# **Module 15 – Investment Decisions**

**15.1 Introduction**

* An investment decision is one whose impact extends beyond the immediate operating period
* A decision which has its impact within the operating period is a operating decision

**15.2 The Investment Process**

* *Search* – normally accounting has nothing to do with the identifying of investment opportunities
* *Control* – once an investment is made, the financial control will follow normal budgetary procedures. Actual income and expenditure will be compared with budgeted and any significant differences will be reported. There is a project budget for individual projects and a capital budget showing overall the amount of capital to be invested. This is the input to the strategic plan.
* *Evaluation* – this is the step in between Search and Control. Evaluation takes place within the basic framework that is the company’s strategic plan. Potential investments will be judged against some specific yardsticks - of which cost and revenue are major components.

**15.3 Concept of Present Value**

* Because investment decisions impact future time periods – we need a concept that takes into account the time value of money
* A $1 today is not the same as $1 in a years time – this is not the same as inflation or the risk factors involved
* A $1 today is different from $1 next year because we can get benefit now from the $1 or we can invest it a reap interest
* The concept of present value uses an interest rate to try and give an equivalent value to monies payable or receivable at different points in time
* Present Value = 1

(1 + i)n

# Where, i= Interest rate and n= number of years

Example:

how much is $121 in two years time worth now, given an interest rate of 10%?

$121 x 1/(1+0.1)2 = $121 x 1/(1.1)2 = $121 x 0.826 = $100

**15.4 Discounted Cash Flow Approach**

* This is when we discount the future cash flows down to a present value so that we can calculate the profitability and cost of the investment
* There are two main techniques which incorporate this principle – net present value (same as present value) and the internal rate of return

**15.5 Net Present Value (NPV)**

* NPV takes all the cash flows associated with a project and reduces them (discounts them) to their present value
* If NPV >0, the project will be profitable and has a return which is greater than the interest rate => Accept
* If NPV<0, than the rate of return is lower than the cost of financing the project => Reject
* IF NPV = 0, project breaks even, therefore reconsider
* Managers often think more in terms of profit and rate of return rather than NPV

Example

An investment of $300 now produces cash flows of $114 for the next three years and that the cost of capital is 5%.

 **Cash Flow**

Year 0 -$300

Year 1 $114

Year 2 $114

Year 3 $114

 $42

The NPV of this cash flow at 5% is:

-300 + 114/(1.05)1+114/(1.05)2+ 114/(1.05)3 = -300 + 108.57 + 103.4 + 98.47 = 10.45

* The project is profitable (NPV>0)
* It has a rate of return greater than the cost of capital (NPV>0)
* If the project is undertaken, the wealth of the firm will increase in today’s terms by $10.45
* If there is a choice between this project and another whose NPV<$10.45, then this project should be undertaken
* We could borrow $310.45, spend the $10.45 and invest the $300 and we would come out even, as long as the interest rate remained at 5%

**15.6 Discounted Cash Flow (DCF) Rate of Return**

* The DCF (or Rate of return) requires the same cash flow information as the NPV
* Here we find the interest rate that reduces all these cash flows to zero = the interest rate (rate of return) at which the project will break even
* This is the maximum rate the business could pay on borrowed money and still break even, and so its compared with the cost of capital for a go/no-go decision
* DCF rate of return > cost of capital => Accept
* DCF rate of return < cost of capital => Reject
* DCF rate of return = cost of capital => Reconsider

Example

An investment of $300 now produces cash flows of $114 for the next three years and that the cost of capital is 5%.

We need to use trial an error to find the interest rate at which the NPV = 0

Lets try an interest rate of 10%:

 **Cash Flow 10% Discount Factor NPV**

Year 0 -$300 1.0 -300

Year 1 $114 0.909 103.63

Year 2 $114 0.826 94.16

Year 3 $114 0.751 85.61

 -16.6

NPV<0 => Interest Rate too large, try 5%

 **Cash Flow 5% Discount Factor NPV**

Year 0 -$300 1.0 -300

Year 1 $114 0.952 108.53

Year 2 $114 0.907 103.4

Year 3 $114 0.864 98.5

 10.426

NPV>0 => Interest Rate too small

Interpolate between the two:

10% +[ (-16.6/-16.6 –10.426) x (5% - 10%)]

= 10% + [ 0.614 x 5%]

=10% -3% = 7%

So, the project has a rate of return of 7% and since the cost of capital is 5%, this project is profitable

**15.7 Comparison of NPV and DCF Rate of Return**

* Both techniques tell a manager whether a project is profitable
* If there is a choice of projects, the NPV of one may be higher than the other but the DCF may be the opposite
* In simplistic terms, an investment of $100 which earns $10 per annum gives a DCF of 10%, but so does an investment of $1,000,000 which earns $100,000 per annum
* The NPV is the absolute measure whereas rate of return is relative measure

Example

A company has a choice of two mutually exclusive projects. Project A requires an investment of $2000 and generates $1309 per annum for 2 years whereas Project B requires an investment of $20,000 and generates cash flows of $12,302 per annum for 2 years. The cost of capital is 8%.

##  Project A Project B

 Cash Flow NPV Cash Flow NPV

Year 0 -2000 -2000 -20,000 -20,000

Year 1 1309 1212 12,302 11392

Year 2 1309 1122 12,302 10543

 $334 $1935

The DCF is 20% and 15% respectively (this is given – too much hassle to work it out)

* So the DCF says Project A but NPV says project B – NPV should be used and hence Project B should be undertaken
* To help confirm this answer, the difference in cash flows between the two projects can be studied:

 **Project A Project B Difference**

**Cash Flow Cash Flow (B-A)**

Year 0 -2000 -20,000 -18,000

# Year 1 1309 12,302 10,993

Year 2 1309 12,302 10,993

* Is the initial difference of $18,000 outlay worth the increased cash flow that you get with project B? Is there another project that you could spend the $18,000 on that has a better cash flow?
* You could also look at the NPV and DCF rate of return of this difference – what is the rate of return on an investment of $18,000 with cash flows of $10,993 for two years at a cost of capital of 8%

**Cash Flow NPV @ 8%**

Year 0 -18,000 -18,000

# Year 1 10,993 10,180

# Year 2 10,993 9,421

 1601

# DCF is given @ 14%

* So project B gives a rate of return of 14% on the extra initial investment of $18,000 – this should be compared to the rate of return on other projects to see if the $18,000 can be better invested

**15.8 Investment Appraisal in Non-Revenue & Non-Profit Situations**

* There are many situations where capital budgeting involves a cost–only situation, such as a new building that won’t generate any additional revenue
* The approach here is to use NPV and then apply the cost minimization objective – this occurs when NPV is at its lowest

Example

A company has a choice between two central heating systems – one with a higher cost but lower maintenance costs, the other the opposite. Cost of capital is 16%.

 **System One System Two**

 **Cash NPV Cash NPV**

**Flow @ 16% Flow @16%**

Year 0 -$8000 -8000 -12000 -12000

Year 1 -2000 -1724 -1500 -1293

Year 2 -2000 -1486 -1500 -1114

Year 3 -2500 -1602 -1500 -961

Year 4 -2500 -1380 -2000 -1104

Year 5 -3000 -1428 -2000 -952

Year 6 -3000 -1230 -2000 -820

 -16850 -18244

* System One is cheaper, and hence would be better
* You can analyze the difference to obtain more information

 **System One – System Two NPV**

**Cash Flow @ 16%**

Year 0 $4000 4000

Year 1 -500 -431

Year 2 -500 -371.5

Year 3 -1000 -641

Year 4 -500 -276

Year 5 -1000 -476

Year 6 -1000 -410

 1394

DCF = 3% (given)

* So System One gives $1394 more in present value savings to the company than System Two

**15.10 Risk and Uncertainty**

* Management can reduce risk and uncertainty by reducing exposure to any one project or capital investment
* One approach is to do no further analysis of risk factors – just rely on the budgeted figures
* Another approach is to have projects that are considered higher risk to pass more rigorous tests of acceptability
* Sometimes a higher target rate of return is applied to riskier projects – but if its only one project variable which is uncertain (e.g. costs) then using this method reduces the present value of all the variables

**15.11 Payoff of Payback Period**

* Payback is the time taken to recover the original investment

Example

An investment of $50,000 has the following cash flows:

##  Cash Flow Cumulative Cash Flow

Year 0 -50,000 -50,000

Year 1 13,000 -37,000

Year 2 15,000 -22,000

Year 3 15,000 -7,000

Year 4 15,000 +8,000

Year 5 15,000 +23,000

Year 6 10,000 +33,000

So payoff occurs sometime in the fourth year.

* This ignores the opportunity cost forgone – this opportunity cost can be represented by the cost of capital

Let’s use a 10% cost of capital in the example above

## Cash Flow PV of Cash Flow Cumulative Cash Flow

Year 0 -50,000 -50000 -50000

Year 1 13,000 11817 -38183

Year 2 15,000 12390 -25793

Year 3 15,000 11265 -14528

Year 4 15,000 10245 -4283

Year 5 15,000 9315 5032

Year 6 10,000 5640 10672

* The Payoff now occurs in the fifth year – the questions would have to be asked if its worth embarking on a project that lasts 6 years when the payoff only occurs in the fifth?
* The standard payback period can be adjusted depending upon the risk of the project – e.g. 3 years for high risk, 4 years for medium and 5 for low
* Payback ignores profit and so should be only used in conjunction with NPV and DCF

**15.12 Sensitivity Analysis**

* This consists of changing the value of a key variable to assess the impact which this has on the final result

Example

A company has the following cash flow. This cash flow was generated by sales revenue of $70K per annum for years 1-3 and $75K per annum for years 4 –10.

To do a sensitivity analysis using variations in sales prices of +/- 10%.

So in years 1-3, would increase or decrease by $7000, whereas in years 4-10 its +/- $7500.

 Original Cash Flow Cash Flow with Cash flow with

 a decrease of 10% an increase of 10%

 in selling prices in selling price

# Year 1 -100000 -100000 -100000

Year 2 27500 20500 34500

Year 3 27500 20500 34500

Year 4 37500 30000 45000

Year 5 37500 30000 45000

Year 6 37500 30000 45000

Year 7 37500 30000 45000

Year 8 37500 30000 45000

Year 9 37500 30000 45000

Year 10 37500 30000 45000

Year 11 2500 2500 2500

# NPV @15% 65909 24909 102410

[NPV given]

* At a decrease of 10%, a profit is still made
* With further calculations, it can be shown that at 18% reduction in sales price, the project breaks even
* Sensitivity analysis can be done on more than one variable at a time
* Sensitivity analysis does not take into account the likelihood of the variation taking place

**15.13 Risk Analysis**

* It is important that some consideration be given to the likelihood of change where it is reasonable to expect that change will occur
* Risk Analysis is about taking the idea of a range of likely values and applying the techniques of probability analysis to it in order to give a better ‘feel’ for the riskiness of the project

Example

A sales rep estimates that there is a 25% chance of a selling price being $10, a 50% chance that its $12 and a 25% chance that it will be $13

## Forecast Selling Price Probability Expected Value

$10 0.25 $2.50

 $12 0.5 $6

 $13 0.25 $3.25

1. $11.75 = Most Likely Value
* All the expected selling prices deviate from the most likely, this deviation can give us a feel for the riskiness associated with the variable – more deviation, more risk
* A project with a wide range of possible values for a variable can be regarded as being a higher risk than a project such as the one above that has a relatively small range of values for its key variable

**15.14 The Key Investment Factors**

* All four of these are central to the profitability of an investment

**15.14.1 Capital Investment**

* This consists of the total fixed and working capital required for a specific project
* Not only cash outflows are included, but cash inflows like selling off fixed assets
* Timing is critical, as often profitability is effected by positive cash flows not been available as early as anticipated due to a delay in getting the project operational

**15.14.2 Operating Cash Flows**

* Concerned with cash flows only, non cash expenses such as depreciation are not considered
* Investment appraisal looks at the profitability over the lifetime of the project – not just the accounting year, so the principles used in evaluation differ from those used in financial accounting
* As yet, there is no acceptable solution which reconciles financial evaluation with published financial reports

Example

An investment in new equipment of $100,000 generates $40,000 per annum in cash flows for five years. DCF = 28.5% but if the equipment is written off over 5 years with straight line depreciation then:

Year 1 Profit for year $20,000 ($40K - $20K depreciation)

###  Balance Sheet as at end of Year 1

  **Cost Depreciation Book Value**

Fixed Asset 100,000 20,000 80,000

* This will continue until at end of year five the profit will be $20K and Fixed Asset = $0
* The DCF of 28.5% - the rate of return on the asset - is in no way related to the book value or the profit in the financial report
* many companies as well as wanting to know what the rate of return on an investment is, would also want to know how their financial accounts would look if they undertake the project
* Taxation should be treated like any other cash flow if the rate of return or present value after corporate tax is to be calculated

**15.14.3 Investment Life**

* Most assets have a finite life and need eventually to be disposed of
* This life depends on
* Physical, i.e. wear and tear makes the asset no longer serviceable
* Technical, i.e. obsolete
* Market, i.e. the product the asset provides is no longer in demand
* Any of the above will determine the investment life of a project
* Investment life = which of the above three occurs first
* Some assets have standard lives (e.g. building = 50 years), but this is not appropriate for estimating the investment life of a specific project

**15.14.4 Cost of Capital**

* For most managers, the cost of capital is laid down by the board of directors
* Different rates may be used depending on the nature of the investment

**15.5 Projected Average Cost of Capital**

* A company would usually have a central pool of resources from which all projects are financed
* This pool would contain a mix of different types of sources of long term capital
* The cost of capital is regarded as the average cost of all of these various sources
* The sources include
* ***Fixed Interest loans***, the cost of this source is the rate of interest plus an allowance for the cost of servicing the loan less taxation, e.g. (12%+0.5%)x(1-0.3), in the case of 30% taxation
* ***Fixed Interest (dividend) shares (Preference Shares)*** – the cost is the dividend plus the cost of raising it. In UK dividends is not allowable for taxation – hence the cost cannot be reduced by the appropriate tax rate
* ***Residual equity shares* (Ordinary shares)**, no dividend – so the company must set the cost associated with this source.

## Example of Residual Equity Shares

A company has issued 100,000 $1 ordinary shares and its after tax earnings are $20,000.

This means a earnings per share of $20,000/100,000 = $0.20 per share.

Lets assume that the current market value of each share is $2.

This means that there is an earnings yield of $2/$0.20 = 10%.

If there were no costs in issuing such shares, the cost of capital associated with this source would be 10%.

If there are issue costs of say 5% of cash paid, then out of the $2 the company actually only receives $1.90. To make up for this the company needs to increase the target rate of return to something higher than 10%.

So, if the company want to raise $50,000 it will have to sell:

 $50,000/$1.90 shares = 26,316 shares

If each of these shares needs to earn a $0.20 per share = 26,316 x $0.2 = $5263

The target rate of return is therefore: $5263/$50,000 = 10.5%

* ***Retained Earnings (Profits)****,* if the relative value of shareholders interest in the business must be maintained, these funds should earn at the least the same as the existing investment. In the above example, the shareholders have an earnings yield of 10% - this is the target cost of capital

**15.16 Average Cost of Capital**

* Having worked out the costs of the various sources of funds, we must now find the average cost based on the relative proportions that are expected to be used
* Suppose the corporate plan showed the following proposed capital structure

Source of Finance Optimum Estimated Weighted

Proportion(%) Cost Cost

Long term loan 30 8.75 0.3x8.75=2.625

# Preference Share capital 5 10.5 0.05x10.5=0.525

Existing Ordinary Share Capital 20 10 2.0

New Ordinary Share Capital 10 10.5 1.05

Retained Earnings 35 10 3.5

 9.7%

* 9.7% is therefore the average cost of capital
* Other variables may be involved in this decision including how the share price will be effected by the relative proportions of the different sources of capital – this is the finance decision

**15.17 Opportunity Cost, Risk and the Cost of Capital**

* The Opportunity cost concept is applied when management decides that irrespective of what it will cost to raise funds they should only be used internally if the return achieved is at least as a good as that which could be achieved externally
* The external opportunity forgone is what determines the price of capital
* This sets the target rate at higher than the cost of capital

## Case Study

AB company is considering an investment of $100,000 in capital equipment - $60,000 on receipt, $40,000 in one year. Installation costs $10,000. The machine will last for ten years, at the end of which its scrap value is $2500.

Working Capital will increase as follows:

Debtors $30,000

Creditors $20,000

Stocks $15,000

The net operating cash flows will be $30,000 per annum for the first four years and $35,000 thereafter.

Cash flows do not include interest on an increased bank overdraft of $15,000 which is estimated at $2500 per annum.

The company intends to issue a ten year $50,000 12 % long term loan repayable at par.

The company’s cost of capital is based on a target long term capital structure of :

 60% equity at a cost of 18%

 40% loans (long term) at an average cost of 13%

 Equipment Installation Working Capital Cash Flow Bank O/D Total

Yr 0 -60,000 -10,000 15,000 - 55,000

Yr 1 -40,000 -25,000 30,000 -2500 37500

Yr 2 30,000 -2500 37500

Yr 3 30,000 -2500 37500

Yr 4 30,000 -2500 37500

Yr 5 35,000 -2500 32500

Yr 6 35,000 -2500 32500

Yr 7 35,000 -2500 32500

Yr 8 35,000 -2500 32500

Yr 9 35,000 -2500 32500

Yr 10 35,000 -175001 32500

# Yr 11 2500 25,000 27500

1 At the end of the project the last lump of interest must be paid ($2500) and the overdraft cleared ($15000), hence $17500

The cost of capital is (0.6 x 18%) + (0.4 x 13%) = 10.8% + 5.2% = 16%

# Let’s find the NPV & rate of return for this project

 **Cash PV @ 16% PV @16%**

 **Flow Factor**

Yr 0 -55,000 1 -55000

Yr 1 37500 0.862 32325

Yr 2 37500 0.743 27863

Yr 3 37500 0.641 24037

Yr 4 37500 0.552 20700

Yr 5 32500 0.476 15470

Yr 6 32500 0.410 13325

Yr 7 32500 0.354 11505

Yr 8 32500 0.305 9912

Yr 9 32500 0.263 8547

Yr 10 32500 0.227 7377

# Yr 11 27500 0.195 5362

 34007

PV for 24% = 1038, for 28% = -10190

DCF rate of return = 24% +[1038/(1038+10190) x (28%-24%)]

 = 24% + [ (0.9) x 4%] = 24.4%

**15.18 Investment Appraisal and Inflation**

* The NPV does not include any inflation
* If you want to build an allowance in for inflation then you must do so specifically
* Inflation should be included for each variable, as the value of different variables inflates/deflates

**15.19 Post-Assessment/Continuous Post Audit of Capital Expenditure Projects**

* Additional controls beyond the normal budgetary control procedures are required for an investment project
* A post assessment audit is one is a series of interim audits during the project life where all the key investment factors are reviewed against forecast and an assessment is made on the effect of any deviations on the projects profitability
* This audit takes into consideration not only cash flows, investment life and cost of capital but also external factors such as changes in the social and economic environment
* Lessons learnt in this audit can be applied to future projects

**Review Questions:**

1. c
2. FALSE
3. d

4.

 **Cash Flow PV Factor @ 8% PV**

Year 0 -$20,000 1 -$20,000

Year 1 $7000 0.926 $6482

Year 2 $7000 0.857 $5999

Year 3 $7000 0.794 $5558

Year 4 $7000 0.735 $5145

 $3184

Total PV of INCOME = $23,184 = c

5. b

6.

 **Cash Flow PV Factor @ 10% PV**

Year 0 -$20,000 1 -$20,000

Year 1 $7000 0.909 $6363

Year 2 $7000 0.826 $5782

Year 3 $7000 0.751 $5257

Year 4 $7000 0.683 $4781

 $2183 = a

7.

**Cash Flow PV Factor @ 8% PV**

**Declined by**

**10%**

Year 0 -$20,000 1 -$20,000

Year 1 $6300 0.926 $5834

Year 2 $6300 0.857 $5399

Year 3 $6300 0.794 $5002

Year 4 $6300 0.735 $4630

 $865 = b

8. FALSE

9. c

10.

##  Cash Flow PV @ 5% PV @ 8%

Year 0 -80000 -80000 -80000

Year 1 25000 23800 23150

Year 2 25000 22675 21425

Year 3 25000 21600 19850

Year 4 20000 16460 14700

1. -875

Rate of return = 5% + [(4525/4535+875) x (3%)] = 5% + 2.5% = 7.5% = d

11. d

12. FALSE

13. TRUE

14. Easilog II

##  Cash Flow PV @ 12%

Year 0 -12000 -12000

Year 1 -4000 -3572

Year 2 -4000 -3188

Year 3 -4000 -2848

Year 4 -2000 -1272

 -22880 = d

15. Peach

## Cash Flow PV @ 12%

Year 0 -10000 -10000

Year 1 -3000 -2679

Year 2 -3000 -2391

Year 3 -2000 -1424

Year 4 -2000 -1272

Year 4 -1000 -567

 -18,333

Ans: a

16. FALSE

17. b

18. Payoff (ignoring opportunities forgone) occurs between year 3 (-$1500) and year 4(+$2500). The portion of the year at which the shortfall of $1500 is made up is 1500/4000 = .38. hence ans = 3.38 = a

19. Ans= 2.75 = b

20. Now Auto moderne payoff = 2 years + 500/3000 = 2.17 years, hence a

21. b

22. c+d

23. Selling price of North = 50(0.1) + 55 (0.2) + 60 (0.4) + 65 (0.3) = 5+11+24+19.5= $59.5 = b

24.South = 2.5+8.25+15+22.75+14=62.5= c

25. a

26. FALSE

27. TRUE

28. c

29. (0.1) 11% + (0.25) 9.50% + 0.1 x 10% + 0.3 x 9.5 + 0.25 x 9.25% = c

30. (0.1) 11% + (0.25) 10.75% + 0.1 x 10% + 0.3 x 10.75 + 0.25 x 9.25% = a

31. TRUE

32.

##  Buses Operating Costs Contrib. Total PV @ 15%

Year 0 -450,000 -450000 -450000

Year 1 -60000 140000 80000 69600

Year 2 -75000 180000 105000 79380

Year 3 -100000 205000 105000 69090

Year 4 -110000 230000 120000 68640

Year 5 220000 -120000 270000 370000 183890

 20600 = a

33.

## Buses Operating Costs Contrib. Total PV @ 15%

 (increased by 10%)

Year 0 -450,000 -450000 -450000

Year 1 -66000 140000 74000 64380

Year 2 -82500 180000 97500 73710

Year 3 -110000 205000 95000 62510

Year 4 -121000 230000 109000 62348

Year 5 220000 -132000 270000 358000 177926

 -9126 = a

34.

## Buses Operating Costs Contrib. Total PV @ 15%

 (increased by 10%) (incr. 10%)

Year 0 -450,000 -450000 -450000

Year 1 -66000 168000 102000 88740

Year 2 -82500 216000 133500 100926

Year 3 -110000 246000 136000 89488

Year 4 -121000 276000 155000 88660

Year 5 50000 -132000 324000 242000 120274

 -38088 = c

Case Study 51.1

Orlando

 Licensing Fee Net contribution Closing Inv Royalty Total

Year 0 -100,000 -100,000

Year 1 60,000 -26,666 -16,000 17334

Year 2 110,000 -40,000 -23,500 46500

Year 3 140,000 -45,000 -27000 68,000

Project B

 Purchase Workshop Sales rev Costs Total

Year 0 -75000

Year 1 -225000 -25000 270000 -70000

Year 2 -405,000 -25000 625,500 -122000

Year 3 -630000 -25000 1,008,000 -189000