MGT 388 Finance and Law for Engineers

Capital Investment Decision

Sajid Bashir

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Investment

An investment involves foregoing consumption now, in anticipation of the opportunity to consume more in the future.

A particular opportunity to invest is known as 'Project'. For e.g.

- Opening a new branch
- Building a new factory
- Buying a new machine
- Purchase of van
- Significant upgrade of existing equipment

Investment Appraisal involves

- identification of future cash flows which are relevant to the project.
- Estimate the scale of future cash inflows/outflows
- Ascertain timing of these future cash inflow /outflow
- Comparison with a set standard or among projects to determine their suitability

Capital Investment Appraisal

To achieve the business strategy an investment in a project, contract or new development may be required.

An investment decision often requires a considerable financial outlay with returns expected over an extended time period.

Capital Investment Appraisal

If only one project is available need to decide whether to invest or not.

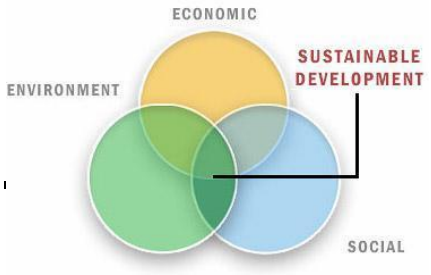
Where more than one project is available need to decide which project to invest in. *Capital Rationing.*

When deciding on an investment must consider:

Risk and uncertainty

Monetary returns

Non-monetary business objectives



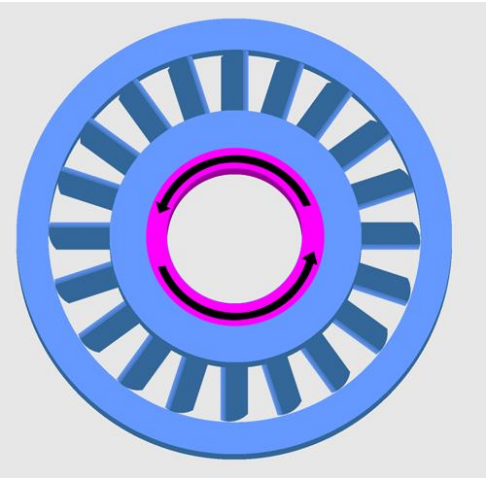
Examples of Capital Investment

Dyson – develop a suite of electric cars by 2020. £2bn investment in the car and battery.

JD.com -$397m investment to launch a standalone ecommerce platform to target buyers of luxury goods in small cities in China

Examples of Capital Investment

Rolls Royce – £100m on smart machine tools in Tyne and Wear factory reducing time to make turbine discs
For one component time reduced from 118 hour to30 hours.



Sheffield University – £200m in buildings in two years.

Appraisal Techniques

All the investment appraisal techniques consider cash flows rather than profits as cash does not suffer from accounting allocations and is a better predictor of future wealth.

Main appraisal techniques are:

- Accounting rate of return
- Payback period
- Net present value
- Internal rate of return

Example 1

INVESTMENT

A project will require an initial investment of £200,000 and will last 5 years.

At the end of 5 years some of the equipment can be sold off for £10,000.

SALES

The sales revenue will be £75,000 in year 1, £85,000 in years 2 and 3, £60,000 in year 4 and £50,000 in year 5.

COSTS

Labour costs are expected to be £25,000 for each year.

Material costs will be £2,000 in year 1, £3,000 in years 2 and 3, £2,000 in year 4 and £1,000 in year 5.

Calculation of net cash flow

Year	Investment/ Scrap	Labour	Materials	Revenue	Net Cash flow
0	(200,000)				(200,000)
1		(25,000)	(2,000)	75,000	48,000
2		(25,000)	(3,000)	85,000	57,000
3		(25,000)	(3,000)	85,000	57,000
4		(25,000)	(2,000)	60,000	33,000
5	10,000	(25,000)	(1,000)	50,000	34,000
Total	**(190,000)**	**(125,000)**	**(11,000)**	**355,000**	**29,000**

Accounting rate of return

$$\text{ARR} = \frac{\text{Average expected return}}{\text{Average capital employed/investment}} \times 100\%$$

$$\text{Average expected return} = \frac{£355{,}000 - 11{,}000 - 125{,}000}{5 \text{ years}}$$

$$= £219{,}000 / 5 \text{ years} = £43{,}800$$

$$\text{Average investment} = \frac{200{,}000 + 10{,}000}{2} = £105{,}000$$

$$\text{ARR} = \frac{£43{,}800}{£105{,}000} = 42\%$$

Accounting rate of return

Simple and easy to calculate. Easy to understand.

Very similar to Return on capital employed- seen as key ratio by investors

Projects judged by ARR are assessed internally in the same way as assessed externally.

But attaches same value to cash flows whether received in year 1 or year 5

Should ARR be calculated before or after depreciation.

Doesn't consider size of investment. An investment of £40,000 with ARR of 10% generates £4,000. An investment of £400,000 with ARR of 10% generates £40,000.

Payback period

The payback period is the length of time it takes for an initial investment to be repaid out of the net cash inflows from a project.

Year	Net Cash flow	Cumulative net cash flow
0	(200,000)	(200,000)
1	48,000	(152,000)
2	57,000	(95,000)
3	57,000	(38,000)
4	33,000	(5,000)
5	34,000	29,000

Payback period

For the above project it takes between 4 and 5 years to payback the initial investment of £200,000.

Assuming the £34,000 inflow in year 5 accrued evenly at (£34,000/12 months) = £2,833 per month.

The payback period is approximately 4 year 2 months.

Example 2 Payback Period

"Armchair TV" are considering buying the television rights to the Albanian premier (soccer) league, at an immediate cost of £1.9m. They will then re-package the games and sell programmes to cable networks, with expected revenues as follows:

Worked example: Armchair TV

- Pay £1.9 m NOW
- Revenue end Yr 1 £200,000
- Revenue end Yr 2 £300,000
- Revenue end Yr 3 £350,000
- Revenue end Yr 4 £350,000
- Revenue end Yr 5 £400,000
- Revenue end Yr 6 £400,000
- Revenue end Yr 7 £300,000
- Revenue end Yr 8 £100,000

Armchair TV: 'on the face of it'

Profit = total revenue – total costs

= £2.4m less £1.9m = £0.5m

Payback Period

The payback period calculation; **need to re- coup £1.9m**

	Annual Inflows (£)	Cumulative Inflows (£k)
Yr 1	200,000	200,000
Yr 2	300,000	500,000
Yr 3	350,000	850,000
Yr 4	350,000	1,200,000
Yr 5	400,000	1,600,000
Yr 6	400,000	2,000,000
Yr 7	300,000	Irrelevant
Yr 8	100,000	irrelevant

The payback period calculation

After 5 yrs £1.6m re-couped

After 6 yrs £2.0m re-couped

We only require £1.9m to pay-back

therefore 'payback' occurred at:

5 yrs plus (0.3m / 0.4m) x 12 months

giving **5 yrs 9 months overall**

Payback

Strengths of Payback Period

- Minimises impact of long term risk – like change of government, Chances of competitors producing copy products
- Quick and simple to calculate and managers easily understand it.
- Avoids obvious difficulties in projecting cash flow several years from hence.

Weaknesses of Payback Period

- Difficulties in predicting what expenditure has to be paid – Especially when large negative cashflow at the end of the project is present.
- Ignores time value of money.
- Favours short term projects over long term projects .

Time value of money

Compounding

£100 invested today at 10% p.a. is worth £110 in 1 yr.

In 2 years it will be worth £110 x 110%, i.e. £121

In 3 years it will be worth £121 x 110%, i.e. £133

To find out what £100 invested for 3 years at 10% is:

$£100 \times 1.10^3 = £133$

Time Value of Money

Discounting

If we know we are to receive £133 in 3 years' time, how much is that worth now, given that the rate of interest is 10%?

The answer is:

$$£133 \times \frac{1}{(1.10)^3} = £100$$

$$\frac{1}{(1.10)^3} = 0.751$$

0.751 is the '*discount factor*' (for 3 years at 10%).
Tables are provided for discount factors they do not need to be calculated

Present Value Tables

Present Value Table

Present value of 1 i.e. $(1 + r)^{-n}$

Where r = discount rate
n = number of periods until payment

Periods (n)	*Discount rate (r)* 1%	2%	3%	4%	5%	6%	7%	8%	9%	10%	
1	0·990	0·980	0·971	0·962	0·952	0·943	0·935	0·926	0·917	0·909	1
2	0·980	0·961	0·943	0·925	0·907	0·890	0·873	0·857	0·842	0·826	2
3	0·971	0·942	0·915	0·889	0·864	0·840	0·816	0·794	0·772	0·751	3
4	0·961	0·924	0·888	0·855	0·823	0·792	0·763	0·735	0·708	0·683	4
5	0·951	0·906	0·863	0·822	0·784	0·747	0·713	0·681	0·650	0·621	5
6	0·942	0·888	0·837	0·790	0·746	0·705	0·666	0·630	0·596	0·564	6
7	0·933	0·871	0·813	0·760	0·711	0·665	0·623	0·583	0·547	0·513	7
8	0·923	0·853	0·789	0·731	0·677	0·627	0·582	0·540	0·502	0·467	8
9	0·914	0·837	0·766	0·703	0·645	0·592	0·544	0·500	0·460	0·424	9
10	0·905	0·820	0·744	0·676	0·614	0·558	0·508	0·463	0·422	0·386	10

Time value of money

Discounting

With investment appraisal we use the reverse of compounding.

We estimate cash flows we expect in future years and discount them at an appropriate rate.

The rate used for discounting takes into account inflation but also the firm's required rate of return.

The required rate of return on a project depends on the risk involved and the opportunity cost of not investing the funds elsewhere.

The discount rate a business uses for investment appraisal is known as its cost of capital.

Net present value

Having established the timing and amount of future cash flows the firms cost of capital can be applied to bring those cash flows to their present value.

The total of the present values is the net present value of a project.

If the net present value is positive the project should be accepted.

If the net present value is negative the project should be rejected.

Net present value

Decide whether to accept the project if the firm's cost of capital is 7%

Year	Net Cash flow £	Discount Factor	Net present value £
0	(200,000)	1	(200,000)
1	48,000	0.935	44,880
2	57,000	0.873	49,761
3	57,000	0.816	46,512
4	33,000	0.763	25,179
5	34,000	0.713	24,242
			(9,426)

As the NPV is negative at that cost of capital the project should be rejected.

Example 2 – NPV

"Armchair TV" are considering buying the television rights to the Albanian premier (soccer) league, at an immediate cost of £1.9m. They will then re-package the games and sell programmes to cable networks, with expected revenues as follows:

Worked example: Armchair TV

- Pay £1.9 m NOW
- Revenue end Yr 1 £200,000
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- Revenue end Yr 5 £400,000
- Revenue end Yr 6 £400,000
- Revenue end Yr 7 £300,000
- Revenue end Yr 8 £100,000

Lets calculate the present value of each of these cash flows @5%

NPV – Calculation

	£	x Disc. Factor	= Present Value
Year 1	200,000	0.952	190,400
Year 2	300,000	0.907	272,100
Year 3	350,000	0.864	302,040
Year 4	350,000	0.823	288,050
Year 5	400,000	0.784	313,600
Year 6	400,000	0.746	298,400
Year 7	300,000	0.711	213,300
Year 8	100,000	0.677	67,700
Total			**1,945,950**
less investment			**1,900,000**
=Net present value			**45,950**

NPV

- Invest if NPV is Positive
- Do Not Invest if NPV is Negative
- If NPV is Zero, investor is indifferent as to whether to invest

- In the given example the Investment should go ahead.

NPV

Strengths of NPV

- It Recognises the Time Value of Money
- It recognises the difference in size of investment
- It allows for additivity – So projects whose success depends upon the introduction of subsequent projects , may be added together to find out their combined NPV.

Weaknesses of NPV

- Difficult to explain to people not formally trained in Finance
- Provides answers in monetary terms, so does not allow comparison for profitability of the project.

	Initial Investment	NPV
• Which is better ?	• £ 50,000	£25,000
	• £250,000	£30,000

Internal rate of return

The internal rate of return of a particular investment is the discount rate that, when applied to its future cash flows, will produce an NPV of zero.

The internal rate of return represents the return from an investment opportunity.

The way to obtain an IRR is through a computer package, trial and error with linear interpolation or graphically.

Internal Rate of Return

The NPV is preferred to IRR

Where net cash flows are both positive and negative there can be more than one IRR

IRR is a percentage. A business might be concerned with value of cash flow

YOU WILL NOT BE ASKED TO CALCULATE AN IRR BUT FOR COMPLETENESS THE IRR FOR THE LECTURE EXAMPLE HAS BEEN SHOWN IN THE FINAL SLIDES

Calculating Internal Rate of return

Prepare NPV calculations for two discount rates one which produces a negative NPV and one which produces a positive NPV.

Use linear interpolation to determine the internal rate of return.

For our project we have used a 7% discount rate and obtained a negative NPV.

Re-calculate NPV using a discount rate of 5%

Internal Rate of return

Calculating the net present value using a discount rate of 5%

Year	Net Cash flow £	Discount Factor	Net present value £
0	(200,000)	1	(200,000)
1	48,000	0.952	45,696
2	57,000	0.907	51,699
3	57,000	0.864	49,248
4	33,000	0.823	27,159
5	34,000	0.784	26,656
			458

If the company had a cost of capital of 5% the project would have been accepted.

Internal rate of return

From the two NPV tables we have two figures either side of zero. Linear interpolation can now be used to estimate the IRR.

The difference in the cash flows are (9,426) + 458 = £9,884

The difference in the discount rate used is (7%–5%)2%

The distance between 7% and IRR is $\frac{9,426}{9,884}$ X2% = 1.9%

IRR is 7%–1.9% = 5.1%

The distance between 5% and IRR is $\frac{458}{9,884}$ X2% = 0.1%

IRR is 5% +0.1% = 5.1%

Summary

- Capital investment appraisal techniques
- ARR
- Payback
- NPV
- IRR
- Limitations
- Worked examples