15 - Investment Appraisal

Investment can be divided into **capital expenditure** and **revenue expenditure** and can be made in **non-current assets** or **working capital**.

Capital expenditure is expenditure which results in the **acquisition** of non-current assets or an **improvement** in their earning capacity. It is not charged as an expense in the income statement; the expenditure appears as a non-current asset in the statement of financial position.

Revenue expenditure is charged to the income statement and is expenditure which is incurred:

- (a) For the purpose of the trade of the business this includes expenditure classified as selling and distribution expenses, administration expenses and finance charges
- (b) To maintain the existing earning capacity of non-current assets

Investment can be made in non-current assets or working capital.

- (a) **Investment in** non-current assets involves a significant elapse of time between commitment of funds and recoupment of the investment. Money is paid out to acquire resources which are going to be used on a continuing basis within the organisation.
- (b) Investment in working capital arises from the need to pay out money for resources (such as raw materials) before it can be recovered from sales of the finished product or service. The funds are therefore only committed for a short period of time.

Capital budgeting is the process of identifying, analysing and selecting investment projects whose returns are expected to extend beyond one year.

Relevant v irrelevant cash flows

Relevant Costs	Irrelevant Costs
Cash based	Non cash costs e.g. depreciation, provisions
	etc.
Future inflows and outflows	Past / Historical / Sunk costs
Incremental costs	Fixed Costs
Opportunity costs	General Fixed costs
Differential costs	Allocated costs
Variable costs	Committed costs
Specific Fixed Costs	Apportioned costs
Attributable / Directly attributable Fixed costs	Absorbed costs
Working capital costs	

Investment Appraisal Techniques

Investment appraisal technique can be divided into two categories:

Traditional (Non-DCF) Techniques

- Simple Payback
- ARR (Accounting Rate of Return)

DCF Based Techniques

- Discounted Payback
- NPV (Net Present Value)
- IRR (Internal Rate of Return)

The payback period

Payback is the time it takes the cash inflows from a capital investment project to equal the cash outflows, usually expressed in years.

Advantages of the payback method

- (a) It is **simple to calculate** and **simple to understand**. This may be important when management resources are limited. It is similarly helpful in communicating information about minimum requirements to managers responsible for submitting projects.
- (b) It uses cash flows rather than accounting profits.
- (c) It can be used as a screening device as a first stage in eliminating obviously inappropriate projects prior to more detailed evaluation.
- (d) The fact that it tends to bias in favour of short-term projects means that it tends to minimise both financial and business risk.
- (e) It can be used when there is a **capital rationing situation** to identify those projects which generate additional cash for investment quickly.

Disadvantages of the payback method

- (a) It **ignores** the **timing** of cash flows within the payback period.
- (b) It ignores the cash flows after the end of payback period and therefore the total project return.
- (c) 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 \$1 today is worth more than \$1 in one year's time. An investor who has \$1 today can either consume it immediately or alternatively can invest it at the prevailing interest rate, say 10%, to get a return of \$1.10 in a year's time.
- (d) Payback is unable to distinguish between projects with the same payback period.

- (e) The choice of any cut-off payback period by an organisation is arbitrary.
- (f) It may lead to excessive investment in short-term projects.
- (g) It takes account of the risk of the timing of cash flows but not the **variability** of those cash flows.

Accounting Rate of Return

The return on capital employed method (ROCE) (also called the accounting rate of return method or the return on investment (ROI) method) of appraising a capital project is to estimate the accounting rate of return that the project should yield. If it exceeds a target rate of return, the project will be undertaken

OR

The ARR and the comparison of mutually exclusive projects

The ROCE method of capital investment appraisal can also be used to compare two or more projects which are mutually exclusive. The project with the highest ROCE would be selected (provided that the expected ROCE is higher than the company's target ROCE).

Advantages of ARR

- (a) It is a quick and simple calculation.
- (b) It involves the familiar concept of a percentage return.
- (c) It looks at the entire project life.

Disadvantages of ARR

- (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.

Time value of money

The concept of time value of money rests on the following assumptions

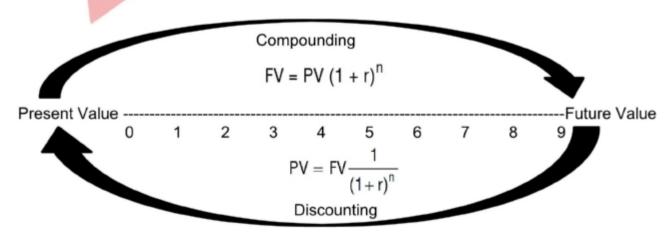
- Consumption Preference
- Investment Preference
- Risk Preference

Discounted cash flow

Discounted cash flow, or **DCF** for short, is an investment appraisal technique which takes into account both the timings of cash flows and also total profitability over a project's life.

Two important points about DCF are as follows.

- (a) DCF looks at the **cash flows** of a project, not the accounting profits. Cash flows are considered because they show the costs and benefits of a project when they actually occur and ignore notional costs such as depreciation.
- (b) The **timing** of cash flows is taken into account by **discounting them**. The effect of discounting is to give a bigger value per \$1 for cash flows that occur earlier: \$1 earned after one year will be worth more than \$1 earned after two years, which in turn will be worth more than \$1 earned after five years, and so on.



where FV is the future value of the investment with interest

PV is the initial or 'present' value of the investment

- r is the compound rate of return per time period, expressed as a proportion (so 10% = 0.10, 5% = 0.05 and so on)
- n is the number of time periods.

Present value is the cash equivalent now of a sum of money receivable or payable at a stated future date, discounted at a specified rate of return.

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 net present value method

The **NPV** method of investment appraisal is to accept projects with a positive NPV. Ensure that you are aware of the three conventions concerning the timings of cash flows.

An **annuity** is a constant cash flow for a number of years. A **perpetuity** is a constant cash flow forever.

Net present value or NPV is the value obtained by discounting all cash outflows and inflows of a capital

investment project by a chosen target rate of return or cost of capital.

The NPV method compares the present value of all the cash inflows from an investment with the present value of all the cash outflows from an investment. The NPV is thus calculated as the PV of cash inflows minus the PV of cash outflows.

NPV	
NPV positive	Return from investment's cash inflows in excess of cost of capital ⇒ undertake project
NPV negative	Return from investment's cash inflows below cost of capital ⇒ don't undertake project
NPV 0	Return from investment's cash inflows same as cost of capital

Note. We assume that the cost of capital is the organisation's target rate of return.

NPV and shareholder wealth maximisation

If a project has a positive NPV it offers a **higher return** than the return required by the company to provide satisfactory returns to its sources of finance. This means that the **company's value** is increased and the project contributes to shareholder wealth maximisation.

Advantages of NPV

- a) The method uses all relevant cash flows relating to the project
- (b) It allows for the **timing** of the cash flows
- (c) It allows for time value of money

Disadvantages of NPV

- (a) The basic decision rule, accept all projects with a positive NPV, will not apply when the capital available for investment is rationed.
- (b) The cost of capital used in DCF calculations may be difficult to estimate.
- (c) The **cost of capital** may **change** over the life of the investment.

The internal rate of return method

The IRR method of investment appraisal is to accept projects whose IRR (the rate at which the NPV is zero) exceeds a target rate of return. The IRR is calculated using interpolation.

Using the NPV method of discounted cash flow, present values are calculated by discounting at a target rate of return, or cost of capital, and the difference between the PV of costs and the PV of benefits is the NPV. In contrast, the internal rate of return (IRR) method is to calculate the exact DCF rate of return which the project is expected to achieve, in other words the rate at which the NPV is zero. If the expected rate of return (the IRR or DCF vield) exceeds a target rate of return, the project would be worth undertaking (ignoring risk and uncertainty factors).

IRR
$$\approx a + \left(\left(\frac{NPV_a}{NPV_a - NPV_b} \right) (b-a) \right) \%$$

where a = the lower of the two rates of return used = the higher of the two rates of return used

NPV_a = the NPV obtained using rate a

NPV_b = the NPV obtained using rate b

Note. Ideally NPVa will be a positive value and NPVb will be negative. (If NPVb is negative. then in the equation above you will be subtracting a negative, ie treating it as an added positive).

Advantages of IRR

(a) Information it provides is more easily understood by managers, especially nonfinancial managers.

- (b) Based on cash flows rather than profits
- (c) Also incorporates time value of money
- (d) indicates return actually to be expected from expenditure
- (e) May assist in ranking different proposals

Disadvantages of IRR

- (a) Managers may confuse IRR and accounting return on capital employed, ARR
- (b) IRR method **ignores** the **relative size** of investments
- (c) May give multiple IRR or even no IRR when projects with un-conventional cashflows are appraised
- (d) IRR and NPV may give different recommendations in case of mutually exclusive projects
- (e) more difficult to calculate than NPV
- (f) NPV is usually more useful in ranking different projects

Summary of NPV and IRR comparison

- (a) When cash flow patterns are conventional both methods gives the **same** accept or reject **decision**.
- (b) The IRR method is more easily understood.
- (c) NPV is technically superior to IRR and simpler to calculate.
- (d) IRR and accounting ROCE can be confused.
- (e) IRR ignores the relative sizes of investments.
- (f) 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.
- (g) The **NPV method** is superior for **ranking mutually exclusive projects** in order of attractiveness.
- (h) The reinvestment assumption underlying the IRR method cannot be substantiated.
- (i) 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.
- (j) Despite the advantages of the NPV method over the IRR method, the **IRR method** is **widely used** in practice.

15 - INVESTMENT APPRAISAL

Q1. The committee of the Qadir Cricket club want your financial advice about employing Brad Driscoll at the start of next season.

Brad is a young player who has impressed cricket lovers all over the world. He would sign a 5 year contract. He would receive an initial payment and be paid a salary as follows:

	\$
Initial payment	200 000
Salary year 1	30 000
2	36 000
3	43 200
4	51 840
5	62 208

The club would rent an apartment for Brad. The rent of the apartment would be as follows:

				\$
Rent	year	1	3	600
		2	3	600
	1	3	4	500
		4	4	500
		5	4	500

The total rent for each year would be paid at the start of the year.

The club would pay Brad \$1000 at the end of each year towards the air fare to visit home.

Without Brad attendance receipts would remain constant at \$1,000,000 per year.

If Brad were employed receipts would rise by 10% each year.

REQUIRED

(a) Calculate the net cash flow generated by the new player, Brad Driscoll. [22]

The current cost of capital for the club is 12%.

The current cost of capital for the club is 12%.

The present value of \$1 at an interest rate of 12% per annum is:

Year 1	\$0.893
Year 2	\$0.797
Year 3	\$0.712
Year 4	\$0.636
Year 5	\$0.507

REQUIRED

(b) Calculate the net present value for Brad.

[8]

(c) Calculate the discounted payback period for Brad.

[4]

The Qadir Cricket Club has also considered employing a different player, Tanzeel. The club accountant has calculated the net present value of Tanzeel to be \$181 606 and that his payback period would be 2.27 years. Tanzeel would retire from cricket at the end of year 3.

REQUIRED

(d) Advise the club committee which player they should employ, Brad or Tanzeel. Give reasons for your answer, using both financial and non-financial factors.
[6]

[Total: 40]

Q2. Ghosh Ltd is considering expanding its business and has to decide between taking on Project A or Project B. Both projects have a life of four years. Equipment is expected to have no scrap value.

Other information about the projects is as follows:

	Project A	Project B
Initial outlay	\$150 000	\$140 000
Annual sales	\$100 000	\$120000
Annual purchases	\$40 000	\$65000
Other costs as a percentage of sales	8%	5%
Increase in working capital	\$10000	\$18000

Ghosh Ltd uses a cost of capital of 10%. Discounting factors at 10% are as follows:

Year 1	0.909
Year 2	0.826
Year 3	0.751
Year 4	0.683

Using a cost of capital of 10% Project B has a net present value of \$15281.

REQUIRED

(a) For each of the two projects calculate the following:

	(i)	the annual net cash flow	[2]	
	(ii)	the accounting rate of return	[6]	
	(iii)	the payback period.	[10]	
(b)	Cal	culate the net present value of Project A only.	[11]	
(c)	(c) State two limitations of each of the following:			
	(i)	accounting rate of return	[2]	
	(ii)	the payback period	[2]	
	(iii)	the net present value.	[2]	

(d) State which of the two projects Ghosh Ltd should select. Give reasons for your answer.

[Total: 40]

[5]

Q3. The managers of Namllih Ltd believe that demand for their product will fall over the next few months if they do not lower the selling price of each briefcase. They intend to purchase a machine that will cut and prepare the leather used to make the briefcases at a lower cost.

There are currently two machines on the market capable of doing exactly what the company requires. Each machine will be used for 4 years, after which it will be scrapped. Machine A is made locally and costs \$40 000. Machine B is manufactured in Indonesia and costs \$44 000.

Whichever machine is purchased output will increase by 875 briefcases per month and the directors are confident that they could all be sold for \$13.50 each.

The total annual costs of producing the extra 875 briefcases using machine A will be \$120 000 in the first year of use and these costs will rise by 5 % each year thereafter.

The annual costs of producing the extra 875 briefcases using machine B in the first year will also be \$120 000 but costs are expected to rise by \$5000 each year thereafter.

The current cost of capital for Namllih Ltd is 7%.

The present value of \$1 is shown.

	7%	14%
Year 1	0.935	0.877
Year 2	0.873	0.770
Year 3	0.816	0.675
Year 4	0.763	0.592

The net present value of machine A using a discount rate of 14 % is negative \$740.68.

The net present value of machine B using a discount rate of 7 % is \$5697.25.

Using 14% as the discount rate the net present value of machine B is negative \$100.50.

REQUIRED

.

- (c) Calculate the net present value for machine A at 7% cost of capital. [12]
- (d) Advise the directors of Namllih Ltd which machine they should purchase. Give reasons for your advice.
 [8]
- (e) Calculate the internal rate of return for your chosen machine. Show your workings. [6]

Q4. Tesda plc is a supermarket chain. They have been offered the choice of two five-year leases on supermarkets abroad. Lack of finance means that they can choose only **one** of them.

The directors have projected the following forecasts:

The lease on supermarket A will cost \$5m.

The lease on supermarket B will cost \$8m.

They expect cash receipts and payments to be as follows:

	Without leasing either new supermarket	With supermarket A	With supermarket B
Year	\$	\$	\$
Total receipts			
1 2 3 4 5	61 m 64 m 67 m 71 m 75 m	63.6 m 67.7 m 71.2 m 75.5 m 80.1 m	63.9 m 69.4 m 73.3 m 77.9 m 83.4 m
Total payments	3		
1 2 3 4 5	20 m 23 m 27 m 32 m 38 m	21.8 m 25.0 m 29.2 m 34.4 m 40.6 m	25.7 m 30.3 m 35.9 m

Assume all receipts and payments occur at the end of the respective year.

Additional information:

Estimated additional costs	Supermarket A	Supermarket B
Additional working capital required		
at start of lease	\$0.6 m	\$1 m
Improvements end of year 2	-	\$1.8 m
Improvements end of year 3	\$2.9 m	-
Improvements end of year 4	-	\$1 m
Depreciation	\$0.5 m per annum	\$0.7 m per annum

REQUIRED

(a) Calculate the estimated annual net cash flows for

	(i)	Supermarket A	[3]
	(ii)	Supermarket B	[3]
(b)	b) Calculate the accounting rate of return (ARR) for		
	(i)	Supermarket A	[7]
	(ii)	Supermarket B	[7]

The following are extracts from present value tables for \$1:

Year	8 %	14%
1	0.926	0.877
2	0.857	0.769
3	0.794	0.675
4	0.735	0.592
5	0.681	0.519

The current cost of capital for Tesda plc is 8%.

REQUIRED

- (c) Calculate the net present value for
 - (i) Supermarket A [6]
 - (ii) Supermarket B
- (d) Identify the supermarket that Tesda plc should lease. Explain your choice. [3]

The net present value for each supermarket using a cost of capital of 14% is estimated to be:

Supermarket A \$1 057 900 negative

Supermarket B \$2 127 600 negative

REQUIRED

(e) Calculate the internal rate of return (IRR) for the supermarket chosen in (d). [5]

[Total: 40]

Q5. The directors of Makeit Ltd propose to buy a machine costing \$300 000. At the end of five years the machine will be sold for \$50 000. In each of the five years the machine will increase revenue by \$160 000. Increased annual expenditure of \$80 000 will be incurred.

Makeit Ltd will require an increase in working capital of \$40 000. Machinery is depreciated on the straight line method.

REQUIRED

(a) Calculate the accounting rate of return (ARR) which will result if the machine is purchased.

[10]

The directors have decided to calculate the payback period of the machine and have decided to discount future net receipts by the cost of capital which is 10%.

The discounting factors at 10% are:

year 1	0.909
2	0.826
3	0.751
4	0.683
5	0.621

REQUIRED

(b) Calculate the discounted payback period for the machine. (It will be necessary to discount the net receipts.)
[5]

Makeit Ltd currently earns a return of 15% on its capital. The discounting factors at 20% are:

year 1	0.833
2	0.694
3	0.579
4	0.482
5	0.402

REQUIRED

(c) (i) Calculate the internal rate of return (IRR).

[10]

(ii) State with reasons whether the directors should purchase the machine.

[3]

The directors believe that the various methods of appraising capital expenditure have advantages and disadvantages.

REQUIRED

- (d) State the advantages and disadvantages of using the following methods:
 - (i) accounting rate of return (ARR)
 - (ii) payback period

(iii) internal rate of return (IRR).

[12]

[Total: 40]

Q6. Clegg is replacing one of his machines. He can choose between machine A or machine B.

Details of the machines are as follows:

	Machine A	Machine B
Cost	\$80 000	\$100 000
Estimated useful life	4 years	4 years
Scrap value	\$4000	\$8000

Annual depreciation (each machine): straight line.

Estimated receipts and payments are as follows:

		Re	evenue receipts	
	Ma	chine A	vende receipts	Machine B
		\$000		\$000
Year	1 6	66 000		70 000
1	2 8	30 000		90 000
	3 10	0000		100 000
	4	70 000		60 000
100				
			Payments	
16		\$000		\$000
Year	1	31 000		42 000
1	2	7 000		49 000
	3	000 88		67 000
	4	88 000		29 000
Cleg	g Ltd's cost of capital is	10%.		
Disco	ounting rates:	10%		20%
Year	The state of the s	0.909		0.833

Discounting rates:	10%	20%
Year 1	0.909	0.833
2	0.826	0.694
3	0.751	0.579
4	0.683	0.482

REQUIRED

- (a) Calculate the accounting rate of return (ARR) for each machine. [12]
- (b) Calculate the payback period for each machine. [4]
- (c) Calculate the net present value (NPV) of each machine. [11]

The new machine must produce an internal rate of return (IRR) of at least 22%.

REQUIRED

- (d) Prepare calculations to show the internal rate of return (IRR) produced by each machine. [4]
- (e) State which machine Clegg should purchase. Give your reasons. [5]
- (f) Suggest why Clegg requires the new machine to produce an IRR of at least 22% if it already produces a positive NPV.
 [4]

Q7. The directors of Drake plc wish to invest in a new production plant, and must choose between Project Utopia and Project Sylvania.

In each case the investment will be financed with a bank loan for the full amount. This will be received in full on the day the plant is purchased. The loan will be repaid in full in a single payment at the end of year five, however interest is payable throughout the useful life of the plant at 10% per annum.

The useful life of the plant will be 5 years, and it will then be scrapped with no sale proceeds.

The following information is available for Project Utopia:

Cost of production plant \$200 000 Cost of capital \$10%

Depreciation rate 30% reducing balance

Revenue in year 1 \$110 000 Direct costs in year 1 \$40 000

Revenue each year will be 5% higher than the year before. Costs each year will be 3% higher than the year before.

Discount factors showing net present value of \$1

Year	10%	40%
1	0.909	0.714
2	0.826	0.510
3	0.751	0.364
4	0.683	0.260
5	0.621	0.186

Copy the following table into your answer booklet.

					400		
Yea	ar	R	eveni	ue	Costs	Interest	Net cash flow
			\$	A	\$	\$	\$
0							
1							
2				1			
3							
4	1						
5							
Tota	al						

REQUIRED

- (a) Complete the table from the information given to calculate the net cash flow for **each** year and in total for Project Utopia. [7]
- (b) Calculate the net present value for Project Utopia.

(c) Calculate the accounting rate of return (ARR).

[5]

(d) Calculate the internal rate of return (IRR).

[7]

Additional information

The following information has also been calculated for Project Sylvania.

Net present value	\$41 680
Accounting rate of return (ARR)	19.48%
Internal rate of return (IRR)	17.29%

REQUIRED

(e) State, with reasons, in which project the directors of Drake plc should invest.

[4]

Additional information

The directors of Drake plc could finance the new project by issuing new ordinary shares and not using a bank loan.

REQUIRED

- (f) Explain how financing the new project from the proceeds of issuing new ordinary shares would affect the accounting rate of return (ARR). [6]
- (g) State and explain two other sources of finance for the project.

[4]

[Total: 40]

Sensitivity Analysis

Sensitivity analysis is one method of analysing 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

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.

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.

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 non-viable.

Q1. Alfonso Trading Limited provides the following budgeted data for 2014.

Budgeted sales (units) for April = 5800

Sales price per unit = \$9.5

Additional information relating to April 2014 is as follows:

Budgeted total variable costs 24 900 Budgeted total fixed costs 16 700

Calculate for April 2014:

- (i) the sensitivity of performance to changes in the selling price
- (ii) the selling price per unit at which profit would be zero
- (iii) the sensitivity of performance to changes in variable cost.

Q2. Kriti Singh is considering expanding her business and manufacturing an additional product.

Projected costs and revenues for this product are:

Direct production costs	\$60 per unit
Variable administration and distribution costs	\$10 per unit
Rent of second factory	\$30 000 a year
Supervisor's salary	\$22 000 a year
Other fixed manufacturing costs	\$18 000 a year

Production is expected to be 2000 units a year with no inventory of finished goods being held. She charges profit at 30% on cost.

REQUIRED

(e)	Calculate the expected profit for the year.	[2]
(f)	Calculate the sensitivity of the expected profit to changes in:	
	(i) sales price;	[2
	(ii) sales volume;	[6
	(iii) variable costs;	[2
	(iv) fixed costs.	[2

Q3. The directors of Ragley Limited are considering a new business opportunity. This involves the purchase of machinery costing \$600 000.

Units produced by the machine are expected to have a selling price of \$50 each and the variable costs of production are expected to be \$31.10 per unit. Fixed costs are expected to be \$120000 per annum excluding depreciation.

The machinery is expected to lose its value evenly over four years and then be scrapped.

The directors expect to produce and sell 20 000 units a year.

Ragley Limited has a cost of capital of 10%. Discount factors are as follows.

Year 1 0.909 Year 2 0.826 Year 3 0.751 Year 4 0.683 3.169

The directors provide the following incorrect net present value calculation as an aid to decision making.

Annual surplus \$108 000
x Discount factor for four years 3.169
Net present value \$342 252

- (a) Calculate the correct net present value of the machinery.
- (b) Calculate the sensitivity of the project to changes in the cost of the machinery.
- (c) Calculate the sensitivity of the project to changes in the selling price.
- (d) Calculate the sensitivity of the project to changes in units sold.
- (e) Calculate the sensitivity of the project to changes in Variable costs.
- (f) Calculate the sensitivity of the project to changes in Fixed Costs