Accounting Information for Capital Investment

Risk and uncertainty

- A distinction is often drawn by decision theorists between **risk** and **uncertainty**.
- **Risk** is applied to a situation where there are several possible outcomes and there is relevant past experience to enable statistical evidence to be produced for predicting the possible outcomes.
- **Uncertainty** exists where there are several possible outcomes, but there is little previous statistical evidence to enable the possible outcomes to be predicted. Most business decisions can be classified in the uncertainty category, but the distinction between risk and uncertainty is not essential for our analysis and we shall use the terms interchangeably.

Probabilities

- Because decision problems exist in an uncertain environment, it is necessary to consider those uncontrollable factors that are outside the decision-maker's control and that may occur for alternative courses of action. These uncontrollable factors are called **events** or **states of nature**.
  - For example, in a product launch situation, possible states of nature could consist of events such as a similar product being launched by a competitor at a lower price, at the same price, at a higher price or no similar product being launched.
- The likelihood that an event or state of nature will occur is known as its probability, and this is normally expressed in decimal form with a value between 0 and 1. A value of 0 denotes a nil likelihood of occurrence, whereas a value of 1 signifies absolute certainty – a definite occurrence. A probability of 0.4 means that the event is expected to occur four times out of ten. The total of the probabilities for events that can possibly occur must sum to 1.0.
  - For example, if a tutor indicates that the probability of a student passing an examination is 0.7 then this means that the student has a 70 per cent chance of passing the examination. Given that the pass/fail alternatives represent an exhaustive listing of all possible outcomes of the event, the probability of not passing the examination is 0.3.

Probability distribution

- A **probability distribution** is a list of all possible outcomes for an event and the probability that each will occur.
- Some probabilities are known as **objective probabilities** because they can be established mathematically or compiled from historical data. Tossing a coin and throwing a die are examples of objective probabilities. For example, the probability of heads occurring when tossing a coin logically must be 0.5.
- It is unlikely that objective probabilities can be established for business decisions, since many past observations or repeated experiments for particular decisions are not possible; the probabilities will have to be estimated based on managerial judgement.
- Probabilities established in this way are known as **subjective probabilities** because no two individuals will necessarily assign the same probabilities to a particular outcome. Subjective probabilities are based on an individual's expert knowledge, past experience and observations of current variables which are likely to have an impact on future events. Such probabilities are unlikely to be estimated correctly, but any estimate of a future uncertain event is bound to be subject to error.

Expected value

- The presentation of a **probability distribution** for each alternative course of action can provide useful additional information to management, since the distribution indicates the degree of uncertainty that exists for each alternative course of action.
- The **expected value** (sometimes called expected payoff) is calculated by weighting each of the profit levels (i.e. possible outcomes).

Product A probability distribution

(1) Outcome	(2) Estimated probability	(3) Weighted (col. 1 amount × col. 2) (£)
Profits of £600 000	0.10	60 000
Profits of £700 000	0.20	140 000
Profits of £800 000	0.40	320 000
Profits of £900 000	0.20	180 000
Profits of £1 000 000	0.10	100 000
	1.00	
	Expected value	800 000

Product B probability distribution

(1) Outcome	(2) Estimated probability	(3) Weighted (col. 1 amount × col. 2) (£)
Profits of £400 000	0.05	20 000
Profits of £600 000	0.10	60 000
Profits of £800 000	0.40	320 000
Profits of £1 000 000	0.25	250 000
Profits of £1 200 000	0.20	240 000
	1.00	
	Expected value	890 000

Decision tree

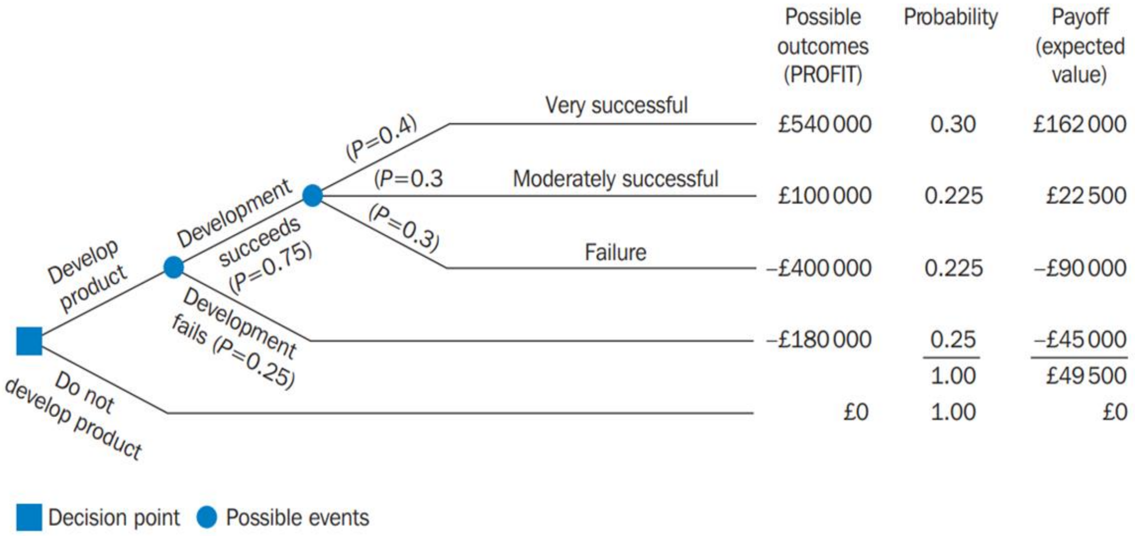
- A useful analytical tool for clarifying the range of alternative courses of action and their possible outcomes is a **decision tree**.
- A decision tree is a diagram showing several possible courses of action and possible events (i.e. states of nature) and the potential outcomes for each course of action. Each alternative course of action or event is represented by a branch, which leads to subsidiary branches for further courses of action or possible events.
- Decision trees are designed to illustrate the full range of alternatives and events that can occur, under all envisaged conditions. The value of a decision tree is that its logical analysis of a problem enables a complete strategy to be drawn up to cover all eventualities before a firm becomes committed to a scheme.

A company is considering whether to develop and market a new product. Development costs are estimated to be £180 000, and there is a 0.75 probability that the development effort will be successful and a 0.25 probability that the development effort will be unsuccessful. If the development is successful, the product will be marketed, and it is estimated that:

1. if the product is very successful profits will be £540 000;
2. if the product is moderately successful profits will be £100 000;
3. if the product is a failure, there will be a loss of £400 000.

Each of the above profit and loss calculations is after taking into account the development costs of £180 000. The estimated probabilities of each of the above events are as follows:

1	Very successful	0.4
2	Moderately successful	0.3
3	Failure	0.3



Exercise 12.11

Darwin uses decision tree analysis to evaluate potential projects. The company has been looking at the launch of a new product which it believes has a 70 per cent probability of success. The company is, however, considering undertaking an advertising campaign costing £50 000, which would increase the probability of success to 95 per cent. If successful, the product would generate income of £200 000 otherwise £70 000 would be received.

Required:

What is the maximum that the company would be prepared to pay for the advertising?

Suggested solution:

Expected income with advertising = (£200 000 x 0.95)+ (£70 000 x 0.05) = £ 193 500

Expected income without advertising = (£200 000 x 0.7) + (£70 000 x 0.3) = £ 161 000

The maximum amount the company should pay for advertising is the increase in expected value of £32 500.

Exercise 12.18

An events management company is trying to decide whether or not to advertise an outdoor concert. The sale of tickets is dependent on the weather. If the weather is poor it is expected that 5 000 tickets will be sold without advertising. There is a 70% chance that the weather will be poor. If the weather is good it is expected that 10 000 tickets will be sold without advertising. There is a 30% chance that the weather will be good. If the concert is advertised and the weather is poor, there is a 60% chance that the advertising will stimulate further demand and ticket sales will increase to 7 000. If the weather is good there is a 25% chance the advertising will stimulate demand and ticket sales will increase to 13 000.

The profit expected, before deducting the cost of advertising, at different levels of ticket sales are as follows:

Exercise 12.18

Number of tickets sold	Profit $
5 000	(20 000)
6 000	(5 000)
7 000	35 000
8 000	55 000
9 000	70 000
10 000	90 000
11 000	115 000
12 000	130 000
13 000	150 000

The cost of advertising the concert will be $15 000.

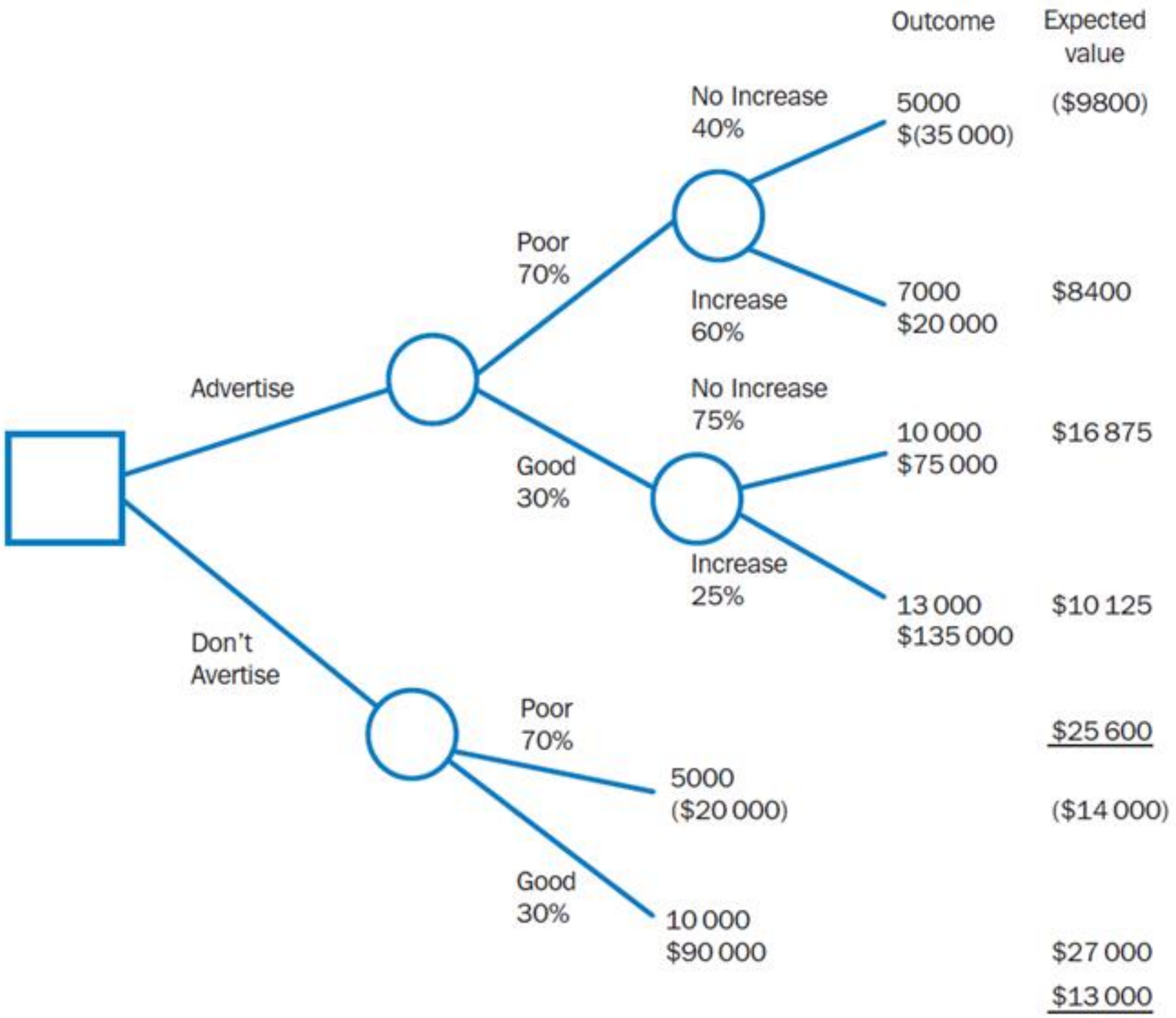
Required:

Demonstrate, using a decision tree, whether the concert should be advertised.

Exercise 12.18

Suggested solution:

Note that the entries in the expected value column are calculated by multiplying the joint probability of the outcomes by the monetary value of the outcome. The joint probabilities of the 4 outcomes arising from the 'advertise option' are 0.28 (0.7 x 0.4), 0.42 (0.7 x 0.6), 0.225 (0.75 x 0.3) and 0.075 (0.3 x 0.25). Based on the expected value approach the concert should be advertised.



Net present value

- The most straightforward way of determining whether a project yields a return in excess of the alternative equal risk investment in traded securities is to calculate the **net present value** (**NPV**). This is the present value of the net cash inflows less the project's initial investment outlay.
- If the rate of return from the project is greater than the return from an equivalent risk investment in securities traded in the financial market, the NPV will be positive.
- Alternatively, if the rate of return is lower, the **NPV** will be negative. A positive **NPV** therefore indicates that an investment should be accepted, while a negative value indicates that it should be rejected. A zero NPV calculation indicates that the firm.
- The NPV can be expressed as:

$$NPV=\frac{FV_1}{1+K}+\frac{FV_2}{(1+K)^2}+\frac{FV_3}{(1+K)^3}+\cdots+\frac{FV_n}{(1+K)^n} - I_0$$

- where I_0 represents the investment outlay and FV represents the future values received in years 1 to n. The rate of return K used is the return available on an equivalent risk security in the financial market.

Net present value

- Assume that a firm examines two investment projects. Both projects require an initial outflow of 1.000 €. The cost of capital of the firm is 10%. The net cash flows of the two projects are presented in the following table:

T	A	B
1	500	100
2	400	200
3	300	300
4	100	400
5	10	500
6	10	600

		10 %	
Year	PVIF	A	B
1	0,9091	455	91
2	0.8264	331	165
3	0.7513	225	225
4	0.6830	68	273
5	0.6209	6.	310
6	0.5645	6	339
PV		1.091	1.403
(-) Initial Cost		1.000	1.000
NPV		91	403

Net present value

- Net Present Value – Advantages
  - Considers the time value of money
  - Discounts NCFs with the weighted average cost of capital
  - Provides the absolute contribution of a project
  - NPVs from various projects can be added to give the total NPV a firm can achieve within a period of time
  - Can be modified to consider the investment risk.
- Net Present Value – Disadvantages
  - Assumes that the weighted cost of capital remains constant over the whole life of the investment project.

Exercise 13.13

An investment has the following cash inflows and cash outflows:

Time	Cash flow per annum £000
0	(20 000)
1–4	3 000
5–8	7 000
10	(10 000)

Required:

What is the net present value of the investment at a discount rate of 8 per cent?

Suggested solution:

Time	Cash flow (£000)	Discount factor at 8%	Present value (£000)
0	(20 000)	1.0	(20 000)
1–4	3 000	3.312	9 936
5–8	7 000	2.435 (5.747 –3.312)	17 045
10	(10 000)	0.463	(4 630)
		NPV	2 351

Exercise 13.21

A car manufacturer has been experiencing financial difficulties over the past few years. Sales have reduced significantly as a result of the worldwide economic recession. Costs have increased due to quality issues that led to a recall of some models of its cars. Production volume last year was 50 000 cars and it is expected that this will increase by 4% per annum each year for the next five years. The company directors are concerned to improve profitability and are considering two potential investment projects.

Project 1 – implement a new quality control process.

The company has paid a consultant process engineer $50 000 to review the company's quality processes. The consultant recommended that the company implement a new quality control process. The new process will require a machine costing $20 000 000. The machine is expected to have a useful life of five years and no residual value.

It is estimated that raw material costs will be reduced by $62 per car and that both internal and external failure costs from quality failures will be reduced by 80%. Estimated internal and external failure costs per year without the new process, based on last year's production volume of 50 000 cars, and their associated probabilities are shown below:

Exercise 13.21

Internal failure costs		External failure costs	
$	Probability	$	Probability
300 000	50%	1 300 000	60%
500 000	30%	1 900 000	30%
700 000	20%	3 000 000	10%

Internal and external failure costs are expected to increase each year in line with the number of cars produced. The company's accountant has calculated that this investment will result in a net present value (NPV) of $1 338 000 and an internal rate of return of 10.5%.

Project 2 – in-house component manufacturing

The company could invest in new machinery to enable in-house manufacturing of a component that is currently made by outside suppliers. The new machinery is expected to cost $15 000 000 and have a useful life of five years and no residual value. Additional working capital of $1 000 000 will also be required as a result of producing the component in-house.

The price paid to the current supplier is $370 per component. It is estimated that the in-house variable cost of production will be $260 per component. Each car requires one component Fixed production costs, including machinery depreciation, are estimated to increase by $5 000 000 per annum as a result of manufacturing the component in-house. Depreciation is calculated on a straight line basis.

Additional Information

The company is unable to raise enough capital to carry out both projects. The company will therefore have to choose between the two alternatives. Taxation and inflation should be ignored. The company uses a cost of capital of 8% per annum.

Exercise 13.21

Required:

Calculate for Project 1 the relevant cash flows that the accountant should have used for year 1 when appraising the project. All workings should be shown in $000.
Calculate for Project 2 the net present value (NPV).

Suggested solution:

Project 1

Internal failure cost savings

Current expected value of savings ($000s) = ($300 x 0.5) + ($500 x 0.3) + ($700 x 0.2) = $440

Expected savings ($000s) in year 1 = $440 x 1.04 x 80% = $366.08

External failure cost savings

Current expected value of savings ($000s) = ($1 300 x 0.6) + ($1900 x 0.3) + ($3 000 x 0.1) = $1650

Expected savings ($000s) in year 1 = ($1 650 x 1.04 x $ 80%) = $1 372.8

Raw material cost future savings

Expected savings ($000s) in year 1 = 50 000 x $62 x 1.04 = $3 224

Net cash flows in year 1

$366 080 + $1 372 800 + $3 224 000 = $4 962 880

Exercise 13.21

Suggested solution:

Project 2 NPV

Expected savings in year 1 = $110 ($370 -$260) x 50 000 x $110 x 1.04 = $5 720 000

Additional annual fixed costs = $5m - $15m/5

depreciation = $2m

	Year 0 $000	Year 1 $000	Year 2 $000	Year 3 $000	Year 4 $000	Year 5 $000
Initial Investment	(15 000)					
Working capital	(1 000)					1 000
Cost savings		5 720	5 949	6 187	6 434	6 691
Fixed costs		(2 000)	(2 000)	(2 000)	(2 000)	(2 000)
Net cash flows	(16 000)	3 720	3 949	4 187	4 434	5 691
Discount factor @ 8%	1 000	0.926	0.857	0.794	0.735	0.681
Present value	(16 000)	3 445	3 384	3 324	3 259	3 876

NPV = 1 288 000

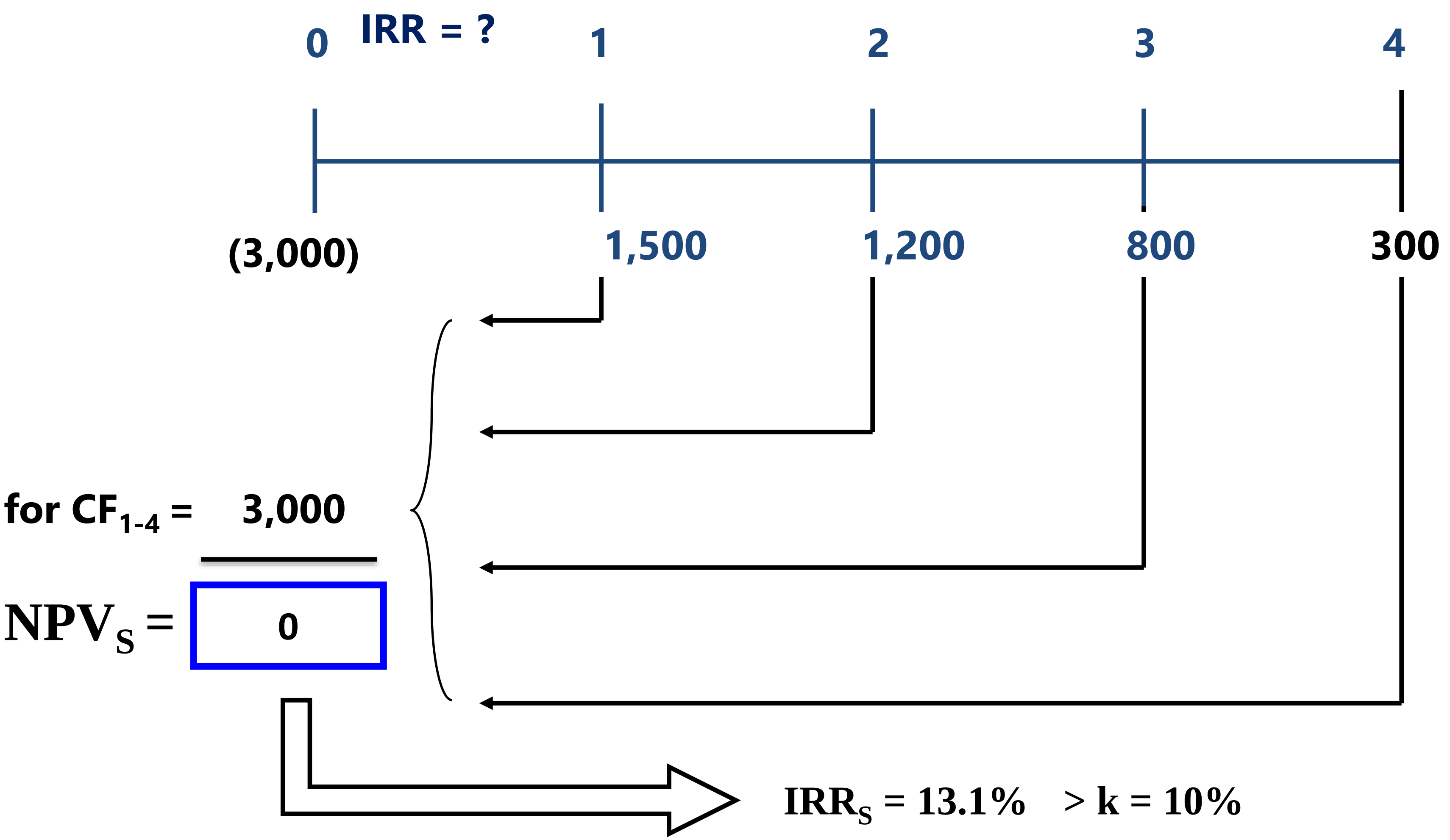
Note that the cost savings increase at 4% per annum because of the increased production.

Internal rate of return

- The **internal rate of return** (IRR) is an alternative technique for use in making capital investment decisions that also takes into account the time value of money.
- The internal rate of return represents the true interest rate earned on an investment over the course of its economic life. This measure is sometimes referred to as the discounted rate of return.
- The internal rate of return is the interest rate K that when used to discount all cash flows resulting from an investment, will equate the present value of the cash receipts to the present value of the cash outlays. In other words, it is the discount rate that will cause **the net present value of an investment to be zero**.
- Alternatively, the internal rate of return can be described as the maximum cost of capital that can be applied to finance a project without causing harm to the shareholders. The internal rate of return is found by solving for the value of K from the following formula:

$$I_0 = \frac{FV_1}{1+K} + \frac{FV_2}{(1+K)^2} + \frac{FV_3}{(1+K)^3} + \cdots + \frac{FV_n}{(1+K)^n}$$

Internal rate of return

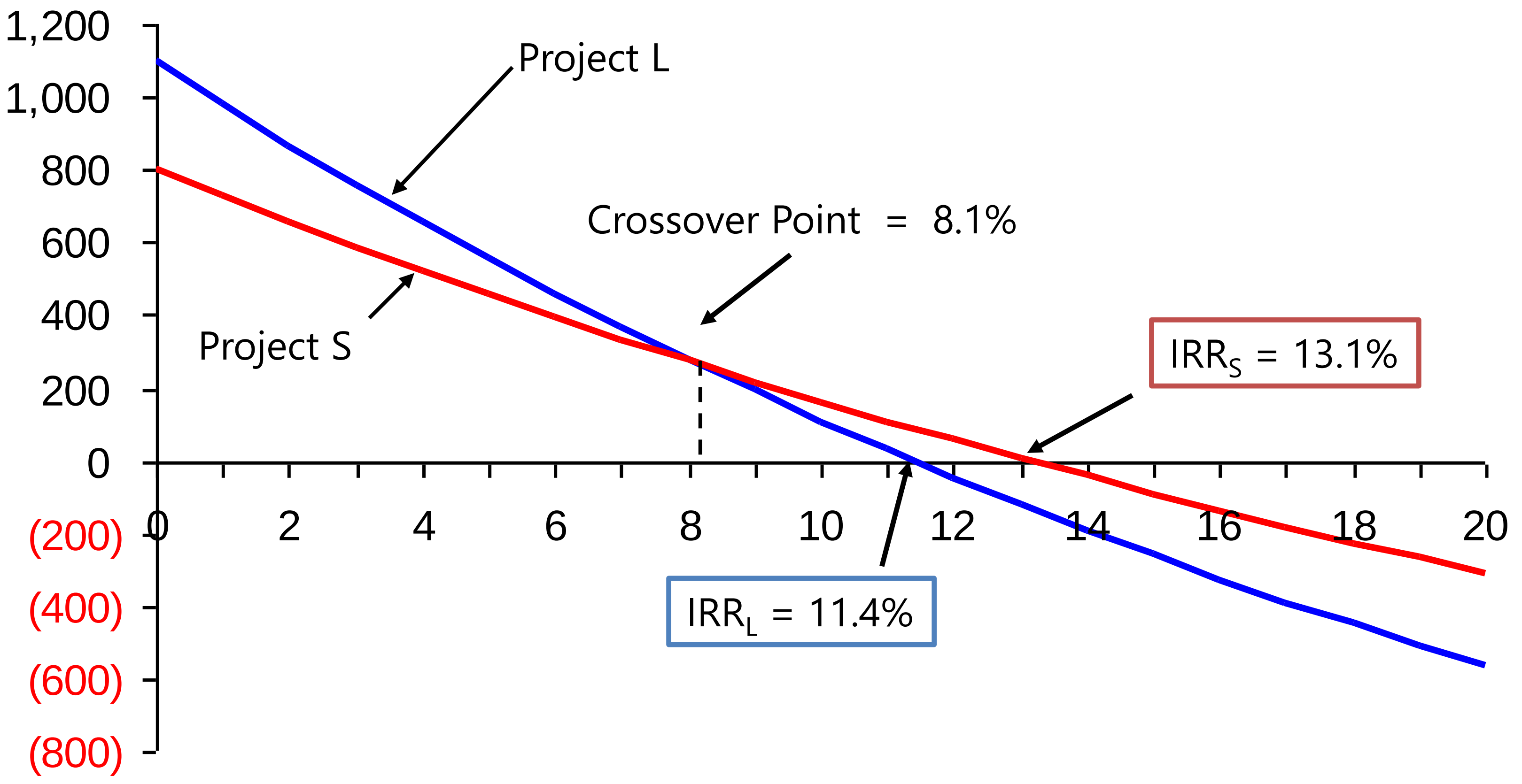


Mutually exclusive projects

- Mutually exclusive projects exist where the acceptance of one project excludes the acceptance of another project, for example the choice of one of several possible factory locations, or the choice of one of many different possible machines.
- Where projects are **mutually exclusive**, it is possible for the NPV and the IRR methods to suggest different rankings as to which project should be given priority.
- When evaluating mutually exclusive projects, the IRR method can incorrectly rank projects, because of its reinvestment assumptions, and in these circumstances it is recommended that the NPV method is used.

Net present value versus internal rate of return

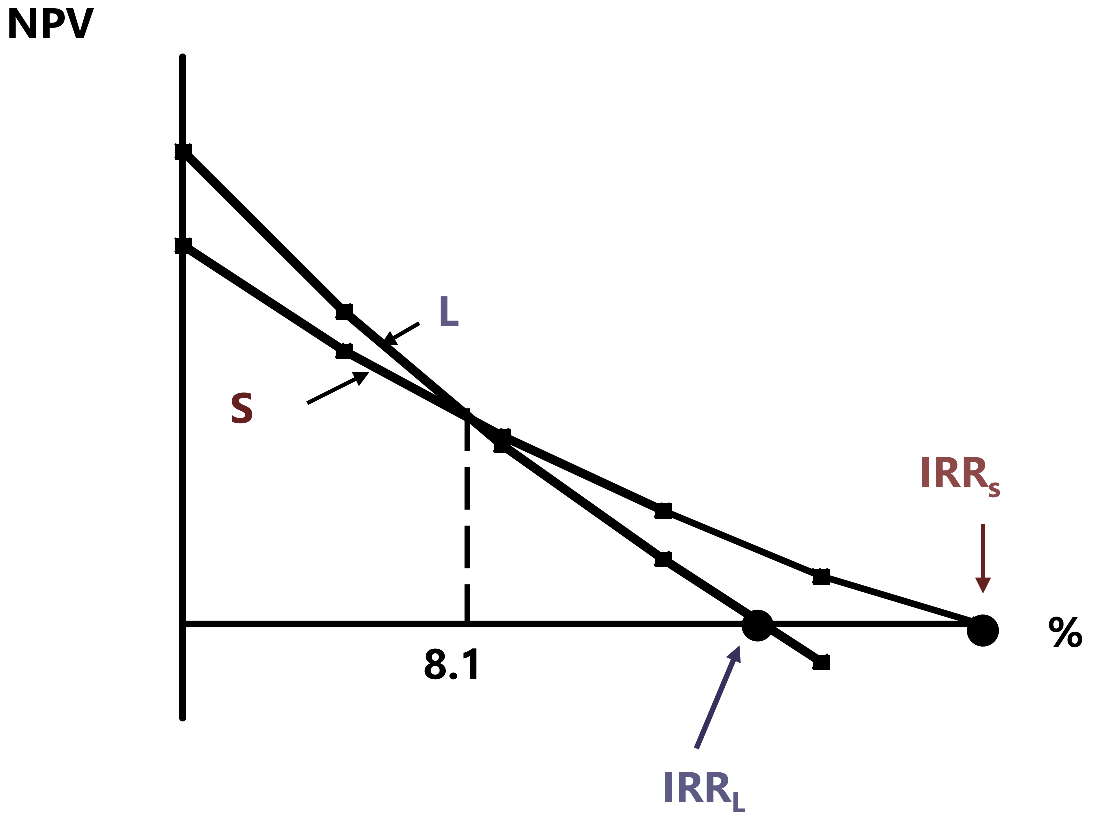
- Consider two mutually exclusive projects: L and S.



k	NPV_L	NPV_S
0	1,100	800
5	554	455
10	109	161
15	(259)	(91)
20	(566)	(309)

Net present value versus internal rate of return

- Consider two mutually exclusive projects: L and S.



k< 8.1: $NPV_L > NPV_S$, $IRR_L < IRR_S$
CONFLICT

k> 8.1: $NPV_S > NPV_L$, $IRR_S > IRR_L$
NO CONFLICT

Differentiation of decisions between investment projects

- In general, the NPV and IRR lead to the same decision. However, they may lead to opposite decisions, if the projects are mutually exclusive. This happens in the following three cases:
  - When project size differences exist (size disparity problem), i.e., compare a big investment project with a small one.
  - When the projects have unequal lives i.e., we compare a long-lasting investment project with a short-term project.
  - When cash flow timing differences exist (time disparity problem), i.e., we compare a project whose most of the cash flows come in the early years with another one whose most of the cash flows come in the later years.
- NPV's superiority
  - NPV assumes that cash flows will be reinvested at k (required rate of return - cost of capital), which is the same for each investment and represents the return of all available investment opportunities.
  - IRR assumes that cash flows will be reinvested at project's IRR, which varies among projects, depending on the project's cash flows.
  - Reinvest at opportunity cost, k, is more realistic, so NPV method is best. NPV should be used to choose between mutually exclusive projects.
- If all projects enjoy a positive NPV and being accepted, then net cash flows should:
- either being distributed to investors (shareholders, lenders), or being used as a substitute for external capital, which cost is equal to the cost of capital.

Relevant cash flows

- Investment decisions, like all other decisions, should be analyzed in terms of the cash flows that can be directly attributable to them.
- These cash flows should include the **incremental cash flows** that will occur in the future following acceptance of the investment. The cash flows will include **cash inflows** and **outflows**, or the **inflows** may be represented by savings in **cash outflows**.
- For example, a decision to purchase new machinery may generate cash savings in the form of reduced out-of-pocket operating costs.
- For all practical purposes such cost savings are equivalent to cash receipts.
- It is important to note that depreciation is not included in the cash flow estimates for capital investment decisions, since it is a non-cash expense. This is because the capital investment cost of the asset to be depreciated is included as a cash outflow at the start of the project, and depreciation is merely a financial accounting method for allocating past capital costs to future accounting periods. Any inclusion of depreciation will lead to double counting.

Incremental cash flows

- **Initial Investment Outlay**: the incremental cash flows associated with a project that will occur only at the start of a project's life
- **Incremental Operating Cash Flow**: the changes in day-to-day cash flows that result from the purchase of a capital project and continue until the firm disposes of the asset.
- This is cash flow remaining after operating expenses and taxes have been paid. Subtract expenditures for the project's capital assets (Cap Exp) and working capital (Add WC).

Incremental Operating Cash Flow= $[(\text{Revenue} - \text{OpE}) \times (1 - \text{t})] + \text{D\&A} - \text{CapExp} - \text{AddWC}$

Where:

OpEx is operating expenses

D&A is depreciation and amortization

CapExp is capital expenditures

AddWC* is additional working capital

t is the tax rate

$*AddWC = Change\ in\ cash\ and\ cash\ equivalents + Change\ in\ accounts\ receivable + Change\ in\ inventories - Change\ in\ accounts\ payable$

Incremental cash flows

- **Terminal Cash Flow**: cash flows in the last, or terminal, year of a project often includes cash flows not typically included in the calculations for prior years
  - Long-term assets and working capital that are no longer needed to support the project may be sold
  - Net cash flows from the sale of assets and the impact of the sale on the firm's taxes are included in the terminal year

Example 1: Incremental cash flows

	2005	2006	2007	2008	2009
Initial Investment Outlay	€(9,500)				
Shipping & installation	(500)				
Increase in NWC	(4,000)				
Initial Investment	€(14,000)				
Incremental Operating Cash Flow					
Sales revenue		30,000	30,000	30,000	30,000
Variable Costs		(18,000)	(18,000)	(18,000)	(18,000)
Fixed Costs		(5,000)	(5,000)	(5,000)	(5,000)
Depreciation on new equipment		(2,000)	(3,200)	(1,900)	(1,200)
Earnings before taxes (EBT)		5,000	3,800	5,100	5,800
Taxes (40%)		(2,000)	(1,520)	(2,040)	(2,320)
Net Income		3,000	2,280	3,060	3,480
Add back depreciation		2,000	3,200	1,900	1,200
Incremental operating cash flows		€5,000	€5,480	€4,960	€4,680

Example 1: Incremental cash flows

	2005	2006	2007	2008	2009
Terminal Cash Flow					
Return of net working capital					€4,000
Net salvage value					1,800
Terminal Cash Flow					€5,880
Annual Net Cash Flow					
Total net cash flow/year	€(14,000)	€5,000	€5,480	€4,960	€10,560
NPV at k=15%	€3,790				

Example 2: Incremental cash flows

- Firm A is considering the introduction of a new product. In the next table are presented the estimated sales figures, cost of sales and general administrative expenses for the next four years (after the introduction of the new product):

Years	Sales	Cost of sales	General expenses
1	10.000	6.000	1.800
2	13.000	7.800	2.340
3	12.000	7.200	2.160
4	11.000	6.600	1.980

- In order to produce the new product company A has to invest 3.200 € in new equipment. This equipment has useful life of four years and its residual value is expected to be insignificant. The firm adopts the straight-line method for depreciating its assets. In addition, the firm has to make investments in net working capital. Firm A requires 22 % of net working capital to support each euro of sales. As sales grew, further investments in the working capital have to be made. As sales diminish, net working capital will be liquidated and cash recovered. At the end of the new product life cycle, all remaining net working capital will be liquidated and the cash recovered. Firm’s cost of capital is 18 %.

Example 2: Incremental cash flows

	Years				
	0	1	2	3	4
Sales		10.000	13.000	12.000	11.000
Cost of sales		(6.000)	(7.800)	(7.200)	(6.600)
General expenses		(2.800)	(2.340)	(2.160)	(1.980)
Depreciation		(800)	(800)	(800)	(800)
Profit before taxes		400	2.060	1.840	1.620
Income tax (40%)		(160)	(824)	(736)	(648)
Profit after tax		240	1.236	1.104	972
Cash flow					
Profit after taxes		240	1.236	1.104	972
Depreciation		800	800	800	800
Capital expenditure	(3.200)				
Changes in NWC		(2.200)	(660)	220	2.640
Total cash flow	(3.200)	(1.160)	1.376	2.124	4.412

NPV

-1.160 X 0,8475 = -983,10
1.376 X 0,7182 = 988,24
2.124 X 0,6086 = 1.292,66
4.412 X 0,5158 = <u>2.275,00</u>
3.573,89
(-) <u>3.200,00</u>
373,89

Example 3: Incremental cash flows – replacement analysis

	2005	2006	2007	2008	2009	2010
Initial Investment Outlay						
Cost of new asset	(12,000)					
Change in net working capital	(1,000)					
Net cash flow/sale of old asset	1,600					
Initial Investment	€(11,400)					
Incremental Operating Cash Flow						
Δ Operating costs		3,500	3,500	3,500	3,500	3,500
Δ Depreciation		(3,460)	(4,900)	(1,300)	(340)	500
Δ Earnings before taxes (EBT)		40	(1,400)	2,200	3,160	4,000
Δ Taxes (40%)		(16)	560	(880)	(1,264)	(1,600)
Δ Net Income		24	(840)	1,320	1,896	2,400
Add back Δ depreciation		3,460	4,900	1,300	340	(500)
Incremental operating cash flows		€3,484	€4,060	€2,620	€2,236	€1,900

Example 3: Incremental cash flows – replacement analysis

	2005	2006	2007	2008	2009	2010
Terminal Cash Flow						
Return of net working capital						€ 1,000
Net salvage value of new asset						1,200
Terminal Cash Flow						2,200
Annual Net Cash Flow						
Total net cash flow each year	€(11,400)	€3,484	€4,060	€ 2,620	€ 2,236	€ 4,100
Net Present Value (15%)	€(261)					

Example 4: Incremental cash flows – replacement analysis

Years	Sales	Cost of sales	General expenses
1	10.000	6.000	1.800
2	13.000	7.800	2.340
3	12.000	7.200	2.160
4	11.000	6.600	1.980

Example 4: Incremental cash flows – replacement analysis

- Firm A contemplates the replacement of Machine 1 and the acquisition of Machine 2. The following information is provided regarding the two pieces of machinery. Tax rate = 40 %, cost of capital = 10 %.

Machine 1	Machine 2
Acquisition cost = 7.500 €	Acquisition cost = 12.000 €
Useful life = 15 years	Useful life = 10 years
Residual value = nil	Residual value = 2.000 €
Accumulated depreciation = 2.500 €	As a consequence of the acquisition of machine 2 it is expected that:
Current selling price = 1.000 €	Sales will increase from 10.000 € to 11.000 € for each of the 10 years of machines useful life.
	Operating expenses will decrease from 7.000 € to 5.000 € for the following ten years.

Example 4: Incremental cash flows – replacement analysis

1. Initial outflow
- Outflow for the acquisition of the machine 2
- Revenue (inflow) from the sale of machine 1
- Tax effect

Purchase price :	12.000
(-) Tax reduction	-1.600
(-) Inflow from selling machine 1	-1.000
	9.400

Tax reduction:

Book value (7.500 – 2.500=)	5.000
(-) Selling price	(-) 1.000
Loss	(4.000)

Reduction in tax (4.000 X 0,4=) 1.600

Example 4: Incremental cash flows – replacement analysis

2. Incremental annual cash flow

Income statement under two scenarios

	Machine 1	Machine 2	Change
Sales	10.000	11.000	1.000
Operational expenses	(7.000)	(5.000)	(2.000)
Depreciation	(500)	(1.000)	500
Profits before tax	2.500	5.000	2.500
Income tax (40%)	(1.000)	(2.000)	1.000
Profits after tax	1.500	3.000	1.500

Example 4: Incremental cash flows – replacement analysis

2. Incremental annual cash flow

Alternatively:

	Change
Sales	1.000
Operational expenses	2000
Depreciation	(500)
Profits before tax	2.500
Income tax (40%)	(1.000)
Profits after tax:	1.500

Accounting income should be adjusted in order to represent the expenses and revenues on a cash-basis. Although depreciation charges do not constitute cash out flow, reduce firm's tax obligation, which result in cash outflow. As a consequence cash benefits resulting from depreciation allowances should be taken into consideration

Example 4: Incremental cash flows – replacement analysis

2. Incremental annual cash flow

Alternatively:

	Change
Sales	1.000
Operational expenses	2000
Depreciation	(500)
Profits before tax	2.500
Income tax (40%)	(1.000)
Profits after tax	1.500
Depreciation Difference	500
Net cash flows (*F*)	2.000

Example 4: Incremental cash flows – replacement analysis

3. PV of Incremental annual cash flow

$$PV_{r,t} = 2.000x[\sum_{1}^{10} \frac{1}{(1+0,10)^{10}}]$$ = 2.000 x (6,1446)= 12.289

4. Residual value

$$PV = \frac{V_{r,n}}{(1+r)^n} = 2.000_{0,10,10}\left[\frac{1}{(1+0,10)^{10}}\right]$$ = 2.000 x 0,3855 = 771

5. NPV

Inflows :	PV of annual cash flows	12.289
	PV of residual value	771
Outflow :		(9.400)
NPV		3.660

The internal rate of return (IRR) is 18 % > 10 %.

Payback method

- Computes the amount of time required to recoup the initial investment.
- The project is acceptable if the payback period is shorter than a certain amount of time.
- Projects with shorter payback periods are more desirable.
- Strengths of Payback:
  - Provides an indication of a project's risk and liquidity
  - Easy to calculate and understand
- Weaknesses of Payback:
  - Ignores time value of money
  - Ignores CFs occurring after the payback period

Payback method: example

$$PB = Years\ before\ cost\ recovery + \frac{Remaining\ cost\ to\ recover}{Cash\ flow\ during\ the\ year}$$

	0	1	2	PB	3	4
Net Cash Flow	**-3,000**	**1,500**	**1,200**		**800**	**300**
Cumulative Net CF	**-3,000**	**-1,500**	**-300**		**500**	**800**

Payback = **2 + 300/800 = 2.375 years**

Payback period: evaluation of investment proposals

- Assume that a firm examines two investment projects. Both projects require an initial outflow of 1.000 €. The cost of capital of the firm is 10%. The net cash flows of the two projects are presented in the following table:

T	A	B
1	500	100
2	400	200
3	300	300
4	100	400
5	10	500
6	10	600

- Time taken for a project to recover its initial investment
- Project A: 2 years and 4 months
- Years 1 and 2 = 500 + 400=900
- (1.000 -900=) 100
- 100/300 = 0,33333 X 12 months = 4 months
- Project B: 4 years
- Years 1-4 = 100 + 200 + 300 +400

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