

School of Engineering

Engineering Management – Capital Investment Decisions

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Project Appraisal

Why or why not to do something

- ☐ As engineers we want to do projects
 - ☐ New product
 - Research a new idea
 - Develop it
 - Bring it to production and sell it
 - ☐ Better product – performance engineering
 - Improved performance
 - ☐ Power, weight, speed (Cd)
 - ☐ Handling
 - ☐ Fuel economy and emissions
 - Costs
 - ☐ Develop new process/use of materials
 - ☐ Cost down exercises
 - ☐ Innovative solutions
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Project Appraisal

Different techniques

- ☐ Payback period
 - ☐ Accounting rate of return
 - ☐ Net present value
 - ☐ Internal rate of return
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Project Appraisal

Payback period

- If we spend some money, how long does it take to make the money back again ?
 - Example – TTK wants to develop a new kit
 - Development of new kit cost £12,000
 - Predicted volume 17/month
 - Cost of kit £700
 - Expenses per kit £65
 - Sale price of kit £1000
 - Net profit per kit £235
 - Net profit per month $17 \times £235 = £4000$
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Project Appraisal

Payback period

- If we spend some money, how long does it take to make the money back again ?

Month	monthly net cash flow	cumulative cash flow
0	-£12,000	-£12,000
1	4,000	-£8,000
2	4,000	-£4,000
3	4,000	NIL
4	4,000	£4,000
5	4,000	£8,000

Project Appraisal

Accounting Rate of Return (ARR)

- ❑ Payback is concerned with cash flow
- ❑ AAR is concerned with the profit that we make compared to our average capital employed (or invested)
- ❑ Capital employed is the money tied up in the business that is used for the project
- ❑ Average capital employed is the capital invested in the project over time period that the project runs
- ❑ Eg capital needed in 1st year is £190k and then a further £20k the next year. Average=£200k
- ❑ ARR is the profit as a percentage of the capital employed

$$\frac{\text{Profit (before tax)}}{\text{Average capital employed}} \times 100$$

Project Appraisal

Accounting rate of return (ARR)

- Tenby Turbo Kits is contemplating two projects both provide a kit to an importer to sell on a special edition (high performance variant) of their current road car, over a two year period
- One project has a higher volume than the other

	Project A	ProjectB
Sales	£100,000	£210,000
Cost of sales including expenses	£60,000	£130,000
Capital required to start the project	£190,000	£450,000
Extra catital required during the 2nd year	£20,000	£100,000

Project Appraisal

Accounting rate of return (ARR)

	Project A	ProjectB
Profit less cost of sales	£40,000	£80,000
Average capital employed		
start of year 1	£190,000	£450,000
end of year 1	£210,000	£550,000
	£400,000	£1,000,000
Average capital over two years	£200,000	£500,000
pre tax profit	£40,000	£80,000
Average capital employed	£200,000	£500,000
x100 = ARR	20%	16%

Which project is best ?

Project Appraisal

Discounted cash flow

- ❑ Concept of time value of money. £100 now is worth more than £100 in the future.
- ❑ Example: £100 now invested at 10% interest

Year	original sum		factor		cumilated
	invested				value
0	£100 x	1	=		£100
1	£100 x	1.1	=		£110
2	£100 x	1.1 ²	=		£121
3	£100 x	1.1 ³	=		£133.10
4	£100 x	1.1 ⁴	=		£146.41
5	£100 x	1.1 ⁵	=		£161.05

Project Appraisal

Discounted cash flow

- A = final amount or compounded sum
- P = principle amount or amount invested
- R = annual interest rate as a decimal (10% = 0.1)
- T = time in years

$$A = P (1+R)^T$$

Similarly the value of money in the future can be expressed
As the value today. Called **discounting**

$$P = \frac{A}{(1+R)^T}$$

(see tables)

Project Appraisal

Net Present Value (NPV)

- Now we have the concept that if we invest now and get returns in future years, the value of those returns reduces as the years go by.
- We can reflect the value of future returns to their net present value (or what they would be worth to us today)

Year	Detail	Cash Flows		Discount		Present
				factor 15%		value
0	Purchase of machine	-75,000		1		-75,000
1	Net cash inflow	£30,000				
2	Net cash inflow	£30,000				
3	Net cash inflow	£30,000				
4	Net cash inflow	£30,000				
5	Net cash inflow	£30,000		3.352		£100.56
	Net present value					<u>£25,560</u>

Project Appraisal

Internal Rate of Return (IRR)

- ❑ IRR is related to the NPV that we have just covered
- ❑ It is the discount rate that would result in a NPV of zero

Year	Detail	Cash Flows	Discount	Present
			factor 15%	value
0	Purchase of machine	-75,000	1	-75,000
1	Net cash inflow	£30,000		
2	Net cash inflow	£30,000		
3	Net cash inflow	£30,000		
4	Net cash inflow	£30,000		
5	Net cash inflow	£30,000	3.352	£100.56
	Net present value			£25,560

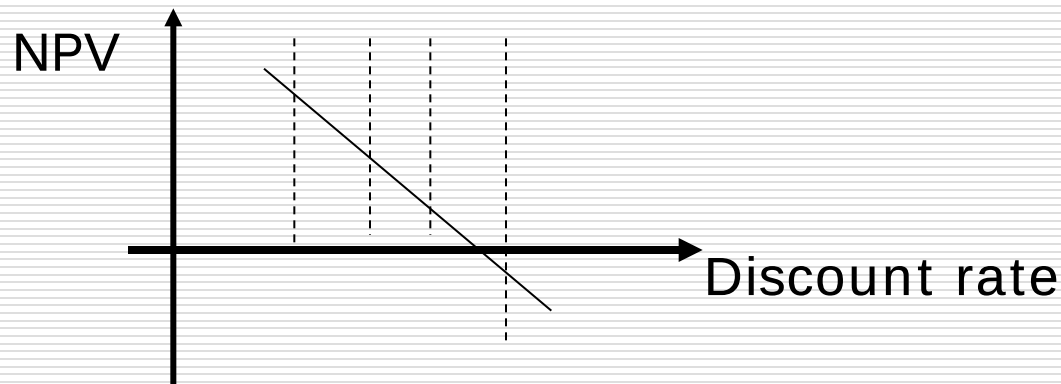
- ❑ With a 15% discount rate the NPV is £25,560 positive
 - ❑ We can recalculate the NPV at higher %s (20%,25%,30%)
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Project Appraisal

Internal Rate of Return (IRR)

- We can recalculate the NPV at higher %s (20%,25%,30%)

Year	Detail	Cash Flows	Discount factor 15%	Present value	Discount factor 20%	Present value	Discount factor 25%	Present value	Discount factor 30%	Present value
0	Purchase of machine	-75,000	1	-75,000	1	-75,000	1	-75,000	1	-75,000
1 to 5	Net cash inflow	£30,000/pa	3.352	£100,560	2.991	£89,730	2.689	£80,670	2.436	£73,080
				£25,560		£14,730		£5,760		-£1,920



Project Appraisal Conclusions

- ❑ There are many ways to financially evaluate projects
 - ❑ Payback and Accounting Rate of Return do not take into account the time value of money
 - Best used for smaller shorter projects
 - ❑ Net Present Value does include the time value of money. If NPV is nil then then the return is the same as the discount rate applied.
 - ❑ It is more realistic if working capital is included
 - This we have not covered
 - ❑ Always be aware of the level of investment required.
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