# CAPITAL BUDGETING[[1]](#footnote-1)

In making investments, usually, the concern is whether the investment is worth the capital put in. How then do you decide whether to invest in a building, matatu, farm, and so on? These are the concerns in this topic, called capital budgeting.

***Capital******Budgeting*** *is the planning process by which the firm decides which long-term investments (also called capital investments) to make.*

We measure all potential projects by their **cash flow** merit. We then discount (or get the present value of) in order to compare the initial investment cost with a project’s future returns to determine if it will add incremental value after compensating for a given level of risk.

There are, however, a number of techniques used to evaluate capital investments, namely:

* The NPV method.
* The Internal rate of return method
* The Payback (period) method.
* The Discounted Payback (period) method.
* The Profitability Index
* The Accounting rate of return

The aim of this chapter is to present the above methods of investment appraisal and to consider their strengths and limitations.

## CASH FLOW VS ACCOUNTING PROFITS

The investment decision is the decision to commit the firm’s financial and other resources to a particular course of action. Confusingly, the same term is often applied to both investments such as buildings and equipment, and financial investment, such as investment in shares. While the principles underlying investment analysis are basically the same for both types of investment, it is helpful for us to concentrate here on the former category, usually referred to as capital investment. Our particular emphasis on strategic capital projects concentrates on the allocation of a firm’s long-term capital resources.

■ Cash flow matters more than profit

Managers in business usually view profit as the best measure of performance. It might, therefore, be assumed that capital project appraisal should seek to assess whether the investment is expected to be ‘profitable’. Indeed, many firms do use such an approach (example, the accounting rate of return, ARR). There are, however, many problems with the profit measure for assessing future investment performance. Profit is based on accounting concepts of income and expenses relating to a particular accounting period, based on the matching principle. This means that income receivable and expenses payable, but not yet received or paid, along with depreciation charges, form part of the profit calculation. Consider the case of the Oval Furniture Company with expected annual sales from its new factory ofKsh.400, 000 and profits ofKsh.60, 000. In order to stimulate demand, customers are offered two years’ credit. While this decision has no impact on the reported profit, it certainly affects the cash position – no cash flow being received for two years. Cash flow analysis considers all the cash inflows and outflows resulting from the investment decision. Non-cash flows, such as depreciation charges and other accounting policy adjustments, are not relevant to the decision. We seek to estimate the stream of cash flows arising from a particular course of action and the period in which they occur. To convert profits to cash flows, we usually use the following formula[[2]](#footnote-2)

CF = EBIT (1-T) +DTS ±WORKING CAPITAL CHANGES±CHANGES IN CAPITAL EXPENDITURE

EBIT is the earnings before interest and tax.

T is the tax rate, say 30%.

## THE DISCOUNTED CASH FLOW METHODS

Discounted cash flow (DCF) analysis is a family of capital budgeting techniques that include;

* The NPV method
* The internal rate of return (IRR)
* The Discounted Payback (period) method.
* The profitability index (PI).

The principle in these methods is to get the present value of all EXPECTED[[3]](#footnote-3) FUTURE CASH FLOWS in order to make the decision whether to invest or not. It is a well-founded principle that a shilling today is worth more than a shilling tomorrow. So in order to be able to evaluate projects, their expected future inflows must be expressed in present terms. A rate of return that is used to convert expected future inflows to present terms is called the **discount rate**, the **hurdle rate**, the **required return**, or the **opportunity cost of capital** or simply **cost of capital.** It is simply that rate of return you would earn if you choose not to invest in this particular project but in an alternative.

## THE NON-DISCOUNTED CASH FLOW METHODS

Many managers prefer to use non-discounting approaches such as the payback and return on capital methods; others use both approaches. These methods include the payback period and the Accounting rate of return, ARR.

The following example illustrates the various approaches to investment appraisal.

## APPRAISING PROJECTS

We shall use the example below to illustrate the various methods of evaluating cash flows. Please note that we are treating the savings as the cash flows from the projects K and N. Mostly, we use cash flows in DCF methods, and as discussed earlier, cash flow is different from accounting profit.

Appraising the K and N projects

Sportsman LTD is a manufacturer of sports equipment. The firm is considering whether to invest in one of two automated processes, K or N, both of which give rise to staffing and other cost savings over the existing process. The relevant data relating to each are given below:

**K. (Ksh.) N. (Ksh.)**

Investment outlay (payable immediately) (40,000) (50,000)

Year 1 Annual cost savings 16,000 17,000

2 Annual cost savings 16,000 17,000

3 Annual cost savings 16,000 17,000

4 Annual cost savings 12,000 17,000

The required return is 14 per cent p.a.

The investment outlays are obviously additional cash outflows, while the annual cost savings are cash flow benefits because total annual expenditures are reduced as a result of the investment. Should the company invest in either of the two proposals and if so, which is preferable?

DISCOUNTED CASH FLOW METHODS

1. The Payback Period

This method does not factor in the time value of money, in other words a shilling today is deemed to be equivalent to a shilling tomorrow. The interest here is the PERIOD in which the project will pay back or recoup the initial investment. How long will the investors in K and N have to wait till they recoup their investments? Which of the two investments is better?

SOLUTION: See class illustration.

This method is simple, but ignores cash flows after the payback.

1. The Accounting Rate of Return

The amount of profit, or return, that an individual can expect based on an investment made. Accounting rate of return divides the average profit by the initial investment in order to get the ratio or return that can be expected. This allows an investor or business owner to easily compare the profit potential for projects, products and investments. ARR is considered a straight-line method of gathering quantitative information. While this is a positive measure in some aspects, its lack of sophistication is also a drawback. ARR does not consider the time value of money, which means that returns taken in during later years may be worth less than those taken in now, and does not consider cash flows, which can be an integral part of maintaining a business. It is also based on accounting measures based on questionable principles and assumptions.

The example above is not appropriate to illustrate this method. See another illustration for this method towards the end.

DISCOUNTED CASH FLOW METHODS

1. The Net present value method (NPV)

This is a widely used approach for evaluating an investment project. Under the net present value method, the present value (PV) of all cash inflows from the project is compared against the initial investment (I). The [net present value (NPV)](http://www.answers.com/topic/net-present-value) , which is the difference between the present value and the initial investment (i.e., NPV = PV - I), determines whether the project is an acceptable investment. To compute the present value of cash inflows, a rate called the [cost of capital](http://www.answers.com/topic/cost-of-capital) is used for discounting. Under the method, if the net present value is positive (NPV > 0 or PV > I), the project should be accepted.

For example, the NPV for K is computed as follows.

Calculate this, is the NPV greater than Zero? Or in other words is the PV at least equal to the initial cost of the project.

Then use the same approach to get the NPV for N. is the NPV greater than Zero?

Which of the two projects is better? In other words, which project has a higher NPV?

NB: when NPV=0, then you are indifferent.

This method has the advantage in that it considers the time value of money. However there is the downside of the appropriate discount rate to use.

1. The Internal Rate of Return

Internal rate of return (IRR) is a common and very useful way for financial analysts to measure the effectiveness of an investment. Technically, it is the rate of return when the net present value is equal to zero. In other words, it is the rate at which the company is naturally growing. There are a few pros and cons to this metric.

### PROS

#### Clarity

The greatest advantage to the IRR is its clarity and easy conceptualization. Most analysts and financial managers can understand the opportunity costs of a company. If the IRR exceeds this rate, then the project provides financial accretion. However, if the rate of an investment is projected to be below the IRR, then the investment would destroy company value. IRR is used in many company financial profiles due its clarity for all parties.

#### Popularity

Another important reason for using IRR is the popularity of the figure. Payback period, IRR and NPV are very common ways of looking at any investment. These figures are included in any analysis and make management's decision much easier when deciding whether to pursue a project or make an investment. It is also relatively simple to compute, so most people without advanced math skills can still use it.

### CONS

#### Poor Assumptions

* A key disadvantage of the IRR is that it must assume the discount rate or cost of capital. However, this could change each year as market conditions change. In fact, it is extremely likely to change from year to year. Financial analysts have no way of accurately predicting this future rate.

#### Multiple of No Rates of Return

* Another disadvantage to the use of IRR is that there may not be one singular rate. Depending on the cash flow structure, if there are different cash flow signs in different years (positive and negative), then the math will not add up. Instead there will be multiple or no IRRs. This makes management's decision even more difficult, especially due to the fact that the assumptions are inherently uncertain in the first place.

What is the IRR of the two projects above… see class illustration. Note that it is tedious to compute IRR manually, which is a disadvantage.

NB: You accept projects that are above a predetermined rate, in our case 14%.

1. The Discounted Payback Period (DPP)  
   Length of time required to recover the initial cash outflow from the discounted future cash inflows. This is the approach where the present values of cash inflows are cumulated until they equal the initial investment. It has an advantage of taking into account the time value of money, and is relatively straight forward. However, for a project with negative NPV, you can’t get a sensible DPP.

By filling in the table below for each of the projects, we can easily get the DPP.

|  |  |  |  |
| --- | --- | --- | --- |
| YEAR | CASH FLOW | DISCOUNT FACTOR | DISCOUNTED CASH FLOW |
| 0 |  |  |  |
| 1 |  |  |  |
| 2 |  |  |  |
| 3 |  |  |  |
| 4 |  |  |  |

4. The Profitability Index

An index that attempts to identify the relationship between the costs and benefits of a proposed project through the use of a ratio calculated as:  
  
A ratio of 1.0 is logically the lowest acceptable measure on the index. Any value lower than 1.0 would indicate that the project's PV is less than the initial investment. As values on the profitability index increase, so does the financial attractiveness of the proposed project.

See class solutions of our illustration.

ILLUSTRATION FOR ACCOUNTING RATE OF RETURN

You are evaluating whether to invest in a machine A. You estimate that by purchasing and installing the machine, your EBIT will increase as shown in the table below;

|  |  |
| --- | --- |
| YEAR | INCREMENTAL EBIT (Ksh. Millions) |
| 1 | 2 |
| 2 | 5 |
| 3 | 10 |
| 4 | 20 |

The cost of the machine is Ksh. 30 million.

Required:

* The ARR.
* A discussion of the advantages and disadvantages of ARR.

SUMMARY

We have examined a number of commonly employed investment appraisal techniques and asked the question: to what extent do they assist managers in making wealth- creating decisions? The primary methods advocated involve discounting the cash flows resulting from the investment decision, although non-discounting techniques are useful secondary methods for evaluating capital projects.

*Key points*

* *The net present value (NPV) method discounts project cash flows at the firm’s required return and then sums the cash flows. The decision rule is: accept all projects whose NPV is positive.*
* *The internal rate of return (IRR) is that discount rate which, when applied to project cash flows, produces a zero NPV. Projects with IRRs above the required return are acceptable.*
* *The profitability index (PI) is the ratio of the present value of project benefits to the present value of investment costs. The decision rule is to accept projects with a PI greater than 1.*
* *The NPV, IRR and PI methods give the same investment advice for independent projects. But where projects are mutually exclusive, differences can arise in rankings.*
* *The NPV approach is viewed as more sound than the IRR method because it assumes reinvestment at the required return rather than the project’s IRR.*
* *Payback is a useful method, but ignores cash flows beyond the payback period. Simple payback also ignores the time-value of money.*
* *The discounted payback takes into account the time value of money.*
* *Accounting rate of return (ARR) compares the average profit of the project against the book value of the asset acquired. Its main merit is that, as a measure of profitability, it can be related to the accounts of the business. However, it takes no account of the timing of cash flows or of the size and life of the investment.*

EXERCISES

* 1. A company is evaluating an investment in alternative projects that have expected cash flows indicated below. Year zero is the initial period when the investment is made, and all figures are in Ksh. Millions

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Project 1 | Project 2 | Project 3 | Project 4 | Project 5 |
| Year 0 | (100) | (180) | (120) | (150) | (80) |
| 1 | 20 | 10 | 10 | 100 | 10 |
| 2 | 40 | 10 | 10 | 100 | 15 |
| 3 | 60 | 65 | 10 | 0 | 18 |
| 4 | 60 | 75 | 40 | 20 | 12 |
| 5 | 60 | 80 | 60 | 4 | 12 |
| 6 | 60 | 80 | 20 | 20 | 40 |
| 7 | 75 |  | 120 |  |  |

Evaluate the projects using the following methods, and rank the projects from the most desirable to the least. Where necessary use a discount rate of 11%.

* The payback period.
* The discounted payback period.
* The profitability index.
* The IRR.
* The NPV method.

1. Refer to our recap on time value of money. [↑](#footnote-ref-1)
2. We are not emphasizing conversion of profits into cash flows at this level. [↑](#footnote-ref-2)
3. Note the cash flows are simply expected estimates and may not be very accurate. Indeed they are not expected to be accurate but just provide crude estimates of the cash flows you would expect from the project. [↑](#footnote-ref-3)