2} & \text{Yr3} & \text{Yr4} \\ 9090.91 + 16,528.93 + 11,269.72 + 5464.11 - 20,000 \\ \text{NPV} = \$42,353.67 - \$20,000 = \$22,353.67 \end{array}$$

Decision: Accept the project since the NPV is positive and it increases Kunle Amusan's wealth by **\$22,353.67**.

Due to the "over simplicity" of this method, it has severally been discouraged by lecturers in many higher institutions, therefore giving rise to the second method below. You can however use it, if the method is accepted in your university, polytechnic or college of education.

Method 2

Draw four columns in the following order:

Column 1 = Period.

Column 2 = Cash flows.

Column 3 = Discounting factor.

Column 4 = Present value.

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The first step is to input the number of years in the period column starting from 0. Period zero represents the time or the beginning when the capital outlay was taken out of the pocket or account and set aside for investment.

Period	Cash flows \$	Discounting factor	Present value \$
0			
1			
2			
3			
4			

The second step is to input the cash inflows in the second column as provided in the question.

Period	Cash flows \$	Discounting factor 10%	Present value \$
0	(20,000)		
1	10,000		
2	20,000		
3	15,000		
4	8,000		

Note that the cash outlay or initial outlay as it were, will be written in the second column beside period zero and bracketed. See table above.

The third step is to calculate the discounting factor and input same in the third column. Nevertheless, let me give you a quick rundown of how to calculate the discounting factor:

The formula is $\frac{1}{(1+r)^n}$ or $(1+r)^{-n}$

Where 1 is always constant

$r = 10\% = (10/100) = 0.1$ (as given in the question)

$n =$ the period or years you are calculating for. See below:

Using $(1+r)^{-n}$ to calculate for 10% discounting factor.

$$\text{Period 0} = (1 + 0.1)^{-0} = 1$$

$$\text{Period 1} = (1 + 0.1)^{-1} = 0.9091$$

$$\text{Period 2} = (1 + 0.1)^{-2} = 0.8264$$

$$\text{Period 3} = (1 + 0.1)^{-3} = 0.7513$$

$$\text{Period 4} = (1 + 0.1)^{-4} = 0.6830$$

Note: I stopped at period 4, because the number of periods provided in the question were 4, if they were more, I would have continued.

Now, I will like to let you in on a secret of calculating the discounting factor using **the jet age method**. Imagine that you have a cash flow of say 40 years for which you must calculate their discounting

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