

# Investment / Project Appraisal

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# INVESTMENT / PROJECT APPRAISAL

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## Investment Appraisal

- Introduction to capital investment appraisal
- Capital investment appraisal – payback method
- Capital investment appraisal – ARR method
- The principles of discounted cash flow
- Annuities and perpetuities
- Working capital and profits
- Net present value (NPV) method
- Capital investment appraisal – internal rate of return (IRR) method
- NPV v IRR Non-financial factors

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# What is an investment?

- An investment is an **asset** or item that is purchased with the hope that it will generate income or will appreciate in the future.
- In an economic sense, an investment is the purchase of goods that are not consumed today but are used in the future to create wealth.
- In finance, an investment is a monetary asset purchased with the idea that the asset will provide income in the future or will be sold at a higher price for a profit.
- Capital budgeting is the process in which a business determines and evaluates potential expenses or investments that are large in nature. These expenditures and investments include projects such as building a new plant or investing in a long-term venture.

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## Capital Budgeting

- **Capital budgeting** is the process of **identifying, analyzing and selecting investment projects** whose returns are expected to **extend beyond one year**.
- A typical **model for investment decision making** has a number of distinct stages.
  - *Origination of proposals*
  - *Project screening*
  - *Analysis and acceptance*
  - *Monitoring and review*
- **Relevant costs** of investment appraisal include opportunity costs, working capital costs and wider costs such as infrastructure and human development costs. **Non-relevant costs** include past costs and committed costs.
- **Relevant benefits** from investments include not only **increased cash flows**, but also **savings and better relationships with customers and employees**.

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# Capital Budgeting

- The capital budget will normally be prepared to cover a longer period than sales, production and resource budgets, say from three to five years, although it should be broken down into periods matching those of other budgets. It should indicate the expenditure required to cover capital projects already underway and those it is anticipated will start in the three to five year period, say, of the capital budget.
- The budget should therefore be based on the current production budget, future expected levels of production and the long-term development of the organisation, and industry, as a whole.
- Organizations may have defined time periods during which proposals are considered so as to allow for an indication of expected capital expenditure in the forthcoming budget period. Alternatively, proposals may be accepted on a regular basis, allowing greater scope for investment in unanticipated opportunities. Projects which emerge during a budget period may be disadvantaged compared with those anticipated when the budget was set, however, as specific funds will not be set aside for them in the budget. If funds are limited, such projects may undergo more rigorous analysis than an anticipated

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# Capital Budgeting

Project to justify the allocation of funds.

- Budget limits or constraints might be imposed internally or externally.
  - *The imposition of internal constraints, which are often imposed when managerial resources are limited, is known as soft capital rationing.*
  - *Hard capital rationing occurs when external limits are set, perhaps because of scarcity of financing, high financing costs or restrictions on the amount of external financing an organization can seek.*
- Projects can be classified in the budget into those that generally arise from top management policy decisions or from sources such as mandatory government regulations (health, safety and welfare capital expenditure) and those that tend to be appraised using the techniques covered in this chapter and the next.
- The administration of the capital budget is usually separate from that of the other budgets. Overall responsibility for authorization and monitoring of capital expenditure is, in most large organizations, the responsibility of a committee.
- For example:
  - *Expenditure up to Rs. 75m may be approved by individual divisional managers.*
  - *Expenditure between Rs. 75m and Rs. 150m may be approved by divisional management.*
  - *Expenditure over Rs. 150m may be approved by the board of directors.*

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# Investment analytics and acceptance

The analysis stage can be broken down into a number of steps.

- **Step 1** Complete and submit standard format financial information as a formal investment proposal.
- **Step 2** Classify the project by type (to separate projects into those that require more or less rigorous financial appraisal, and those that must achieve a greater or lesser rate of return in order to be deemed acceptable).
- **Step 3** Carry out financial analysis of the project.
- **Step 4** Compare the outcome of the financial analysis to predetermined acceptance criteria.
- **Step 5** Consider the project in the light of the capital budget for the current and future operating periods.
- **Step 6** Make the decision (go/not to go).
- **Step 7** Monitor the progress of the project.

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# Investment Screening

Each proposal must be subject to detailed screening. So that a qualitative evaluation of a proposal can be made, a number of key questions such as those below might be asked before any financial analysis is undertaken. Only if the project passes this initial screening will more detailed financial analysis begin.

- What is the purpose of the project?
- Does it 'fit' with the organization's long-term objectives?
- Is it a mandatory investment, for example to conform with safety legislation?
- What resources are required and are they available, eg money, capacity, labour?
- Do we have the necessary management expertise to guide the project to completion?
- Does the project expose the organization to unnecessary risk?
- How long will the project last and what factors are key to its success?
- Have all possible alternatives been considered?

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# Why investment appraisal ?

- Significant cash outflow at the beginning of the project.
- Future profits are based on the current investments.
- Once the decision is made, it can not be reversed.
- The benefit of the investment derive to entity over the future years.

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# Qualitative issues in investment appraisal

There is a very wide range of other qualitative issues that may be relevant to a particular project.

- What are the implications of not undertaking the investment, eg adverse effect on staff morale, loss of market share?
- Will acceptance of this project lead to the need for further investment activity in future?
- What will be the effect on the company's image?
- Will the organization be more flexible as a result of the investment, and better able to respond to market and technology changes?

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# Benefits of investments

- The benefits from a proposed investment must also be evaluated. These might consist of benefits of several types.
- Savings because assets used currently will no longer be used. The savings should include:
  - (i) Savings in staff costs
  - (ii) Savings in other operating costs, such as consumable materials
- Extra savings or revenue benefits because of the improvements or enhancements that the investment might bring:
  - (i) More sales revenue and so additional contribution
  - (ii) More efficient system operation
  - (iii) Further savings in staff time, resulting perhaps in reduced future staff growth
- Possibly, some one-off revenue benefits from the sale of assets that are currently in use, but which will no longer be required. Some benefits might be intangible, or impossible to give a money value to.
  - (a) Greater customer satisfaction, arising from a more prompt service (eg because of a computerized sales and delivery service)
  - (b) Improved staff morale from working with higher-quality assets
  - (c) Better decision making may result from better information systems

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# Investment Appraisal techniques

## Basic (Non-discounted cash flows)

- Pay back period (PBP)
- Accounting rate of return (ARR)

## Detailed (Discounted cash flows)

- Net Present Value (NPV)
- Internal Rate of Return (IRR)
- Discounted payback period (DPBP)

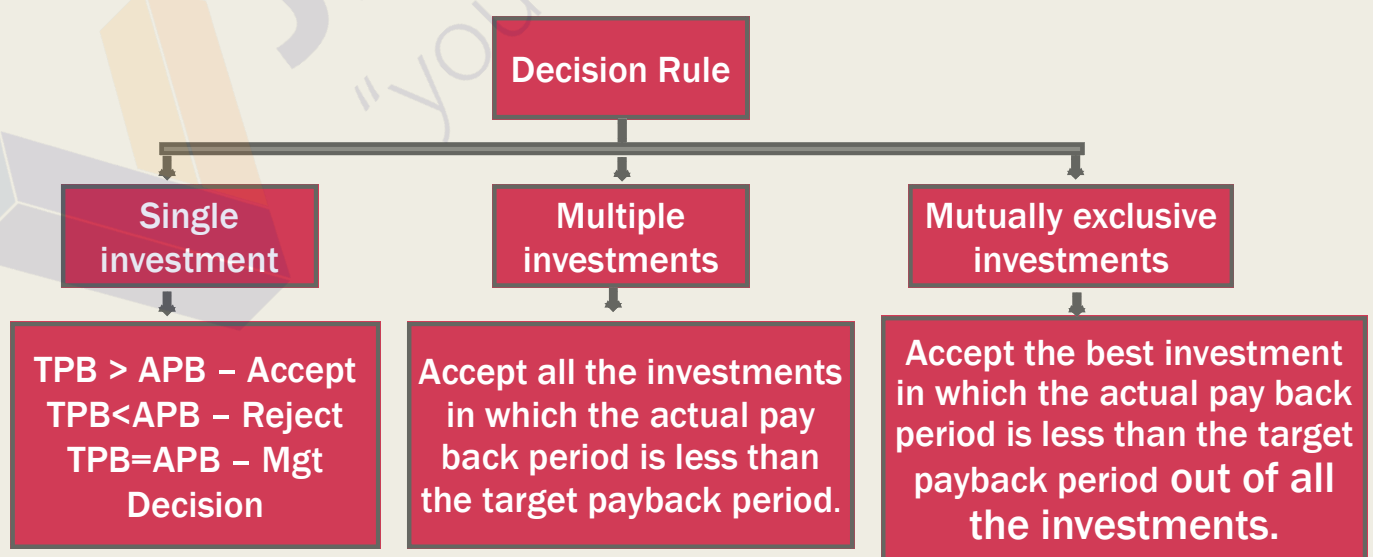
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# Pay Back Period (PBP)

- Payback is the amount of time it takes for project cash inflows to equal project cash outflows.
- Payback is the time it takes the cash inflows from a capital investment project to equal the cash outflows, usually expressed in years.
- Payback is often used as a 'first screening method'. By this, we mean that when a capital investment project is being considered, the first question to ask is: 'How long will it take to pay back its cost?'
- The organisation might have a target payback, and so it would reject a capital project unless its payback period were less than a certain number of years.

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## Payback Period – Decision theory



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## Advantages of Payback Period

- Long payback means capital is tied up
- Focus on early payback can enhance liquidity
- Investment risk is increased if payback is longer
- Shorter-term forecasts are likely to be more reliable
- The calculation is quick and simple
- Payback is an easily understood concept

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## Disadvantages of Payback Period

- There are a number of serious drawbacks to the payback method.
  - (a) It ignores the timing of cash flows within the payback period, the cash flows after the end of the payback period and therefore the total project return.
  - (b) It ignores the time value of money (a concept incorporated into more sophisticated appraisal methods). This means that it does not take account of the fact that Rs. 1 today is worth more than Rs. 1 in one year's time. An investor who has Rs. 1 today can either consume it immediately or, alternatively, can invest it at the prevailing interest rate, say 10%, to get a return of Rs. 1.10 in a year's time.
- There are also other disadvantages.
  - (a) The method is unable to distinguish between projects with the same payback period.
  - (b) The choice of any cut-off payback period by an organization is arbitrary.
  - (c) It may lead to excessive investment in short-term projects.
  - (d) It takes account of the risk of the timing of cash flows but does not take account of the variability of those cash flows.

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# Accounting Rate of Return (ARR)

The accounting rate of return (ARR) is also called ROCE and ROI. ARR is used in appraising an investment/project and used to estimate the accounting rate of return that the project should yield. If it exceeds a target accounting rate of return, the project will be undertaken.

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## How to calculate (ARR)

$$\text{ROCE} = \frac{\text{Average annual profits before interest and tax}}{\text{Initial capital costs}} \times 100\%$$

or alternatively:

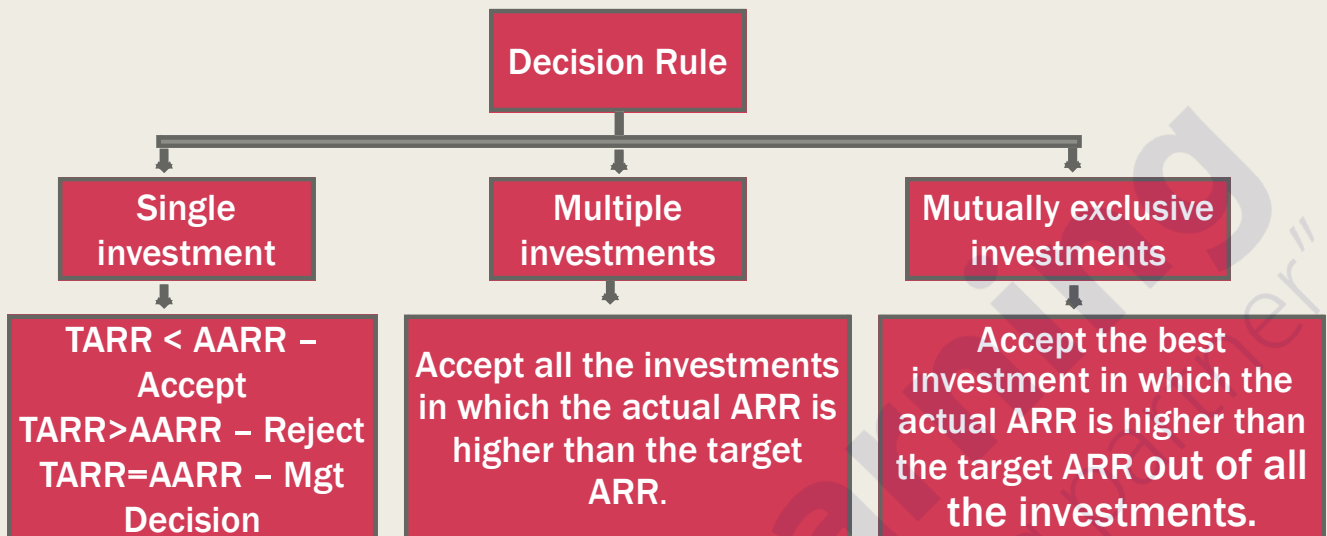
$$\text{ROCE} = \frac{\text{Average annual profits before interest and tax}}{\text{Average capital investment}} \times 100\%$$

The average investment can be calculated as:

$$\text{Average capital investment} = \frac{\text{Initial investment} + \text{scrap value}}{2}$$

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# Accounting Rate of Return – Decision theory



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## Advantages of ARR

- It is quick and simple to calculate
- It involves a familiar concept of a percentage return
- Accounting profits can be easily calculated from financial statements.
- It considers the profit of whole investment / project.

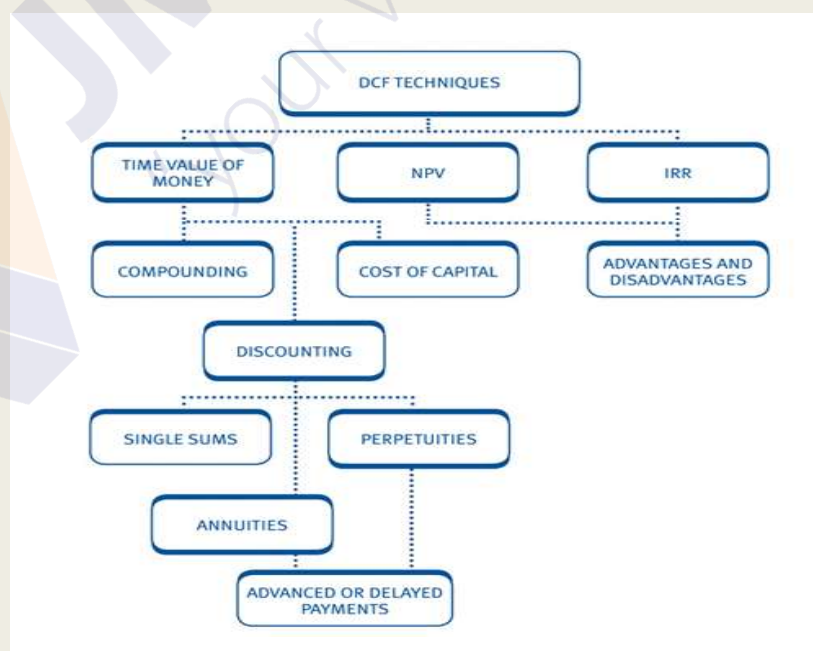
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# Disadvantages of ARR

- The ARR method of capital investment appraisal has the serious drawback that it does not take account of the timing of the profits from an investment.
- Whenever capital is invested in a project, money is tied up until the project begins to earn profits which pay back the investment. Money tied up in one project cannot be invested anywhere else until the profits come in. Management should be aware of the benefits of early repayments from an investment, which will provide the money for other investments.
- There are a number of other disadvantages.
  - (a) It is based on accounting profits and not cash flows. Accounting profits are subject to a number of different accounting treatments.
  - (b) It is a relative measure rather than an absolute measure and hence takes no account of the size of the investment.
  - (c) It takes no account of the length of the project.
  - (d) Like the payback method, it ignores the time value of money.

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# Investment Appraisal – Discounted Cash Flows



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# Relevant Cash Flows

The investments / projects should be evaluated in detail using relevant cash flows as it fulfill the purpose of maximizing the wealth of the shareholders. Profit will not be used. The cash flows are;

- They are **future** costs and revenues – as it is not possible to change what has happened in the past, then relevant costs and revenues must be future costs and revenues.
- They are **incremental** – relevant costs are incremental costs and it is the increase in costs and revenues that occurs as a direct result of a decision taken that is relevant.
- They are **cash flows** – in addition, future costs and revenues must be cash flows arising as a direct consequence of the decision taken.

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# Relevant Cash Flows

- **Tax** - The extra taxation that will be payable on extra profits, or the reductions in tax arising from capital allowances or operating losses in any year.
- **Residual Value** - The residual value or disposal value of equipment at the end of its life, or its disposal cost.
- **Working Capital** - If a company invests Rs. 20m in working capital and earns cash profits of Rs. 50m, the net cash receipts will be Rs. 30m. Working capital will be released again at the end of a project's life, and so there will be a cash inflow arising out of the eventual realization into cash of the project's inventory and receivables in the final year of the project.
- **Opportunity Costs** - These are the costs incurred or revenues lost from diverting existing resources from their best use. Example: Opportunity costs

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# Relevant Cash Flows

- Costs that will often need to be considered include:
- **Infrastructure costs** such as additional information technology or communication systems.
- **Marketing costs** may be substantial, particularly of course if the investment is in a new product or service. They will include the costs of market research, promotion and branding and the organisation of new distribution channels.
- **Human resource costs** including training costs and the costs of re-organisation arising from investments.

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# Compounding

A sum invested today will earn interest. Compounding calculates the future or terminal value of a given sum invested today for a number of years. To compound a sum, the figure is increased by the amount of interest it would earn over the period.

**Formula for compounding:**

To speed up the compounding calculation, we can use a formula to calculate the future value of a sum invested now. The formula is:

$$F = P(1 + r)^n$$

where F = Future value after n periods

P = Present or Initial value

r = Rate of interest per period

n = Number of periods

PV

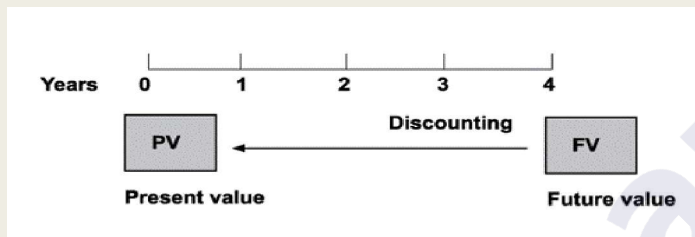
Compounding

FV

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# Discounting

- In a potential investment project, cash flows will arise at many different points in time. To make a useful comparison of the different flows, they must all be converted to a common point in time, usually the present day, i.e. the cash flows are discounted.
- The present value (PV) is the cash equivalent now of money receivable/payable at some future date.



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# Discounting

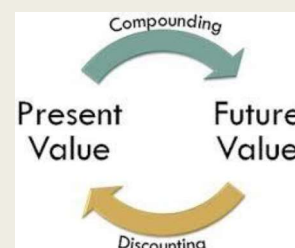
- The PV of a future sum can be calculated using the formula:

$$P = \frac{F}{(1+r)^n} = F \times (1+r)^{-n}$$

- Discounting factor : Today's value of a Rs.1 receivable in the future.

$$D_n = \frac{1}{(1+r)^n}$$

Where  $D_n$  = discount factor  
 $r$  = discount rate  
 $n$  = number of years ahead



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# Time Value of Money

Money received today is worth more than the same sum received in the future, i.e. it has a **time value**.

This occurs for three reasons:

- *Potential for earning interest/cost of finance*
- *Impact of inflation*
- *Effect of risk.*

Discounted cash flow (DCF) techniques take account of this time value of money when appraising investments.

# Net Present Value (NPV)

- The term 'present value' simply means the cash equivalent now of a sum to be received or to be paid in the future.
- Discounted cash flow involves discounting future cash flows from a project in order to decide whether the project will earn a satisfactory rate of return.
- To appraise the overall impact of a project using DCF techniques involves discounting all the relevant cash flows associated with the project back to their PV (present value).
- If we treat outflows of the project as negative and inflows as positive, the NPV of the project is the sum of the PVs of all flows that arise as a result of doing the project.



# Cost of Capital

The cost of capital has two aspects to it.

(a) It is the cost of funds that a company raises and uses.

(b) The return that investors expect to be paid for putting funds into the company. It is therefore the minimum return that a company should make from its own investments, to earn the cash flows out of which investors can be paid their return.

- The cost of capital can therefore be measured by studying the returns required by investors, and used to derive a **discount factor** for discounted cash flow analysis and investment appraisal.

# Meaning of NPV

- The net present value is a measure of the value in terms of 'today's money' of the net benefits from a proposed investment. The discount rate is the rate of return that will be sufficient to cover the cost of the organization's capital.
- If an investment with a positive NPV goes ahead it will add value to the organization, because the value of its net returns will be more than are needed to satisfy the providers of capital to the organization.
- In theory, the value of the organization should increase by the amount of the NPV if the investment goes ahead.

## Present Value of Annuity

- An annuity is a constant annual cash flow for a number of years.
- Where an investment appraisal involves a constant annual cash flow, a special discount factor known as an **annuity factor** can be used.
- The **annuity factor** (AF) is the name given to the sum of the individual DF. The formula for the annuity factor is:

$$AF = \frac{1 - (1+r)^{-n}}{r}$$

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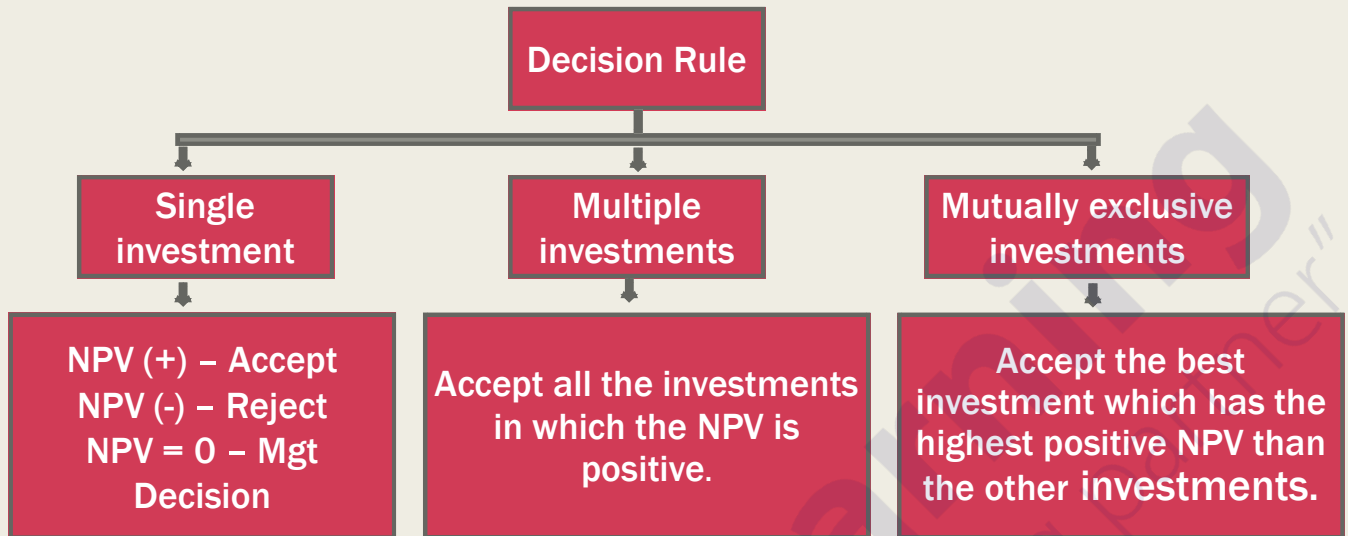
## Present Value of Perpetuity

- A **perpetuity** is an annual cash flow that occurs forever. If similar amount of cash is received in every year to the infinity the present value of a perpetuity is found using the formula;

$$PV = \frac{1}{r} \quad \text{or} \quad PV = \frac{CF}{r}$$

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# Net Present Value – Decision theory



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## NPV Calculation format

Rs.000	Purchase of machine	Sales	Variable cost	Fixed cost	Net Cash flows	COC @ 12%	Present Value
Y0	(12,000)				(12,000)	1.000	(12,000)
Y1	-	8,000	(3,800)	(4,450)	(250)	0.893	(223)
Y2	-	17,000	(8,883)	(5,340)	2,778	0.797	2,214
Y3	-	36,000	(17,250)	(5,874)	12,876	0.712	9,165
Y4	-	60,000	(31,625)	(6,461)	21,914	0.636	13,926
Y5	-	72,000	(34,800)	(7,108)	30,092	0.567	17,075
						<b>NPV</b>	<b>30,158</b>

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# Reinvestment assumption

- An assumption underlying the NPV method is that any net cash inflows generated during the life of the project will be reinvested at the cost of capital (ie the discount rate).
- The IRR method, on the other hand, assumes these cash flows can be reinvested to earn a return equal to the IRR of the original project.
- If the cost of capital is 16%, the NPV method assumes that the cash inflows will be reinvested at the cost of capital of 16% whereas the IRR method assumes they will be reinvested at 20% if the IRR is 20%.
- In theory, a firm will have accepted all projects which provide a return in excess of the cost of capital. Any other funds which become available can only be reinvested at the cost of capital. This is the assumption implied in the NPV rule, but is unlikely to be the case in practice.

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# Assumption of calculating NPV

The following assumptions are made about cash flows when calculating the net present value:

- All cash flows occur at the start or end of a year.
- Initial investments occur at present  $Y_0$
- Other cash flows start one year after that ( $Y_1$ ).
- Working capital investment will be recovered end of the project period.

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## Advantages of NPV

- It considers the time value of money.
- It is an absolute measure of return.
- It is based on cash flows not profits.
- It considers the whole life of the project.
- It should lead to maximization of shareholder wealth.

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## Disadvantages of NPV

- It is difficult to explain to managers
- It requires knowledge of the cost of capital
- It is relatively complex.

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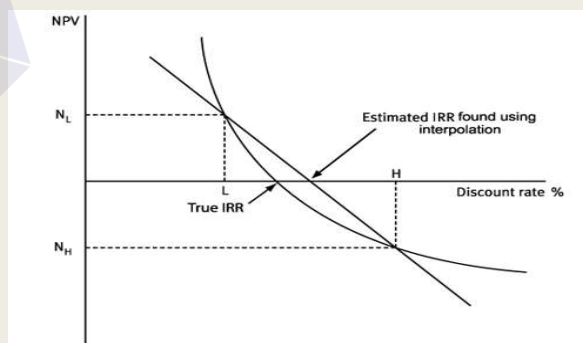
# Internal Rate of Return (IRR)

- The IRR method determines the rate of interest (internal rate of return) at which the NPV = 0. The internal rate of return is therefore the rate of return on an investment.
- The internal rate of return (IRR) method of evaluating investments is an alternative to the NPV method. The NPV method of discounted cash flow determines whether an investment earns a positive or a negative NPV when discounted at a given rate of interest. If the NPV is zero (that is, the present values of costs and benefits are equal) the return from the project would be exactly the rate used for discounting.

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## IRR – Graphical approach

A useful way to estimate the IRR of a project is to find the project's NPV at a number of discount rates and sketch a graph of NPV against discount rate. You can then use the sketch to estimate the discount rate at which the NPV is equal to zero (the point where the curve cuts the discount rate (horizontal) axis).



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# IRR – Interpolation method

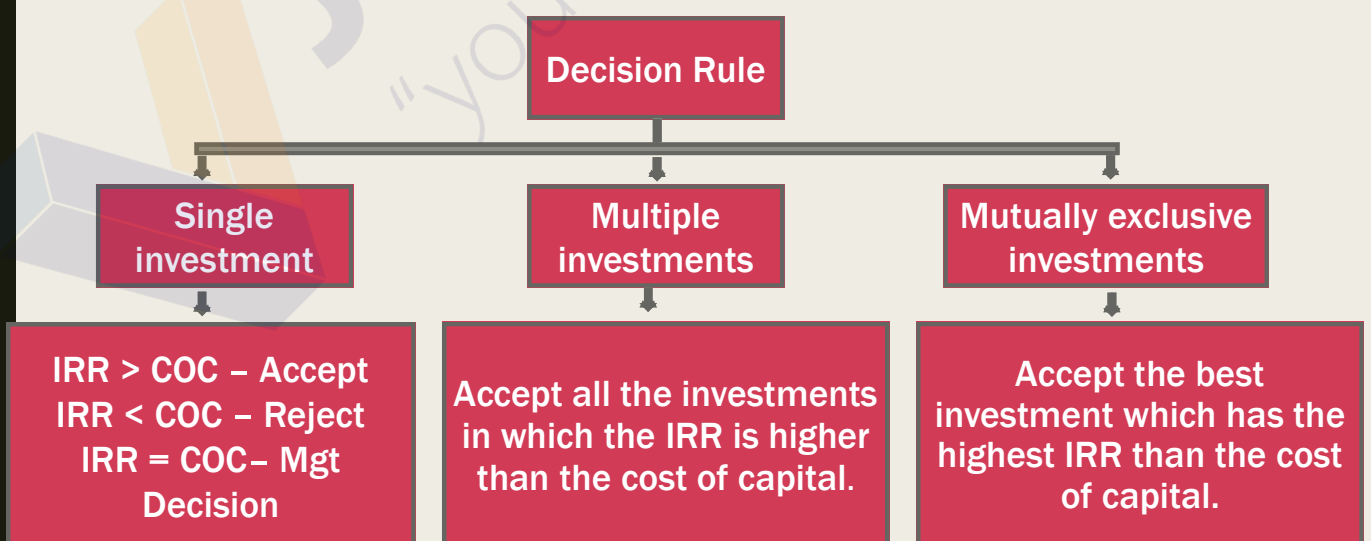
Using the interpolation method, the IRR is calculated by first of all finding the NPV at each of two discount rates. Ideally, one discount rate should give a small positive NPV and the other a small negative NPV. The IRR would then be somewhere between these two discount rates: above the rate where the NPV is positive, but below the rate where the NPV is negative. However, it is possible to use two positive values or two negative values to extrapolate the IRR.

- L = Lower rate of interest
- H = Higher rate of interest
- $N_L$  = NPV at lower rate of interest
- $N_H$  = NPV at higher rate of interest.

$$IRR = L + \left[ \frac{N_L}{N_L - N_H} \times (H - L) \right]$$

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# IRR – Decision theory



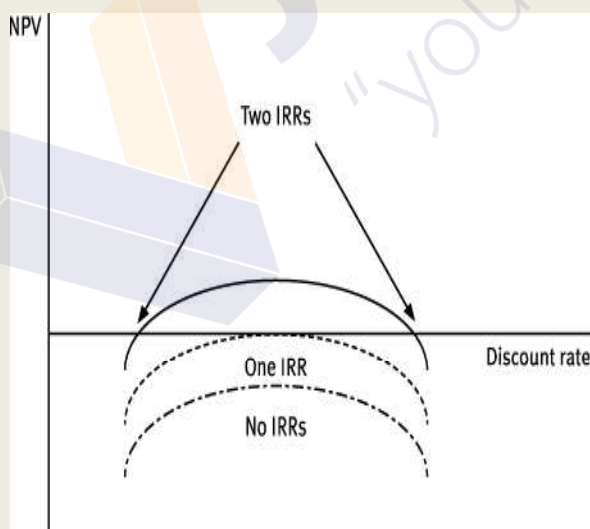
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# NPV vs IRR

- When cash flow patterns are conventional both methods gives the same accept or reject decision.
- The IRR method is more easily understood.
- NPV is technically superior to IRR and simpler to calculate.
- IRR and accounting ROCE can be confused.
- IRR ignores the relative sizes of investments.
- Where cash flow patterns are non-conventional, there may be several IRRs which decision makers must be aware of to avoid making the wrong decision.
- The NPV method is superior for ranking mutually exclusive projects in order of attractiveness.
- The reinvestment assumption underlying the IRR method cannot be substantiated.
- When discount rates are expected to differ over the life of the project, such variations can be incorporated easily into NPV calculations, but not into IRR calculations.
- Despite the advantages of the NPV method over the IRR method, the IRR method is widely used in practice.

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## Difficulties with IRR



- Interpolation only provides an estimate (and an accurate estimate requires the use of a spreadsheet programme). The cost of capital calculation itself is also only an estimate and if the margin between required return and the IRR is small, this lack of accuracy could actually mean the wrong decision is taken.
- Another drawback of IRR is that non-conventional cash flows may give rise to **no IRR or multiple IRRs**. For example a project with an outflow at T0 and T2 but income at T1 could, depending on the size of the cash flows, have a number of different profiles on a graph (see below). Even where the project does have one IRR, it can be seen from the graph that the decision rule would lead to the wrong result as the project does not earn a positive NPV at any cost of capital.

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# Discounted Pay Back Period (DPBP)

- Discounted payback is the time it takes the present values of cash inflows from a capital investment project to equal the present value of cash outflows, usually expressed in years.
- This is similar to pay back period and the only difference is the cash flows are discounted.
- The organization might have a target discounted payback, and so it would reject a capital project unless its discounted payback period were less than a certain number of years.

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## Advantages and Disadvantages of Discounted Payback Period

- The approach has all the perceived advantages of the payback period method of investment appraisal: it is easy to understand and calculate, and it provides a focus on liquidity where this is relevant. In addition, however, it also takes into account the time value of money. It therefore bridges the gap between the theoretically superior NPV method and the regular payback period method.
- However, it does differ from NPV in that the discount rate used is the unadjusted cost of capital whereas NPV often uses an adjusted rate to reflect project risk and uncertainty.
- Because the DPP approach takes the time value of money into consideration, it produces a longer payback period than the non-discounted payback approach and takes into account more of the project's cash flows.
- Another advantage it has over traditional payback is that it has a clear accept or reject criterion. Using payback, acceptance of a project depends on an arbitrarily determined cut-off time. Using DPP, a project is acceptable if it pays back within its lifetime.
- DPP still shares one disadvantage with the payback period method: cash flows which occur after the payback period are ignored (although as the DPP is longer than the payback period, fewer of these are ignored).
- One way of dealing with risk is to shorten the payback period required. A maximum payback period can be set to reflect the fact that risk increases the longer the time period under consideration.

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# Investment appraisal with Inflation

**Inflation** is the general increase in prices in goods and services and fall in the purchasing value of money. It is a common feature of all economies, and it must be accommodated in financial planning.

- **Real cash flows** (ie adjusted for inflation) should be discounted at a **real discount rate**.
- **Nominal cash flows** should be discounted at a nominal discount rate.

So far we have not considered the effect of **inflation** on the appraisal of capital investment proposals. As the inflation rate increases so will the minimum return required by an investor. For example, you might be happy with a return of 5% in an inflation-free world, but if inflation were running at 15% you would expect a considerably greater yield.

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# Investment appraisal with Inflation

- The **nominal interest rate** incorporates inflation. When the nominal rate of interest is higher than the rate of inflation, there is a **positive** real rate. When the rate of inflation is higher than the nominal rate of interest, the real rate of interest will be **negative**.
- The relationship between real and nominal rates of interest is given by the Fisher formula.

## FORMULA TO LEARN

$$(1 + i) = (1 + r)(1 + h)$$

Where  $h$  = rate of inflation

$r$  = real rate of interest

$i$  = nominal (money) rate of interest

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# Investment appraisal with Inflation

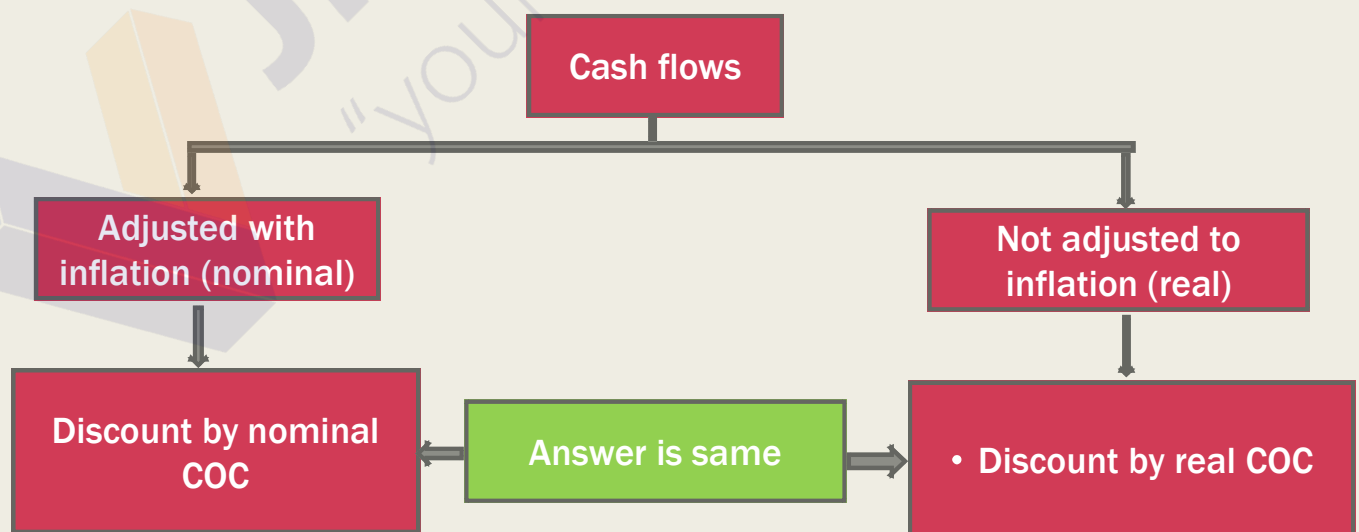
## Do we use the real rate or the nominal rate?

The rule is as follows;

- If the cash flows are expressed in terms of the actual number of rupees that will be received or paid on the various future dates, we use the nominal rate for discounting.
- If the cash flows are expressed in terms of the value of the rupee at time 0 (ie in constant price level terms), we use the real rate.
- 
- The cash flows given above are expressed in terms of the actual number of rupees that will be received or paid at the relevant dates (nominal cash flows). We should, therefore, discount them using the nominal rate of return.

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## Do we use the real rate or the nominal rate?



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## The advantages and misuses of real values and a real rate of return

Although, generally, companies should discount money values at the nominal cost of capital, there are some advantages of using real values discounted at a real cost of capital.

(a) When all costs and benefits rise at the same rate of price inflation, real values are the same as current day values, so that no further adjustments need be made to cash flows before discounting. In contrast, when nominal values are discounted at the nominal cost of capital, the prices in future years must be calculated before discounting can begin.

(b) The government might prefer to set a real return as a target for investments, as being more suitable than a commercial money rate of return.

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## Expectations of inflation and the effects of inflation

- When managers evaluate a particular project, or when shareholders evaluate their investments, they can only guess at what the rate of inflation is going to be. Their expectations will probably be inaccurate, because it is extremely difficult to forecast the rate of inflation correctly. The only way in which uncertainty about inflation can be allowed for in project evaluation is by risk and uncertainty analysis. Plans should be made to obtain 'contingency funds', for example a higher bank overdraft facility if the rate of inflation exceeds expectations. Inflation may be general, affecting prices of all kinds, or specific to particular prices. Generalized inflation has the following effects.
- Since non-current assets and inventories will increase in money value, the same quantities of assets must be financed by increasing amounts of capital.
- Inflation means higher costs and higher selling prices. The effect of higher prices on demand may not be easy to predict. A company that raises its prices by 10% because the general rate of inflation is running at 10% might suffer a serious fall in demand.
- Inflation, because it affects financing needs, is also likely to affect gearing, and so the cost of capital.

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## Mid-year and end-of-year money values

- You might wonder why, in all the examples so far, the cash flows have been inflated to the end-of-year money prices. Inflation does not usually run at a steady rate.
- In discounted cash flow (DCF) calculations it is more appropriate to use end-of year money values. This is because, by convention, all cash flows are assumed to occur at the end of the year, and a discount factor appropriate to the end of the year is applied.

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## Investment appraisal with Taxation

Taxation is a major practical consideration for businesses. It is vital to take it into account in making decisions.

- In investment appraisal, tax is often assumed to be payable one year in arrears.
- Tax-allowable depreciation details should be checked in any question you attempt. However, payments of tax, or reductions of tax payments, are cash flows and ought to be considered in DCF analysis. Assumptions which may be stated in questions are as follows.

Tax is payable in the year following the one in which the taxable profits are made. Thus, if a project increases taxable profits by Rs. 10m in year 2, there will be a tax payment, assuming tax at 30%, of Rs. 3m in year 3.

Net cash flows from a project should be considered as the taxable profits (not just the taxable revenues) arising from the project (unless an indication is given to the contrary).

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# Computation of income tax

## Tax on Business profit

	Rs.
Accounting profit	XXXXXX
(+) Depreciation	XXXXXX
Operating cash flows	XXXXXX
(-) Capital allowances	(XXXX)
Taxable profit	XXXXXX
Corporate tax rate	xx%
Income tax	XXX

## Tax Disposal profit

	Rs.	Rs.
Scrap value of asset		XXXXXX
(-) Tax written down value		
Cost	XXXXXX	
(-) Capital allowances	(XXXX)	(XXX)
Taxable profit on disposal		XXX
Corporate tax rate		XX%
Income Tax		XXXXXX

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## When to claim capital allowances?

There are two possible assumptions about the time when tax-allowable depreciation starts to be claimed.

- (a) It can be assumed that the first claim occurs at the start of the project (at year 0).
- (b) Alternatively, it can be assumed that the first claim occurs later in the first year.

Examination questions generally will indicate which of the two assumptions is required but you should state your assumptions clearly if you have to make assumptions. Assumption (b) is easier to use since there is one claim for tax allowable depreciation for each year of the project.

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# Tax payments and Tax Savings

- **Tax payments** – Where the project is making a taxable profit, it is required to pay the income taxes and it would be a relevant cash outflow of the project. The tax payments will be considered as a cash outflow in the year when the payment is made. Practically it would be in the year following the taxable period. (01 year in arrears).
- **Tax saving** – Where the project is making taxable losses, it will save the income tax to be paid from other projects in operation. Therefore it is a opportunity profit of the project under consideration. The argument is, income tax is paid as a whole for the organization and not by the individual project. Accordingly cash inflow should be identified.

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# Taxation and cost of capital

- The effect of taxation on capital budgeting is theoretically quite simple. Organisations must pay tax, and the effect of undertaking a project will be to increase or decrease tax payments each year. These incremental tax cash flows should be included in the cash flows of the project for discounting to arrive at the project's NPV.
- When taxation is ignored in the DCF calculations, the discount rate will reflect the pre-tax rate of return required on capital investments. When taxation is included in the cash flows, a post-tax required rate of return should be used.

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# Sensitivity Analysis

- **Sensitivity analysis** is one method of analyzing the risk surrounding a capital expenditure project and enables an assessment to be made of how responsive the project's NPV is to changes in the variables that are used to calculate that NPV.
- The NPV could depend on a number of uncertain independent variables.
  - Selling price*
  - Sales volume*
  - Cost of capital*
  - Initial cost*
  - Operating costs*
  - Taxation*
  - Benefits*
- The basic approach of sensitivity analysis is to **calculate the project's NPV under alternative assumptions** to determine how sensitive it is to changing conditions. An indication is thus provided of those variables to which the NPV is most sensitive (**critical variables**) and the **extent** to which those variables **may change** before the investment results in a negative NPV.

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# Sensitivity Analysis

- Sensitivity analysis therefore provides an indication of why a project might fail. Management should review critical variables to assess whether or not there is a strong possibility of events occurring which will lead to a negative NPV.
- Management should also pay particular attention to controlling those variables to which the NPV is particularly sensitive, once the decision has been taken to accept the investment.
- A simple approach to deciding which variables the NPV is particularly sensitive to is to calculate the sensitivity of each variable.

$$\text{Sensitivity} = \frac{\text{NPV}}{\text{Present value of project variable}} \quad \%$$

- The lower the percentage, the more sensitive is NPV to that project variable as the variable would need to change by a smaller amount to make the project nonviable.

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# Capital Rationing

- Capital rationing is a situation in which a company has a limited amount of capital to invest in potential projects, such that the different possible investments need to be compared with one another in order to allocate the capital available most effectively.
- Capital rationing may occur due to internal factors (soft capital rationing) or external factors (hard capital rationing).
- When capital rationing occurs in a single period, projects are ranked in terms of profitability index.
- Soft capital rationing is brought about by internal factors; hard capital rationing is brought about by external factors.
- If an organization is in a capital rationing situation it will not be able to enter into all projects with positive NPVs because there is not enough capital for all of the investments.

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## Soft and hard capital rationing

***Soft capital rationing may arise for one of the following reasons.***

- Management may be reluctant to issue additional share capital because of concern that this may lead to outsiders gaining control of the business.
- Management may be unwilling to issue additional share capital if it will lead to a dilution of earnings per share.
- Management may not want to raise additional debt capital because they do not wish to be committed to large fixed interest payments.
- Management may wish to limit investment to a level that can be financed solely from retained earnings.

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# Soft and hard capital rationing

***Hard capital rationing may arise for one of the following reasons.***

- Raising money through the stock market may not be possible if share prices are depressed.
- There may be restrictions on bank lending due to government control.
- Lending institutions may consider an organization to be too risky to be granted further loan facilities.
- The costs associated with making small issues of capital may be too great.

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## Relaxation of Capital Constraints

- If an organisation adopts a policy that restricts funds available for investment (soft capital rationing), the policy may be less than optimal. The organisation may reject projects with a positive NPV and forgo opportunities that would have enhanced the market value of the organisation.
- A company may be able to limit the effects of hard capital rationing and exploit new opportunities.
  - *It might seek joint venture partners with which to share projects.*
  - *As an alternative to direct investment in a project, the company may be able to consider a licensing or franchising agreement with another enterprise, under which the licensor/franchiser company would receive royalties.*
  - *It may be possible to contract out parts of a project to reduce the initial capital outlay required.*
  - *The company may seek new alternative sources of capital (subject to any restrictions which apply to it), for example:*
    - Venture capital
    - Debt finance secured on the assets of the project
    - Sale and leaseback of property or equipment (see the next chapter)
    - Grant aid
    - More effective capital management

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# Single Period Capital Rationing

- We shall begin our analysis by assuming that capital rationing occurs in a single period, and that capital is freely available at all other times.

- The following further assumptions will be made.

(a) If a company does not accept and undertake a project during the period of capital rationing, the opportunity to undertake it is lost. The project cannot be postponed until a subsequent period when no capital rationing exists.

(b) There is complete certainty about the outcome of each project, so that the choice between projects is not affected by considerations of risk.

(c) Projects are divisible, so that it is possible to undertake, say, half of project X in order to earn half of the NPV of the whole project.

- The basic approach is to rank all investment opportunities so that the NPVs can be maximised from the use of the available funds.
- Ranking in terms of absolute NPVs will normally give incorrect results. This method leads to the selection of large projects, each of which has a high individual NPV but which have, in total, a lower NPV than a large number of smaller projects with lower individual NPVs. Ranking is therefore in terms of what is called the profitability index.
- This profitability index is a ratio that measures the PV of future cash flows per Rs. 1 of investment and so indicates which investments make the best use of the limited resources available.
- Profitability index is the ratio of the present value of the project's future cash flows (not including the capital investment) divided by the present value of the total capital investment.

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## Problems with the profitability index method

- The approach can only be used if projects are divisible. If the projects are not divisible a decision has to be made by examining the absolute NPVs of all possible combinations of complete projects that can be undertaken within the constraints of the capital available. The combination of projects which remains at or under the limit of available capital without any of them being divided, and which maximises the total NPV, should be chosen.*
- The selection criterion is fairly simplistic, taking no account of the possible strategic value of individual investments in the context of the overall objectives of the organisation.*
- The method is of limited use when projects have differing cash flow patterns. These patterns may be important to the company since they will affect the timing and availability of funds. With multi-period capital rationing, it is possible that the project with the highest profitability index is the slowest in generating returns.*
- The profitability index ignores the absolute size of individual projects. A project with a high index might be very small and therefore only generate a small NPV.*

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## Single period rationing with non-divisible projects

- If the projects are not divisible then the method shown above may not result in the optimal solution. Another complication which arises is that there is likely to be a small amount of unused capital with each combination of projects. The best way to deal with this situation is to use trial and error and test the NPV available from different combinations of projects. This can be a laborious process if there are a large number of projects available.

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## Non-financial factors

- Managers must also consider the non-financial implications of their decisions. As well as financial considerations, any decision support information provided to management should also incorporate non-financial considerations.
- Here are some examples.
  - Impact on employee morale. Most investments affect employees' prospects, sometimes for the better, sometimes for the worse. A new cafeteria for employees would have a favourable impact, for example.
  - Impact on the community. This is a particularly important consideration if the investment results in loss of jobs, more jobs or elimination of small businesses.
  - Impact on the environment. The opening of a new mine, the development of products which create environmentally harmful waste and so on all have an impact on the environment. This can affect an organisation's image and reputation and hence its long-term growth and survival prospects. Some of these environmental effects can also impact directly on project cash flows because organisations have to pay fines, incur legal costs, incur disposal and clean-up costs and so on.
  - Ethical issues. Some investments might be legal but might not be in line with the ethics and code of conduct demanded by various stakeholder groups.
  - Learning. Many investments, particularly those which advance an organisation's technology, provide opportunities for learning. For example, investment in new computerised equipment to revolutionise a production process would enable an organisation to better use highly technical production methods.

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