

Appendix 1: The Accounting Rate of Return¹

The ARR method of capital investment appraisal appears to go under a number of guises, with a multitude of definitions used as the basis for its calculation. There is no single accepted formula for the accounting rate of return (ARR), and there is considerable confusion in the academic and the professional literature as to which method of calculation should be adopted. As a result, management may select whichever formula suits them best.

Reference is made to the ARR without giving a precise definition to its calculation or meaning. Comparisons are made on the basic assumption that one is comparing like with like. This, in many cases, is a false assumption. Although, in some cases, a distinction is made between the ARR based on *initial* investment and *average* investment, there is no generally accepted basis of calculating the figures to be used for either *investment* in or the *return* arriving from a project.

The accounting rate of return (ARR) is also commonly referred to as average rate of return (ARR), return on investment (ROI), and return on capital employed (ROCE). It is also known as average book rate of return, return on book value, book rate of return, unadjusted rate of return, and simple rate of return. In many cases the terms are used synonymously, while in others, they imply subtle differences in calculation.

Although the ARR, in whatever format, suffers from serious deficiencies (it is based on an accrual and not a cashflow concept; it does not take fully into account the fact that profits may vary year by year and therefore show an uneven pattern; it ignores the time value of the flow of funds and is not suitable for comparing projects with different life spans), research shows that it continues to be used in the United Kingdom and the United States for the appraisal of capital projects. Reasons

for its use have been given as simplicity and ease of calculation, readily understandability, and its use of accrual accounting measures by which managers are frequently appraised and rewarded. It does, however, offer a potential for manipulation by creative accounting.

Under the 'initial' method, the returns from a project are expressed as a percentage of the initial cost (hence the term 'initial'). The returns are stated after depreciation, so this shows in effect, in a simplistic way, the rate of return that is expected to be achieved above that which is required to recover the initial cost of the investment. There is, however, a school of thought that advances the proposition that as the capital investment will be written-off over the useful life of the project, then the figure for investment should take this into account. In its most basic form, this would result in an 'average' investment figure of one-half of the original cost. The earnings from the project would remain the same under either approach.

There appears to be two further areas of confusion with regard to the calculation of the ARR: how to deal with (i) scrap/salvage values and (ii) different methods of depreciation. Some textbooks show examples that do not include scrap values, thus getting round the problem of what to do with them, and with regards to depreciation, restrict the calculations to straight-line depreciation. This gives the reader of such texts a general impression of incompleteness, in that he/she is left wondering what to do if there is any scrap value from a project or if the organisation uses a different method of depreciation other than the straight-line method.

Suggestion

We would suggest that the *accounting rate of return* (ARR) used in the evaluation of capital projects should be based on either the initial (with the abbreviation, ARR_i) or average (ARR_a) investment method.

The term 'accounting' relates to the concept by which the determination of the actual figures for *income* and *investment* are arrived at. The figure for income should be calculated following the conventional accounting concepts for profit. In this case, income is synonymous with profit. Net income should be after depreciation. By using the following formula, it is immaterial which method of depreciation is used, as the average income will always be total gross income less total depreciation divided by the life (in years) of the project. Total depreciation will be equal to the capital cost of the project less any scrap value. Investment under the 'initial' method will be the capital cost of the project less any

scrap value, while under the 'average' method, it will be the capital cost of the project plus any scrap value divided by 2.

$$\text{Average income} = \frac{\text{Total gross income} - \text{Total depreciation}}{\text{Life of project}}$$

Investment:

- (1) 'Initial' investment = Capital cost of project less scrap value.
- (2) 'Average' investment = (Capital cost of project plus scrap value)/2

$$\text{ARR}_i = \frac{\text{Average income} \times 100}{\text{Initial investment}}$$

$$\text{ARR}_a = \frac{\text{Average income} \times 100}{\text{Average investment}}$$

Once the ARR has been calculated, the figure is compared with a pre-determined hurdle rate to see if the project is 'acceptable'. If the ARR is greater than the hurdle rate, then the project has satisfied this particular financial criterion of investment appraisal.

Our favoured approach to the calculation of ARR

In our opinion, it seems unnecessary to refine the calculations any further. After all, the figures for both investment and income are based on management estimates and are therefore susceptible to errors. Much of the confusion would also disappear if the term 'ARR' (ARR_i and ARR_a) was restricted to capital investment appraisal, and ROI and ROCE are treated as post-investment 'performance measures'.

ROI, which appears to be more widely used in the United States than in the United Kingdom, should be applied to the appraisal of 'performance' and calculated on an annual basis, based on the net book value of the investment at the beginning of each year.

Because of the difficulty and information cost in determining the actual 'profit' from each individual investment made by an organisation, it may be more appropriate to calculate the ROI on a profit centre basis.

The ROCE is more appropriate in measuring divisional performance, rather than as a tool for the initial evaluation of capital projects. It differs from both the ARR and ROI, in that it includes 'working capital' as part of the investment figure, and from the ARR in that it is calculated on an annual basis and does not therefore show, as a single figure, the overall return from a project.

The ROCE is the ratio of accounting profit to capital employed expressed as a percentage. Accounting profit is arrived at after taking into account depreciation, while capital employed is the capital cost of the investment plus additional working capital required as a result of the project less accumulated depreciation.

Although the ROI and ROCE are post-investment performance measures, it is understandable that managers may wish to know how these measures will be influenced by accepting a particular investment project. After all, their own performance will, in many cases, be judged using one of these performance measurements, and they will, invariably, be rewarded accordingly.

It is therefore not surprising that managers may wish to calculate such figures when appraising capital projects. What must be remembered, however, is that the ROI and ROCE calculate the annual return from an investment or group of investments, and it is the returns 'profile' that will be of interest to management. Selecting projects with different profit profiles will influence the total annual profit from all investments. The profit profile will not only be influenced by the pattern of gross income from investments but also by the method of depreciation adopted by the organisation.

It can be seen that by adopting the reducing-balance method of depreciation, this has the effect of showing lower profits in the early years and higher profits in later years, while the straight-line method of depreciation charges the same amount to costs in each year.² The ROI and ROCE should not be the driving force behind project selection, as such techniques may be biased towards managerial benefits and short-termism rather than corporate long-term profitability.

All other 'terms' for ARR should be ignored and left out of future textbooks, as they only breed confusion in the minds of both students and practitioners. This is, perhaps, a 'back to basics' approach, but one which, in our opinion, would eliminate much of the mystique and confusion over the ARR. It must be remembered that the ARR is a basic, simplistic investment appraisal tool. So why try and make it into something that it will never be – a substitute for the more sophisticated DCF methods?

This is not to say that the ARR has no place in the appraisal of capital investments, for any information is useful. Its use, however, must be made in the right context, and its limitations must be made known to the decision-makers. As part of a set of investment tools, the ARR can provide information that will give a wider perspective to the appraisal of capital projects. But the technique should not be used as the sole criteria for selection, or confused with the ROI or ROCE.

Example

The following example will illustrate the detailed workings of the ARR_i , ARR_a , ROI, and ROCE.³ A company is considering the investment in a project, the financial details of which are:

- Capital cost of project (cost of plant and installation): £51,435
- Additional working capital required to finance stock and debtors: £4,565
- Estimated useful life of project: 5 years.
- Scrap value of plant less cost of removing from site: £4,000
- Depreciation method used by organisation: 40% on reducing balance.
- Gross income from project: year 1: £20,000; year 2: £25,000; year 3: £20,000; year 4: £15,000; year 5: £7,000.

Calculation of the accounting rate of return

$$\text{Average net income} = (£87,000 - £47,435) / 5 = £7,913$$

$$\text{Investment (initial method)} = £51,435 - £4,000 = £47,435$$

$$\text{Investment (average method)} = (£51,435 + £4,000) / 2 = £27,718$$

$$ARR_i = (£7,913 / £47,435) \times 100 = 16.68\%$$

$$ARR_a = (£7,913 / £27,718) \times 100 = 28.55\%$$

Calculation of the ROI and ROCE

As the ROI and ROCE are annual performance measures, the second year of the project has been selected for the purpose of illustration (it could equally have been any of the other years of the project). As both these methods show the return for a particular year, and not for the project as a whole, the calculations will be influenced by the depreciation method used by the organisation.

ROI for year 2

$$\begin{aligned} \text{Net Income for year 2} &= £25,000 \text{ less } £12,344 \text{ (second-year depreciation)} \\ &= £12,656 \end{aligned}$$

$$\text{Investment figure} = £30,861 \text{ (book value at beginning of second year)}$$

$$ROI = (£12,656 / £30,861) \times 100$$

$$ROI \text{ for year 2} = 41.01\%$$

ROCE for year 2

Net Income for year 2 = £12,656 (same as ROI)

Investment figure = £30,861 + £4,565 (working capital increase)

$$\text{ROCE} = (\text{£}12,656 / \text{£}35,426) \times 100$$

ROCE for year 2 = 35.73%

Appendix 2: Calculating the Modified Internal Rate of Return from the Net Present Value

The two principal discounted cashflow models of capital investment appraisal – the net present value (NPV) and the internal rate of return (IRR) have traditionally been in direct competition, with academics favouring the NPV and practitioners favouring the IRR. These two models have intrinsic differences from each other, with the NPV being an economic indicator and the IRR a financial indicator of a capital investment.¹ Textbooks show the two approaches being calculated independently of each other, although the same cashflows are used in each case. To overcome some of the perceived problems of the IRR, a modified internal rate of return (MIRR) was developed. This appendix shows a simplified way of calculating a project's MIRR through the net present value profile (NPVP), giving a clear link between the NPV and MIRR.

In its basic form, the NPV of a project is the sum of all the net discounted cashflows during the life of the project less the present value of the capital cost of the project. A positive NPV indicates that if the project is accepted, then the organisation's wealth will increase by this NPV. If the NPV is negative, then the result will be a reduction in an organisation's net worth, while a zero NPV will result in no change.

The IRR model (which is also referred to as the actuarial, the marginal efficiency of capital, and the yield model) uses the same net cashflows as the NPV model but expresses the end-result as a percentage yield. Provided this percentage yield is greater than the organisation's cost of finance/hurdle rate, then the project is said to be acceptable from a financial point of view. The IRR for a project is therefore the discount rate, which reduces the stream of net returns from the project to a present value of zero.

There are, however, two main problems with the IRR, (i) the possibility of arriving at multiple rates, and (ii) concerns over the reinvestment

rate.² Both these problems have been overcome by modifying the IRR model to arrive at what is generally known as an MIRR.³

Under the conventional IRR model, a rate of return is calculated which equates the discounted net cash outflows with the net cash inflows, a situation where the NPV is equal to zero. The most common form of MIRR,⁴ however, compounds the net cash inflows to a single figure at the end of a project's economic life. Then, using the cost of the project as a base figure, calculate the modified return for a project using the following formula, $[(\text{compounded cash inflows}/\text{cost of project})^{1/n} - 1] \times 100$, where 'n' is the length of the project. This gives the compound interest rate which when applied to the base cost of the project produces the compounded net cash inflow figure at the end of the life of the project. As the 'inflow' in the final year has been arrived at by assuming a reinvestment rate equal to the cost of capital and not at the project's IRR, then the MIRR will usually (i.e. where the IRR is greater than the costs of capital) produce a figure that will be lower than the IRR. The figure produced, however, is arguably more 'realistic' and therefore more meaningful than the conventional IRR. The MIRR will, in all cases, provide a compatible accept/reject decision with the NPV rule, where 'accept' is when the NPV > 0 and the MIRR > Cost of Capital.

Until recently, both the NPV and MIRR, although using the same cash-flows, have been arrived at independently. What this appendix shows is that the MIRR can be calculated from the NPV through a project's NPVP.

The NPVP extends the NPV by incorporating the discounted payback (DPB), the discounted payback index (DPBI), and the marginal growth rate (MGR), into a financial profile of an investment opportunity. The NPVP shows a natural progression from NPV to MGR from which the MIRR can be calculated.

The net present value profile

NPV \Rightarrow DPB \Rightarrow DPBI \Rightarrow MGR \Rightarrow MIRR

Calculating the MIRR from the NPVP

In our simplified example (Table A2.1), we look at a project which has a capital cost of £175,000 and an estimated useful life of ten years. The scrap value of the equipment, estimated at £7,500, is taken into account in the final year of the project by increasing the net cash inflow for that year. The company's cost of capital is 8%. For simplicity, the figures in our example ignore taxation and inflation, and the scrap value is included within the cash inflow figure for year 10. From this data it can

Table A2.1 Calculating the MIRR from the NPV

Capital cost of project £175,000				
Year	Net cash inflows from the project			
	Net cash inflow (£)	Discount factor 8%	PV of net cash inflows (£)	Cumulative PVs (£)
1	52,000	0.926	48,152	48,152
2	57,000	0.857	48,849	97,001
3	60,000	0.794	47,640	144,641
4	60,000	0.735	44,100	188,741
5	60,000	0.681	40,860	229,601
6	60,000	0.630	37,800	267,401
7	60,000	0.583	34,980	302,381
8	60,000	0.540	32,400	334,781
9	60,000	0.500	30,000	364,781
10	27,500	0.463	12,733	377,514
Totals	556,500		377,514	

Calculations:

NPV: (Present value of net cash inflows - capital cost of project) = (£377,514 - £175,000) = £202,514.

DPB = $[3 + (30359/44100)] = 3.69$ years.

DPBI = (Present value of net cash inflows/capital cost of project) = (£377,514/£175,000) = 2.1572.

MGR = $[(DPBI)^{1/n} - 1] \times 100 = [(2.1572)^{1/10} - 1] \times 100 = 7.99\%$.

MIRR = $[(1 + 0.0799) \times (1 + 0.08)] = (1.0799 \times 1.08) = 1.1663$. MIRR = $(1.1663 - 1) \times 100 = 16.63\%$.

be seen that, with a capital cost of £175,000 and a total discounted net cash inflow of £377,514, the project has a positive NPV of £202,514. This is the gain in present value terms that the company can expect to achieve if it accepts the project - it is the discounted return in excess of the capital cost of the project.

The DPB calculates what may be described as the break-even point at which the discounted returns from a project are equal to the capital cost of the project. It shows the time that it will take to recover the initial cost of the project after taking into account the cost of capital. It is superior to the conventional payback approach, as it takes into account the future value of money. As the cashflows from a project are discounted, the DPB will always show a longer payback period than the standard payback model and may therefore be regarded as more conservative.

In our example, the DPB is calculated as follows: The cumulative discounted net cash inflow at the end of year 3 is £144,641, which shows

a payback period greater than three years. The company then needs to achieve a further discounted net cash inflow of £30,359 (£175,000–£144,641) to arrive at the actual discounted payback period. As the discounted net cash inflow during year 4 is £44,100, which is greater than that required to break-even, the additional payback period is $30,359/44,100$ (0.69), giving a total payback period of three years plus $0.69 = 3.69$ years (this assumes a linear increase in net cash inflows during the year, if this is not the case and a more accurate figure is required, then actual monthly net cashflows may be used). The company will therefore be placed back in its original financial position in just over three and a half years, having recovered the whole of the cost and financing of the project in that time.

A natural progression from the DPB is the calculation of the DPBI, which is similar to the profitability index. The DPBI is calculated by dividing a project's initial capital cost into its accumulated discounted net cash inflows. This index shows how many times the initial cost of an investment will be recovered during a project's useful life and is therefore a further measure of a project's profitability. The higher the index, the more profitable will be the project in relation to its capital cost. A DPBI of 1.0 will show that the project will only recover the capital cost of an investment once, while a DPBI of 3.0 shows that the initial cost will be recovered three times.

A weakness of the payback model (whether conventional or discounted) is the fact that it ignores the cashflows after the payback period. By highlighting the DPBI, this weakness is eradicated because the total cashflows from a project are now taken into account. In our example, the DPBI can be calculated by dividing the capital cost of the project into the present value of net cash inflows (£377,514/£175,000), which gives a figure of 2.1572. This means that the project recovers just over twice its original cost.

The final stage in the progression of the NPVP is the calculation of the MGR which is reached through the DPBI, where $MGR = [(DPBI)^{1/n} - 1] \times 100$. The MGR is the marginal return on a project after discounting the cash inflows at the cost of capital and can be viewed as a 'net' variant of the MIRR. To validate the meaning of the MGR, it can be seen that applying a compound interest rate equal to the MGR to the initial cost of a project will produce, in the lifespan of that project, a value equal to the present value of the project's net cash inflows. This is therefore the growth rate that, when applied to the capital cost of the project, will produce the NPV of the project. Unlike the DPBI, the MGR reflects the economic life of a project. Although the DPBI of two projects may be

Table A2.2 Traditional method of calculating the MIRR

Capital cost of project £175,000			
Year	Net cash inflows from the project		
	Net cash inflow (£)	Reinvestment rate 8%	Value (£)
1	52,000	1.999	103,948
2	57,000	1.851	105,507
3	60,000	1.714	102,840
4	60,000	1.587	95,220
5	60,000	1.469	88,140
6	60,000	1.361	81,660
7	60,000	1.260	75,600
8	60,000	1.166	69,960
9	60,000	1.080	64,800
10	27,500	1.000	27,500
Totals	556,500		815,175

The MIRR of the project (based on a cash outflow of £175,000 in year 0 and a single cash inflow in year 10 of £815,175 = 16.63% $\{[(\text{compounded cash inflows/cost of project})^{1/n} - 1] \times 100 = [(\text{£}815,175/\text{£}175,000)^{1/10} - 1] \times 100 = 16.63\%$).

identical, if these projects have different economic lives, the MGR will be lower for the longer life project. In our example, the MGR is 7.99% $\{[(\text{DPBI})^{1/n} - 1] \times 100 = [(2.1572)^{1/10} - 1] \times 100\}$ and is a measure of the project's rate of *net* return.

The mathematical 'relationship' between the MGR and the most commonly used MIRR is $(1 + \text{MIRR}) = (1 + \text{MGR}) \times (1 + \text{cost of capital})$. The MIRR for the above example is 16.63% $[(1 + 0.0799) \times (1 + 0.08) = (1.0799 \times 1.08) = 1.1663. \text{MIRR} = (1.1663 - 1) \times 100 = 16.63\%]$. Table A2.2 shows the traditional method of calculating the MIRR of the project and confirms the figure calculated using the NPVP approach.

Through adopting the NPVP approach, we have demonstrated a way of calculating the MIRR from the NPV of a project, which should in future become the standard way of determining a project's MIRR.

Notes

1 Introduction

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2 The Perception that ICT Projects Are Different

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5 The Development of the FAP Model

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3. Publications on the FAP Model: Lefley, F., 1997, Capital investments: The 'Financial appraisal profile'. *Certified Accountant*, June, 89 (6), 26–29. Lefley, F., 1998, The strategic index: A new approach to the strategic appraisal of capital projects. *Control*, September, 24 (7), 26–27. Lefley, F., 1998, Risk evaluation of capital projects using the risk index. *The International Journal of Project and Business Risk Management*, Summer, 2 (2), 69–79. Lefley, F., and Morgan, M., 1998, A new pragmatic approach to capital investment appraisal: The financial appraisal profile (FAP) model. *International Journal of Production Economics*, 55 (3), 321–341. Lefley, F., and Morgan, M., 1999, The NPV profile: A creative way of looking at the NPV. *Management Accounting*, June, 77 (6), 39–41. Lefley, F., 1999, Value judgments. *Accounting Technician*, November, 31–33. Lefley, F., 2000, The financial appraisal profile (FAP) model of investment appraisal. *Management Accounting*, March, 78 (3), 28–31. Lefley, F., 2001, The financial appraisal profile (FAP) model. *International Accountant*, 12, May, 24–26. Lefley, F., 2001, Decisive action. *Financial Management*, October, 36–38. Lefley, F., 2002, The advantages of the Net Present Value Profile (NPVP) model of financial appraisal. *International Accountant*, (14), January, 18–20. Lefley, F., 2002, Adding value to investment appraisal with the Financial Appraisal Profile (FAP) model. *Einstein Network – Finance Channel*, 838 *Management Accounting*, May. Lefley, F., 2002, The financial appraisal profile model, accounting web. *Business Management Zone*, 26 November. Lefley, F., 2003, The third way. *Financial Management*, October, 18–19. Lefley, F., 2004, A brief introduction to the financial appraisal profile (FAP) model. *International Journal of Applied Finance For Non-Financial Managers*, January, 1 (1). Lefley, F., 2004, The positioning of the financial appraisal profile (FAP) model within a project evaluation matrix. *International Journal of Applied Finance for Non-Financial Managers*, February, 1 (1). Lefley, F., 2004, The evaluation of project risk: A more pragmatic approach. *International Journal of Applied Finance for Non-Financial Managers*, April, 1 (2). Lefley, F., 2004, Clear and present value. *Accounting Technician*, June, 22. Lefley, F., 2004, An assessment of various approaches for evaluating project strategic benefits: Recommending the strategic index (SI). *Management Decision*, 42 (7), 850–862. Lefley, F., and Sarkis, J., 2004, Applying the financial appraisal profile (FAP) model to the evaluation of strategic information technology projects. *International Journal of Enterprise Information Systems*, 4 (3), 14–24. Lefley, F., and Sarkis, J., 2005, Applying the FAP model to the evaluation of strategic information technology projects. *International Journal of Enterprise Information Systems (IJEIS)*, 1 (2), 69–90. Lefley, F., 2006, Can a project

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 10. Mohanty, R. P., and Deshmukh, S. G., 1998, Advanced manufacturing technology selection: A strategic model for learning and evaluation. *International Journal of Production Economics*, 55 (3), 295–307.
 11. We use the normative term ‘protocol’ to highlight the FAP model’s emphasis on what ought to be done rather than the descriptive terms of either ‘process’ or ‘procedure’.
 12. Cross, R. L., and Brodt, S. E., 2001, How assumptions of consensus undermine decision making. *Sloan Management Review*, 42 (2), 86–94.
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6 The FAP Model – Basic Data

1. Gregory, A., Rutterford, J., and Zaman, M., 1999, *The Cost of Capital in the UK: A Comparison of the Perceptions of Industry and the City*. (CIMA: London).

2. Kalu, Ch. U., 1999, Capital budgeting under uncertainty: An extended goal programming approach. *International Journal of Production Economics*, 58 (3), 235–251.
3. Peccati, L., 1996, *The Use of the WACC for Discounting Is Not a Great Idea*. (Atti del Ventesimo Convengno Annuale, AMASES: Urbino), 5–7 Settembre, 527–534.
4. Levy, H., and Sarnat, M., 1994, *Capital Investment & Financial Decisions*. Fifth edition (New York: Prentice Hall).
5. Paxson, D., and Wood, D., 1998, *Blackwell Encyclopedic Dictionary of Finance*. (Oxford: Blackwell).
6. See, for example, Peccati. L., 1993, The appraisal of industrial investments: A new method and a case study. *International Journal of Production Economics*, 30–31, 465–476, and Booth, R., 1999, Avoiding pitfalls in investment appraisal. *Management Accounting*, 77 (10), 22–23.
7. Support for interpreting the NPV as an ‘economic return’ is found in the modern financial literature, see, for example, Grinblatt, M., and Titman, S., 1998, *Financial Markets and Corporate Strategy*. (Boston: Irwin/McGraw-Hill), where they refer to the ‘economic value added’ version of the NPV, as a measure of a company’s true economic profitability.
8. The term ‘residual value’ is given to the terminal value of a capital investment and may be calculated using a number of methods of which the most common are: (a) the Price/Earnings ratio which is used to calculate the best estimate of the investments market value, (b) the Perpetuity method which estimates the residual value as being the PV of an ongoing stream of future cashflows, (c) the book value of the investment, and (d) the liquidation value of the investment.

7 The FAP Model – The Net Present Value Profile (NPVP)

1. See, for example, Sangster, A., 1993, Capital investment appraisal techniques: A survey of current usage. *Journal of Business Finance & Accounting*, 20 (3), 307–332, and Lefley, F., and Sarkis, J., 1997, Short-termism and the appraisal of AMT capital projects in the US and UK. *International Journal of Production Research*, 35 (2), 341–368.
2. Lefley, F., and Sarkis, J., 1997. Short-termism and the appraisal of AMT capital projects in the US and UK. *International Journal of Production Research*, 35 (2), 341–368.
3. The most common form of MIRR compounds the net cash inflows to a single figure at the end of the project’s economic life and then, using a base figure for the cost of the project, calculates the modified return from that project, when, using interest tables, the interest rate is found which when applied to the base cost of the project produces the compounded net cash inflow figure at the end of the life of the project.
4. Lefley, F., 1997, Capital investments: The ‘Financial appraisal profile’. *Certified Accountant*, June, 89 (6), 26–29.
5. Keef, S., and Olowo-Okere, E., 1998, Modified internal rate of return: A pitfall to avoid at any cost! *Management Accounting*, 76 (1), 50–51.

6. Gregory, A., Rutterford, J., and Zaman, M., 1999, *The Cost of Capital in the UK: A Comparison of the Perceptions of Industry and the City*. (CIMA: London).
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8. Bengtsson, J., 2001, Manufacturing flexibility and real options: A review. *International Journal of Production Economics*, 74 (1–3), 213–224.
9. Grinblatt, M., and Titman, S., 1998, *Financial Markets and Corporate Strategy*. (Boston: Irwin/McGraw-Hill).
10. Pike, R. H., 1985, Disenchantment with DCF promotes IRR. *Certified Accountant*, July, 14–17.
11. The mathematical ‘relationship’ between the MGR and the MIRR is $(1 + \text{MIRR}) = (1 + \text{MGR}) \times (1 + \text{cost of capital})$. See also Lefley, F., 2004, Clear and present value. *Accounting Technician*, June.
12. Lefley, F., and Sarkis, J., 1997, Short-termism and the appraisal of AMT capital projects in the US and UK. *International Journal of Production Research*, 35 (2), 341–368.

8 The FAP Model – The Project Risk Profile (PRP)

1. See, for example, Markowitz, H., 1952, Portfolio selection. *Journal of Finance*, March, 77–91.
2. Williams, T. M., 1993, Risk-management infrastructures. *International Journal of Project Management*, 11 (1), 5–10.
3. By negative outcome, we mean an outcome that is less financially or strategically advantageous to the firm compared with the expected position if the project were not to proceed.
4. In theory, the importance of risk is the product of its impact multiplied by its probability of occurrence ($R = I \times P$). This therefore assumes that managers will treat, as having the same value (importance) and have no preference for either, a specific risk with an impact of 60 (on a scale of 0–100) and a probability of 10%, and a risk with an impact of 10 and a probability of 60% (both having a value of 6.0). Tests, however, from a small sample of managers, suggested that they treated as ‘equal’ a risk with an impact of 55 and a probability of 10% (5.5), and an impact of 10 with a probability of 60% (6.0). Managers were clearly placing a greater level of significance to higher levels of risk impact, by subconsciously applying a disutility factor to the impact values – in this example the disutility factor is 1.0909, so that $55 \times 0.1 \times 1.0909 = 6.0$, which equates to $10 \times 0.6 (= 6.0)$. So, by applying a disutility factor to the perceived risk impact value, a DIV is achieved. It is argued that the disutility factor will increase exponentially from 1 to (in this example) 1.0909.
5. Madu, C. N., 1994, A quality confidence procedure for GDSS application in multicriteria decision making. *IIE Transactions*, 26 (3), 31–39.
6. Debate is the spontaneous emergent task-focused discussion of differing perspectives and approaches to the task in hand and includes the questioning or challenging of assumptions, reasoning, criteria, or sources of information, disagreement with direct and open presentation of rival recommendations.

7. Simons, T., 1995, Top management team consensus, heterogeneity, and debate as contingent predictors of company performance: The complementarity of group structure and process. In: *Academy of Management Best Paper Proceedings*, Vancouver, WA, pp. 62–66.
8. Simons, T., Pelled, L. H., and Smith, K. A., 1999, Making use of difference: Diversity, debate, and decision comprehensiveness in top management teams. *Academy of Management Journal*, 42 (6), 662–673.
9. Merkhofer, M. W., 1987, Quantifying Judgmental uncertainty: Methodology, experiences, and insights. *IEEE Transaction on Systems, Man, and Cybernetics*, 17 (5), 741–752.
10. Tversky, A., and Kahneman, D., 2000, Judgement under uncertainty: Heuristics and biases, in Connolly, T., Arkes, H. R., and Hammond, K. R., (ed.), Second edition, *Judgement and Decision Making*, Cambridge: Cambridge University Press, 35–52.
11. One may also assume that with a reasonably large team and a number of ‘iterations’ within the ‘quasi-Delphi approach’ the idiosyncratic beliefs are likely to be diversified away leaving a core of rational beliefs as the dominating influence in the group judgement.
12. Cross, R. L., and Brodt, S. E., 2001, How assumptions of consensus undermine decision making. *Sloan Management Review*, 42 (2), 2001, 86–94.
13. Hertz, D. B., 1964, Risk analysis in capital investment. *Harvard Business Review*, 42 January/February, 95–106.

9 The FAP Model – The Strategic Index (SI)

1. Saaty, T. L., 1980, *The Analytic Hierarchy Process*. (New York: McGraw-Hill).
2. Narasimhan, R., 1983, An analytical approach to supplier selection. *Journal of Purchasing and Materials Management*, 19 (4), Winter, 27–32.
3. See Simons, T., 1995, Top management team consensus, heterogeneity, and debate as contingent predictors of company performance: The complementarity of group structure and process. In: *Academy of Management Best Paper Proceedings*, Vancouver, WA, 62–66.
4. See Madu, C. N., Kuei, C-H., and Madu, A. N., 1991, Setting priorities for the IT industry in Taiwan – A Delphi study. *Long Range Planning*, 24 (5), 105–118.
5. Hambrick, D. C., 1981, Strategic awareness within top management teams. *Strategic Management Journal*, 2, 263–279.
6. See Wheelwright, S. C., and Hayes, R. H., 1985, Competing through manufacturing. *Harvard Business Review*, 63 (1), 99–109.

10 Summary Comments on the FAP Model

1. Hambrick, D. C., 1981, Strategic awareness within top management teams. *Strategic Management Journal*, 2, 263–279.
2. Janis, I. L., 1982, *Groupthink*. (Boston: Houghton Mifflin).
3. Tversky, A., and Kahneman, D., 2000, Judgement under uncertainty: Heuristics and biases, in Connolly, T., Arkes, H. R., and Hammond, K. R., (ed.), Second edition, *Judgement and Decision Making*. (Cambridge: Cambridge University Press), 35–52.

4. See, for example, Kaplan, R. S., and Norton, D. P., 1996, *The Balanced Scorecard*. (Boston: Harvard Business School).
5. Farragher, E. J., Kleiman, R. T., and Sahu, A. P., 1999, Current capital investment practices. *Engineering Economist*, 44 (2), 137–150.
6. Small M. H., and Chen, I. J., 1997, Economic and strategic justification of AMT: inferences from industrial practices. *International Journal of Production Economics*, 49 (1), 65–75 and Papadakis, V. M., 1998, Strategic investment decision processes and organizational performance: An empirical examination. *British Journal of Management*, 9 (2), 115–132.
7. Bourgeois, L. J., III, 1981, On the measurement of organization slack. *Academy of Management Review*, 6 (1), 29–39 and Cyert, R. M., and March, J. G., 1992, *A Behavioral Theory of the Firm*. Second Edition, (Oxford: Blackwell).
8. Fredrickson, J. W., 1985, Effects of decision motive and organizational performance level on strategic decision processes. *Academy of Management Journal*, 28 (4), 821–843.

11 Applying the FAP Model to an ICT Project within a Professional Association

1. Mohanty, R. P., and Deshmukh, S. G., 1998, Advanced manufacturing technology selection: A strategic model for learning and evaluation. *International Journal of Production Economics*, 55 (3), 295–307; Serafeimidis, V., and Smithson, S., 2000. Information systems evaluation in practice: A case study of organizational change. *Journal of Information Technology*, 15 (2), 93–105.
2. Ballantine, J., and Stray, S., 1998. Financial appraisal and the IS/IT investment decision making process. *Journal of Information Technology*, 13 (1), 3–14.
3. Small, M. H., and Chen, I. J., 1997, Economic and strategic justification of AMT: Inferences from industrial practices. *International Journal of Production Economics*, 49 (1), 65–75.
4. Graham, J. R., and Harvey, C. R., 2001. The theory and practice of corporate finance: Evidence from the field. *Journal of Financial Economics*, 60 (2–3), 187–243.
5. Bannister, F., and Remenyi, D., 2000. Acts of faith: Instinct, value and IT investment decisions. *Journal of Information Technology*, 15 (3), 231–241.
6. Serafeimidis, V., and Smithson, S., 2000, Information systems evaluation in practice: A case study of organizational change. *Journal of Information Technology*, 15 (2), 93–105.
7. Introna, L. D., 1997, *Management, Information and Power: A Narrative of the Involved Manager*. (Basingstoke: Macmillan).
8. Feldman, S. M., 2005, The problem of critique: Triangulating Habermas, Derrida, and Garamer within metamodernism. *Contemporary Political Theory*, 4 (3), 308.
9. Whitley, E. A., 1999. Understanding participation in entrepreneurial organizations: Some hermeneutic readings. *Journal of Information Technology*, 14 (2), 194.

10. Pondy, L. R., 1983. Union of rationality and intuition in management action, in Srivastva, S., and Associates (eds.), *The Executive Mind*. (San Francisco: Jossey-Bass), 169–191.
11. Heemstra, F. J., and Kusters, R. J., 2004. Defining ICT proposals. *Journal of Enterprise Information Management*, 17 (4), 266.
12. Bannister, F., and Remenyi, D., 2000. Acts of faith: Instinct, value and IT investment decisions. *Journal of Information Technology*, 15 (3), 235.
13. Lefley, F., and Sarkis, J., 2005. Applying the FAP model to the evaluation of strategic information technology projects. *International Journal of Enterprise Information Systems*, 1 (2), 68–87.
14. Janis, I. L., 1982, *Groupthink*. (Boston: Houghton Mifflin).
15. Tversky, A., and Kahneman, D., 2000, Judgement under uncertainty: Heuristics and biases, in Connolly, T., Arkes, H. R., and Hammond, K. R., (ed.), Second edition, *Judgement and Decision Making*. (Cambridge: Cambridge University Press), 35–52.
16. Habermas, J., 1990, *Moral Consciousness and Communicative Action*. *Studies in Contemporary German Social Thought*. (Cambridge, MA: MIT). 198.
17. Klecun, E., and Cornford, T., 2005, A critical approach to evaluation. *European Journal of Information Systems*, 14 (3), 233.
18. This chapter is taken from the following publication, Lefley, F., 2008, Research in applying the financial appraisal profile (FAP) model to an information communication technology project within a professional association. *International Journal of Managing Projects in Business*, 1 (2), 233–259.
19. Members, from both the management team and corporate management, directors/council members, were asked to indicate, on a scale of 0 to 10, whether they perceived themselves to be risk-averse or risk-takers in a business context, with 0 indicating that they were prepared to take no risks at all and 10 indicating that they perceived themselves to be very high risk-takers. They were then asked to multiply this figure by a factor of 10 and told that this would now represent the percentage level of a specific risk impact on a capital project. They were then asked to indicate the maximum level of risk probability, in relation to this level of impact, which they would be prepared to accept as an individual and specific to their own area of responsibility and risk control. The data obtained were respectively – impact/probability – for five members of the management team, 70/10, 20/90, 65/10, 80/10, 75/10 and for six directors/council members, 80/10, 75/15, 30/50, 55/5, 70/15, 50/20. It is interesting to note (assuming the figures were entered correctly, which, as one will appreciate, makes no difference to the calculation of the mean value) that in both sets of figures there is one individual who shows a low impact figure, but a high probability value, which results in high-RVs, where $RV = I \times P$. So, on the one hand, they perceive themselves to be risk-averse, while, on the other hand, they show themselves to be high risk-takers. The arithmetic mean for the management team was 9.4, while the arithmetic mean for the directors/council members was 9.58. It was therefore agreed that the CRT should be 9.5.
20. In theory, the importance of a particular project-specific risk is the product of its perceived impact multiplied by its probability of occurrence ($R = I \times P$). This therefore assumes that managers will treat, as having the same value (importance) and have no preference for either, a specific risk with an impact of 60 (on a scale of 0 to 100) and a probability of 10%, and a risk with an

impact of 10 and a probability of 60% (both having a value of 6.0). Limited tests, however, suggest that managers treat as 'equal' a risk with an impact of 55 and a probability of 10% (5.5), and an impact of 10 with a probability of 60% (6.0). Managers were clearly placing a greater level of significance to higher levels of risk impact, by subconsciously applying a disutility factor to the impact values – in this example, the disutility factor is 1.0909 so that $55 \times 0.1 \times 1.0909 = 6.0$ which equates to $10 \times 0.6 (= 6.0)$. So, by applying a disutility factor to the perceived risk impact value, a DIV is achieved. It is argued that, in this instance, the disutility factor will increase exponentially from 1 to 1.0909 for impact values of between 1 and 55. The formula for arriving at a disutility factor is $c = (b - 1) / [\ln(a/b)]$; $y = e^{[(x-1)/c]}$. If $a = 60$ and $b = 55$, then $a/b = 1.0909$; $c = (55 - 1) / (\ln 1.0909) = 620.6679$. So that if $x = 55$, then $y = e^{[(55-1)/620.6679]} = 1.0909$. If, for example, $x = 40$, then $y = e^{[(40-1)/620.6679]} = 1.0649$.

21. Gregory, A., Rutterford, J., and Zaman, M., 1999, *The Cost of Capital in the UK: A Comparison of the Perceptions of Industry and the City*. (London: CIMA).
22. Rauch, W., 1979, The decision Delphi. *Technology Forecasting and Social Change*, 15 (3), 159–169.
23. Lefley, F., and Sarkis, J., 2005, Applying the FAP model to the evaluation of strategic information technology projects. *International Journal of Enterprise Information Systems*, 1 (2), 68–87.
24. Bromwich, M., and Bhimani, A., 1991, Strategic investment appraisal. *Management Accounting*, 69 (3), 45–48.
25. Hambrick, D. C., 1981, Strategic awareness within top management teams. *Strategic Management Journal*, 2 (3), 263–279.
26. Dixon, R., 1988, *Investment Appraisal – A Guide for Managers*. (London, Kogan: Page/CIMA).
27. Madu, C. N., Kuei, C-H., and Madu, A. N., 1991, Setting priorities for the IT industry in Taiwan – A Delphi study. *Long Range Planning*, 24 (5), 105–118.
28. Cross, R. L., and Brodt, S. E., 2001, How assumptions of consensus undermine decision making. *Sloan Management Review*, 42 (2), 86–94.
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30. Simons, T., 1995, Top management team consensus, heterogeneity, and debate as contingent predictors of company performance: The complementarity of group structure and process. In: *Academy of Management Best Paper Proceedings*, Vancouver, WA, pp. 62–66.
31. Archard, D., 2004, Review of 'from pluralist to patriotic politics, putting practice first, by C. Blattberg. 2000, Oxford: Oxford University Press. *Contemporary Political Theory*, 3 (2), 212–213.
32. See, for example, Scapens, R. W., Sale J. T., and Tikkas P. A., 1982, *Financial Control of Divisional Capital Investment*. (London: ICMA); Pike, R. H., 1983, A review of recent trends in formal capital budgeting processes. *Accounting and Business Research*, 51 (Summer), 201–208; McIntyre, A. D., and Coulthurst, N. J., 1986, *Capital Budgeting Practices in Medium-Sized Businesses – A Survey*. A Research Report. (London: Institute of Cost and Management Accountants).
33. Primrose, P., 1991, *Investment in Manufacturing Technology*. (London: Chapman and Hall).

Appendix 1: The Accounting Rate of Return

1. This appendix is based on an earlier published paper by the author: Lefley, F., 1998, Accounting rate of return: Back to basics. *Management Accounting (UK)*, 76 (3), 52–53.

2. Note:

Depreciation based on straight line method

Year 1, £9,487; Year 2, £9,487; Year 3, £9,487; Year 4, £9,487; Year 5, £9,487.
[Total depreciation £47,435].

Accumulated depreciation

End of Year 1, £9,487; Year 2, £18,974; Year 3, £28,461; Year 4, £37,948; Year 5, £47,435.

3. Note:

Depreciation based on 40% reducing balance

Year 1, £20,574; Year 2, £12,344; Year 3, £7,407; Year 4, £4,444; Year 5, £2,666.
[Total depreciation £47,435].

Accumulated depreciation

End of Year 1, £20,574; Year 2, £32,918; Year 3, £40,325; Year 4, £44,769; Year 5, £47,435.

Net income

Year 1, £574 (loss); Year 2, £12,656; Year 3, £12,593; Year 4, £10,556; Year 5, £4,334. [Total net income £39,565].

[ROI] Investment

Beginning of Year 1, £51,435; Year 2, £30,861; Year 3, £18,517; Year 4, £11,110;
Year 5, £6,666.

[ROCE] Investment

Beginning of Year 1, £56,000; Year 2, £35,426; Year 3, £23,082; Year 4, £15,675;
Year 5, £11,231. [It is assumed that the working capital is required at the beginning of the first year].

ROI

Year 1, 1.12% loss; Year 2, 41.01%; Year 3, 68.01%; Year 4, 95.01%; Year 5, 65.02%.

ROCE

Year 1, 1.03% loss; Year 2, 35.73%; Year 3, 54.56%; Year 4, 67.34%; Year 5, 38.59%.

Appendix 2: Calculating the Modified Internal Rate of Return from the Net Present Value

1. Tang, S. L., and Tang, H. J., 2003, Technical Note – The variable financial indicator IRR and the constant economic indicator NPV. *Engineering Economist*, 48 (1), 69–78. Hajdasinski, M. M., 2004, Technical Note – The internal rate of return (IRR) as a financial indicator. *Engineering Economist*, 49 (2), 185–197.

2. Drury, C., 1988, *Management and Cost Accounting*. Second edition, (London: Chapman and Hall). Lorie, J. H., and Savage, L. J., 1955, Three problems in rationing capital. *Journal of Business*, 28 (4), October, 229–239.
3. Baldwin, R. H., 1959, How to assess investment proposals. *Harvard Business Review*, 37 (3), May/June, 98–104. Lin, S. A. Y., 1976, The modified internal rate of return and investment criterion. *Engineering Economist*, 21 (4), Summer, 237–247.
4. Lefley, F., 1997, The modified internal rate of return (MIRR): Will it replace IRR? *Management Accounting (UK)*, 75 (1), 64–65.

Index

- abandonment option, *see* option theory
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