THE FAP MODEL AND ITS APPLICATION IN THE APPRAISAL OF ICT PROJECTS

FRANK LEFLEY

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Foreword

One of the most important long-term decisions for any business relates to capital investments. The ability of the manager or the board to properly assess investment opportunities and to make sound decisions on the best alternatives is crucial for the success of any company. No matter how simple this subject may appear, and despite a number of books already written on the subject to help managers make the right and well-founded decision, it is clear that many factors remain unaddressed. With every new kind of technology, we hear again and again complaints that the common methods used in its evaluation are completely inappropriate. Some critics argue that new technology is completely different and claim that its idiosyncratic features cannot be taken into account and, as a result, the utilisation of common appraisal methods discriminates against its acceptance.

The worldwide expenditure on information and communication technology (ICT) is enormous and has become a common part of our everyday life being considered, in many respects, as standard and necessary equipment. Nevertheless, despite the many appraisal and evaluation techniques available, many practitioners openly admit that such methods are inappropriate, inadequate, or rather difficult to use, when appraising complex ICT projects.

I strongly believe that this book is essential reading for all those involved in the appraisal/selection of ICT capital projects, as it presents a pragmatic approach to the subject. In this book, Lefley presents a major revision to his earlier work with Bob Ryan, *The Financial Appraisal Profile Model* published by Palgrave Macmillan in 2005, and includes new data on ICT research undertaken over recent years. The text is based on rich practical experience combined with valuable research results that have been acquired and analysed by Lefley over many years of work in the field of investment appraisal.

The huge amount of money currently invested in ICT and its high level of importance makes this book very topical. It brings into focus an inspiring and new way of making the right decisions concerning ICT capital projects. This valuable guide will help managers to view the problem of ICT appraisal in a much broader and very down-to-earth, pragmatic perspective. I have no doubt that managers, financial specialists as well as students in the field of management and finance will find it comprehensible, informative, and useful.

Josef Hynek
Rector of the University of Hradec Králové, Czech Republic

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This book focuses on the application of the Financial Appraisal Profile (FAP) model to information communication technology (ICT) capital projects and is based on research conducted at Royal Holloway College, Imperial College (University of London, UK) and the University of Hradec Králové, Czech Republic. I would like to extend my heartfelt thanks to both Dr Malcolm Morgan and Professor Bob Ryan, who supervised my doctoral studies at the University of London, and to Professor Josef Hynek, Dr Václav Janeček, Kateřina Půžová, and Jan Němeček, who worked with me on the Czech Republic ICT research and who have given me permissions to reproduce the joint research findings. I am an honorary research fellow at both the University of Hradec Králové and Royal Holloway College, University of London.

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Papers. All references have been suitably acknowledged in the text of this book.

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About the Author

Frank Lefley is an honorary research fellow at the University of Hradec Králové, Czech Republic, and the University of London, UK. He received his MSc in Management Systems and Sciences from the University of Hull, UK, his MPhil in Accounting and Financial Management from the University of Buckingham, UK (involving a joint project with the University of Texas at Arlington, USA), and his PhD from the University of London, UK (having studied at both Imperial College and Royal Holloway College). His previously published research has appeared in leading academic journals such as *Engineering Economist*; *International Journal of Production Economic*; *International Journal of Production Research*; *International Journal of Enterprise Information Systems*; *Management Research Review*; *Management Decision*; *International Journal of Systems*; *Control and Communications*; *International Journal of Managing Projects in Business*; *Prague Economic Papers*; and *International Journal of Applied Logistics*. He is the originator of the FAP model.

Abbreviations

AMT	Advanced Manufacturing Technology
APV	Adjusted Present Value
ARR	Accounting Rate of Return
ARRa	Accounting Rate of Return (average investment method)
ARRi	Accounting Rate of Return (initial investment method)
AT	Advanced Technology
CAPM	Capital Asset Pricing Model
CE-v	Certainty Equivalent Value
CR	Corporate Ranking
CRT	Corporate Risk Threshold
CZ	Czech Republic
DCF	Discounted Cash Flow
DPB	Discounted Payback
DPBI	Discounted Payback Index
EU	Expected Utility
FAP	Financial Appraisal Profile
FRS	Financial Reporting Standard
GAPV	Generalised Adjusted Present Value
ICT	Information Communication Technology
IRR	Internal Rate of Return
MADM	Multiple Attribute Decision Model
MGR	Marginal Growth Rate
MIRR	Modified Internal Rate of Return
MPT	Modern Portfolio Theory
Non-ICT	Non-Information Communication Technology
NPV	Net Present Value
NPVP	Net Present Value Profile
PB	Payback
PEU	Perceived Environmental Uncertainty
PRP	Project Risk Profile
PSSV	Project Strategic Score Value
PVI	Present Value Index
RAI	Risk Area Index
ROCE	Return on Capital Employed
ROI	Return on Investment

RV	Risk Value
SI	Strategic Index
TMT	Top Management Team
UK	United Kingdom of Great Britain
US/USA	United States of America
WACC	Weighted Average Cost of Capital

1
Introduction

The development of the financial appraisal profile (FAP) model,[1] described in this book, provides a practical solution to many of the problems faced by organisations considering investment, not only in information communication technology (ICT) but in all medium to large-scale capital projects. The model is versatile in its approach being broadly applicable to a wide variety of investment situations whether they are investments in buildings, plant and machinery or investments that are routine replacements or part of an expansion or rationalisation programme. The FAP model extends the literature and practice of corporate finance by utilising a profiling approach, taking into account the financial, risk, and strategic elements of an investment decision.

Academics are unequivocal in the advice they give to practitioners about how to appraise large-scale capital investments, including ICT projects. The net present value (NPV) rule, based upon the discounting of decision contingent cashflows at the firm's opportunity cost of capital, is regarded as the definitive investment appraisal technique. On this, the academic literature is clear. However, although managers are faced with a variety of financial models when appraising capital projects, not all managers accept the theoretical consensus about which ones to use. While there are strong theoretical justifications for the use of discounted cashflow (DCF) based models, managers continue to use non-DCF appraisal techniques (such as payback and, to a lesser extent, the accounting rate of return), irrespective of their theoretical shortcomings. While academics continue to argue that the NPV method has the greater theoretical validity, managers prefer the internal rate of return (IRR) criterion. The use of sophisticated risk assessment models is also disappointing, with many organisations ignoring risk altogether or simply adopting a naive approach.[2]

In addition, organisations that have used DCF techniques are now placing greater reliance on the qualitative dimensions of their investment decision-making, such as judgement and intuition.[3]

There is a growing recognition by management that the strategic implications of many of today's capital investment decisions are not adequately addressed by traditional approaches to capital investment appraisal. Although attempts are being made to quantify, in financial terms, the strategic benefits from a given investment, it appears that many perceived benefits are left out of the appraisal process because they lack precise financial quantification. It is this under-specification of the strategic benefits associated with given capital investment decisions that we seek to address in this book.

We argue that managers are not forced to choose either an economic/normative approach or a strategic/managerial approach to capital investment decision-making. This we believe is a false choice and that a hybrid approach, including both the economic and strategic dimensions of choice, is required.[4] Indeed, empirical evidence strongly suggests that superior corporate performance is strongly linked with the use of a rational approach to strategic investment decision-making coupled with broader management participation in the decision-making process.

In this chapter, we justify the need for a new, more pragmatic, approach to capital investment appraisal. We briefly review the strengths and weaknesses of existing approaches to financial appraisal and risk assessment as well as the strategic models that have been developed to evaluate capital investment projects and look at the interface between finance and risk. The subject of a judgmental approach to decision-making is also explored. In Chapter 2, we investigate the perception that ICT capital projects are different from 'other' capital projects, while in Chapter 3, we present the results of research from a study of the current practices of UK organisations with respect to the appraisal of ICT and non-ICT capital projects. Chapter 4 presents valuable insights into the treatment of risk with regard to ICT and non-ICT capital project.

In Chapter 5, we outline the elements of the FAP model, which we describe as both pragmatic and multi-dimensional. The development, conceptual reasoning, and research path of the FAP model are discussed, and we position the model within a project evaluation matrix. At the managerial level, we emphasise the importance of a team approach to capital investment appraisal. In Chapter 6, we explore the basics of conventional investment appraisal, and in chapters 7–9, we deal with the three sub-models of the FAP model. In Chapter 10, we look at the advantages of the FAP model as an aid to management decision-making, and in Chapter 11, we present the results of empirical research, based on a detailed case study, into the application of the FAP model to the appraisal of an ICT capital project.

The need for a new approach

We argue that there is a need for a new approach to capital investment appraisal, an approach which should be pragmatic in its concept and based on an integration of the three main aspects of investment decision-making: financial, risk, and strategic. The model should provide a detailed profile of a proposed capital investment, rather than produce a single financial figure on which an investment decision has to be made. Such a model should be based on a management team approach with the involvement of key functional managers. It is also important that any new model should be versatile, so that it can be applied to all types and sizes of projects, and by small, medium, and large organisations.

Considerable theoretical and empirical work has been undertaken, through questionnaire surveys, case studies, and other research methods, to try to understand why managers do not fully accept the advice of academics on the subject of capital investment appraisal (or capital budgeting as some accountants prefer to call it). However, no conclusive answer has been reached. We postulate that the answer may be that although the NPV model under very limited conditions provides a measure of the value added to the firm by a given investment decision, other techniques such as accounting rate of return and payback have something to offer the corporate analyst.

Although attempts have been made to link the use of sophisticated[5] financial appraisal models with improved firm performance, this has, in the main, proved inconclusive, with managers continuing to support basic financial models with intuitive judgement.[6] There is, however, some evidence to suggest that adopting both a strategic and an economic approach, rather than relying solely on either a strategic or an economic approach, does result in higher project success rates and hence greater efficiency in project selection.[7] On this basis, it can be argued that improved efficiency in project selection should lead to improved firm performance. While economic and strategic considerations are important elements of any investment decision, it is also important to consider a third element, namely that of project-specific risk. By linking together, into one appraisal model, the financial, risk, and strategic elements of an investment decision, it should be possible to improve the quality of that decision-making and, as a result, lead to improved firm performance. Greater management commitment to a project should also follow from a team approach to the investment appraisal process and by basing decisions on a consensus of opinion rather than adopting a dictatorial approach.

Arguments have been raised that managers favour those financial appraisal models that are, to some extent, perceived to be biased towards short-term results. This, it is argued, is an example of the agency loss that arises through adverse selection as managers seek to increase their own financial rewards and to improve their career development through assessment and reward systems that weigh heavily on immediate financial returns.[8] The volatility in economic life, with its continuing demand for change, is also seen by some to discourage a long-term business approach. Others argue that financial appraisal models have, in some way, failed and that managers may abandon them altogether and rely only on intuition and subjective judgement.[9] All of these arguments identify and support what can only be described as a cry for help from practising managers. Managers want to do, and be seen to be doing, the 'right' thing, but if, for whatever reason, they are not using the models or approaches recommended, then there is clearly a need to identify the problem as to why this is the case and seek to find a solution.

The existing financial appraisal models

A number of financial appraisal models have been developed over the years with a steady progression to increased sophistication. On the one hand, we have the so-called accounting models, such as Payback (PB) and the Accounting Rate of Return (ARR), while on the other, we have those models derived from economic theory, collectively referred to as the DCF models, such as NPV and IRR. Arguments have been raised that we should ignore the accounting models and only use the DCF models, with preference being given to the use of NPV. Financial appraisal models have also been adapted to take into account project risk and in some way try to capture the strategic implications of an investment decision. Attempts have been made to quantify, in financial terms, the strategic benefits of a project. Within all of the financial appraisal models, there is an element of subjectivity, and while we live in an uncertain economic environment, this subjectivity will remain.

Considerable evidence is available to support the claim that financial appraisal models on their own are perceived to be inadequate for today's high-technology business environment, since they fail to capture many of the strategic benefits from important projects, such as investments in new technology.[10] Such projects are often complex[11] and offer benefits that are more of a strategic nature and are difficult, if not impossible, to quantify in financial terms. Although strategic 'score' models have been developed in recent years, they tend to be based on a progressive multi-staged approach, with managers, in some cases, still having to quantify in financial terms the value of these strategic benefits in order to justify project acceptance. It must be accepted that strategic benefits are an integral part of an investment's profile and that some of these benefits are not susceptible to financial quantification. It is therefore important to determine the strategic profile for each capital investment opportunity, as all major capital investments have, in varying degrees, strategic implications.

Despite all the arguments against the use of the PB and ARR (the so-called unsophisticated, naive, or inferior models), they still continue to be widely used in industry. In fact, the PB has been shown to be the most popular and important of all the models.[12] The IRR (which together with the NPV are referred to as the sophisticated models) has been shown to be more popular than the NPV, despite the fact that the NPV has greater academic support.[13]

The PB is said to have a number of failings including the assertions that it does not measure the profitability of a project, it ignores the returns after the PB period, it ignores the residual value of an asset, and it does not take into account the timing of the returns from a project.

The ARR appears to go under many guises, with many definitions as to its calculation (the reader is referred to Appendix 1 for a fuller discussion on this topic). Comparisons are made on the basic assumption that one is comparing like with like. This is commonly a false assumption. Although a distinction is sometimes 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 the investment in, or the returns arising from, a project. As a result, management may select whichever formula suits them. The ARR is said to arrive at a 'crude' accounting return of profit, but again it does not take into account the timing of the returns and, as a result, it is possible to arrive at the same accounting rate of return for two projects which have vastly differing patterns of profits.

The IRR is said to be defective in that it assumes that the cashflows from an investment can be reinvested at the same rate as the IRR of a project. It does not allow for variations in the cost of capital over the life of a project, and, due to high discounting towards the end of a project's life, it is biased towards projects with a short PB period or those with large initial cash inflows. Another failing of the IRR is that it may not rank some projects in the same order as the NPV, which is said to be more theoretically correct. The NPV also has its faults, in that it does not distinguish between projects of high- and low-value capital cost, and is also biased, but not to the same extent as the IRR, towards projects with short PB periods, or those with relatively higher initial cash inflows.

In order to overcome some of the deficiencies in the various financial models, a discounted PB (DPB) has been introduced which takes into account the time value of money; a modified internal rate of return (MIRR) overcomes, to some extent, the reinvestment and multiple rates issues of the IRR, and a present value index (PVI) has been applied to the NPV which takes into account the level of the discounted cash outflows from each project. Other modifications to the NPV have been made, for example: the adjusted present value (APV) and generalised adjusted present value (GAPV) models.

Yet still, despite all these modifications, there is no single model that, in practice, is universally accepted to the exclusion of all others, although, in theory, the NPV is argued to be the more superior model.

The financial appraisal models are all mathematical models and therefore produce a 'figure', whether it is an absolute figure or a percentage figure, which is used in the appraisal process. But what do the various figures represent? In basic terms, the PB identifies the length of time that it takes to recover the capital cost of a project. The ARR shows the average percentage return from an investment based on historical accounting concepts. This return may be calculated on the initial cost of the investment (ARRi), or the average cost (ARRa) over the life of a project. The IRR calculates the discount rate at which the sum of the cash inflows and outflows from a project is zero and shows this discount rate as the rate of return on a project as a percentage, while the NPV, using the same cashflows as the IRR, but adopting a predetermined discount rate, is expressed as an absolute figure. Both the IRR and NPV are said to identify those projects that, if accepted, will maximise shareholders' value.

All of the financial appraisal models give some information that is of value when making capital investment decisions. It is useful to know what the payback period is, as this will tell us something about the liquidity of a project – how long it will take to recover the initial cost of a project and place the company back in its original position from an historical accounting point of view. It will also tell us something about the time-risk[14] of a project, in that the longer the PB period the greater the time-risk involved. It is also useful to know the average return from a project because it is expressed in accounting terms and is simple to calculate and understand by non-financial managers. The PB will answer the liquidity and time-risk questions, while the ARR will give information on the average accounting return from a capital investment. In commercial and industrial organisations, where the primary economic goal is profit maximisation, it is also important to know how the owners' or shareholders' wealth will be affected by an investment decision as represented by the NPV or IRR.

When considering the NPV, it is usually assumed that the discount rate used in its calculation is the same as the company's cost of capital. If this is the case, then the figure arrived at will be the economic return on a project expressed as an absolute figure, one that is based on cashflows rather than accounting profit and that takes into account the time value of money. In practice, however, an adjustment to the discount rate may be made to include, for example, an allowance for risk and infrastructure costs, and so on. Under such circumstances, the end figure does not reflect the economic return but changes its whole meaning. It then becomes a benchmark against which mutually exclusive projects can be compared or it can be measured against a predetermined acceptable benchmark. This benchmark figure is the negative/positive value after discounting the cashflows at the appropriate rate for each project. If the NPV is positive, the value shown is the excess above that which is required to cover the cost of capital and an allowance for project risk, and so on.

There are therefore two elements to the NPV. On the one hand (assuming a positive NPV), you have the percentage return (which is equivalent to the discount rate used in the calculations), and on the other hand, you have the 'excess', expressed as an absolute figure. It is this two-part 'answer' which may be confusing and may also be one of the reasons why managers prefer the IRR.

The actual calculation of the IRR does not require a predetermined discount rate and expresses the result as a single percentage rate of return. In general, the higher the rate of return, the more favourable the project. The IRR will, in most cases, have to pass a so-called threshold rate of return, which is usually based on an organisation's cost of capital. The MIRR will, however, show a more, some would argue, realistic rate of return from a project than the IRR, which the reinvestment rate problem may distort.

What must be remembered is that all the models of financial appraisal depend upon management estimates for the forecasts of the income from a project as well as its capital cost. So, whichever model is used, and however its refinement, these estimates are open to error. It is therefore important that the cashflow forecasts are as accurate as possible and that as many of the benefits as possible are identified and quantified in financial terms. Even so, it must be accepted that there will inevitably be those benefits, which may be of a strategic nature, that defy financial quantification.

It is important that cashflows from a project should take into account taxation, as it is the net after-tax funds that will recover the initial capital expenditure of an investment. Such calculations should be based on current tax rates and capital allowances, adjusted for any known or anticipated future changes. It is also important to realise that different projects may attract different capital allowances and that the impact of these differences may materially influence the investment decision.

What we have described in this section may appear as a confusing picture, and in many respects, it is, but we hope, with the aid of the FAP model, to enlighten the reader and clear the way forward to a better understanding of the various aspects of capital investment decision-making.

The existing risk appraisal models

Risk models used in the appraisal of capital projects may be conveniently divided into those that aim at identifying the level of risk and those that, in some way, take risk into account. Identification of project risk is, in the main, achieved by analysing the financial data through the measurement of its 'sensitivity' to variations and by determining a project's payback period. Sensitivity analysis, PB, probability analysis, and computer simulation are all models that show the identification of risk as an influence on the financial data of a project. Risk is then taken into account by many organisations through an adjustment within the financial appraisal models used, either by reducing the required PB period in line with the perceived increase in risk or with respect to the DCF models, arbitrarily increasing the hurdle rate of the IRR or the discount rate used to calculate the NPV. This subjective approach to risk is contrary to financial theory, which argues that systematic and possibly unsystematic risk should be taken into account through the cost of capital (from which the discount rate is determined).

Until recently, the most popular risk-assessment model in both the United Kingdom and the United States was sensitivity analysis – which is a pragmatic approach to risk assessment. What is surprising, however, is that it is the PB (which only identifies time-risk) that is seen to be its replacement.[15]

A sensitivity analysis approach identifies how sensitive individual aspects of a capital project are to a project's profitability. Isolating individual aspects of an investment, and calculating how their cash-flows will be affected by moderate variations, will allow managers to identify their level of sensitivity and what influence they will have on a project's overall profitability. Calculating project cashflows more accurately and identifying the nature and characteristics of project-specific risk, rather than estimating risk as a subjective influence of the sensitivity of cashflow errors, may be more important.

The subject of risk is, without doubt, one of the most controversial issues in the appraisal of capital projects. Often risk-adjusted discount rates are used in the financial appraisal of capital projects, without knowing the true nature of the risks involved. This, however, only places a more demanding requirement on the customary financial criteria for investment appraisal.

Another approach that is used to allow for project risk is to apply a risk factor to the forecasted cashflows and arrive at a so-called certainty equivalent value (CE-v). The CE-v is arrived at in many cases by reducing the risky cashflows by a CE factor to arrive at a risk-free cashflow. The CE factor is achieved by comparing the risk-free discount rate with the risk-adjusted discount rate. It is accepted that there are also other approaches to the calculation of the CE-v, but all of them aim at arriving at 'more certain cashflows'. CE-vs are the uncertain values, reduced in the case of revenue and increased in the case of costs, to arrive at a figure said to be more certain. In other words, a more conservative view is taken of the forecasted cashflows which are deemed to be more certain and therefore less risky. Again, this approach merely influences the financial data used in the appraisal process.

The interface between finance and risk

Financial theory suggests that there is a direct relationship between the level of risk and the level of acceptable returns from an investment. That is, the higher the level of risk, the higher the level of returns that would be expected; the lower the level of expected returns, the lower the level of acceptable risk. This relationship is generally assumed to be linear, in that each incremental increase in risk is associated with a corresponding increase in expected return. It assumes that the decision-maker is prepared to accept a higher level of risk only if there is a possibility of a much higher level of return, and that he or she will only accept a low return (one equal to, or just above, the organisation's cost of finance) if it is associated with a low level of risk.

When valuing a company using the NPV rule, the discount rate to be used is based on the beta value for that company which takes into account 'systematic' risk, as it is assumed that an investor can avoid other forms of risk (specific risk or unsystematic risk) by holding a diversified portfolio of investments. This may be appropriate when seeking to value a company; the problem arises when valuing individual projects within a company.

The discount rate used in the valuation of a company is based on a beta factor which is applied to the market return less a risk-free interest rate (the aim is to calculate a future beta, so past values may not reflect what we expect to happen in the future and some form of adjustment may be necessary). The level of systematic risk is deemed to be reflected in the volatility of the company's share price (after taking into account cash dividends paid) when compared to the volatility of the share market as measured by, for example, the FTSE All Share Index. This is an approach that measures risk by the mean-variance rule. Greater volatility of a company's share price, as against the benchmark, will indicate a higher risk and result in a higher beta factor. If the beta for the company is used as a proxy for the beta of a project, then it is assumed that the same level of risk will apply to the project as it does to the company as a whole. From an investor perspective, they can ignore unsystematic risk, but from a company point of view, when evaluating individual projects, it should not. Accepting a discount rate that includes systematic risk still leaves the need to know the 'specific' (unsystematic) risks of each project.

The capital asset pricing model (CAPM) has been adopted by the investment appraisal literature to give a more theoretically structured approach to the valuing of risky investments by determining the degree of exposure to market risk. There appears to be two schools of thought regarding the CAPM. On the one hand, it is argued that we should adopt a portfolio approach to risk, and as a result, systematic risk is what is important and individual project-specific risk should be ignored. On the other hand, it is argued that the CAPM will allow for systematic risk but in addition an allowance for project-specific risk should also be accounted for. It appears, however, that industry is making very little use of the CAPM approach.[16]

The existing strategic models of investment appraisal

Although some 'strategic' models have been developed with new technology projects specifically in mind, strategic aspects are equally applicable to all major projects. All projects have some degree of strategic implication. Some would argue that the decision-making process has become more strategic as a result of the accelerating change in the environment of contemporary organisations.[17]

Although strategic models have been developed with varying degrees of sophistication, no single model has, however, been universally accepted, and it is left to the decision-maker to adopt whichever approach they prefer. It is therefore essential that a 'standard' approach be developed, one that can be universally applied to all major projects.

Strategic factors of an investment decision are invariably those factors that cannot easily be valued in financial terms and are, in some cases, left out of the financial appraisal calculations. Such strategic factors, however, influence the long-term performance of a company, and include, for example, manufacturing flexibility, creating a competitive advantage (e.g. market leadership – being first in the market with a particular product), the ability to respond more positively to customers' needs, environmental issues, and so on. A project becomes strategic because it offers the potential to extend the corporate life of an organisation by replacing the dead cells: a process of continuing change.[18] It is from the strategic factors that invariably the so-called competitive advantages are derived.

Using some kind of 'point system' as a means to overcome problems with the financial valuation of key strategic benefits is a potentially rewarding means of tackling these problems. Some scoring models are vital for strategic-level decisions and should therefore be an integral part of the investment appraisal process. The 'points' or 'score' approach to the valuation of strategic benefits is a possible way forward, provided it is part of a multi-disciplinary approach (i.e. that key managers are involved in the scoring process).

Some strategic models may be classified as 'secondary-supportive models', where they give consideration to the financial issues first, and accept a project on this basis, or, if a project does not meet the financial acceptance criterion first time around, then a value/score is placed on the strategic factors, which is then used to support the financial justification. Such models see the strategic issues as being of a secondary-supportive nature, because they are used to 'top-up' the financial appraisal. Other models, however, seem to infer that strategic factors are more important than financial factors, and that, possibly, a project should be accepted on strategic grounds even though it may not satisfy the financial criteria through a conventional financial appraisal of the project. These models can be classified as 'primary-supportive models', where considerations are given to the strategic issues first, and a project is accepted on this basis, overriding the financial appraisal. The strategic issues are of primary importance, while the financial data acts in a supportive role. However, a number of writers[19] have pointed out the dangers of this kind of approach, in that consistent investment in projects on strategic only grounds, which give financial returns below the cost of capital, will result in organisations going down the road to insolvency.

Strategic benefits are one aspect of a three-dimensional investment profile and deserve equal consideration to the financial and risk aspects. What is required is a 'primary-profile model' – one that treats strategic benefits as a separate issue to financial appraisal and makes a serious attempt to evaluate them in some other way; a model that is systematic, analytical, dynamic, and, above all, produces a meaningful strategic profile of an investment opportunity. The model should incorporate a systematic process to the determination of key strategic benefits looked for in each capital investment (a function of corporate management). It should then identify the levels of these benefits arising from such an investment (a function of the appraisal team). Such benefits should be analysed and a 'value' placed on them so that their respective importance is emphasised. The model should be adaptable, giving it a dynamic perspective, and it should also be pragmatic.

The essential features of any new investment appraisal model

One function of investment appraisal models is to act as a communication vehicle, where information is disseminated to those concerned with capital budgeting proposals and investment decisions. For such models to act effectively in this role, they must not be restricted to financial matters alone, but should give a fuller profile of the investment opportunity. They should take into account a wider spectrum of criteria by adopting a true multi-criterion approach. They should also incorporate the various opinions (by way of judgmental 'score' values, if necessary) of the investment appraisal team, so that the salient details of the background to the data used in the model are known.

Previous research work on the subject of capital investment appraisal has, to some extent, concentrated on theoretical issues. What is now required is a more pragmatic approach, an approach that aims at producing a practical solution to some of the perceived problems associated with the appraisal of capital projects.

A new approach is therefore needed, one which is pragmatic in its concept and based on an integration into a single model of the three main aspects of an investment decision: financial, risk, and strategic. The model should provide a detailed profile of a proposed capital investment rather than produce a single, sometimes arbitrary, figure on which an investment decision is made. Improved performance is achieved when executives combine rational analysis with intuitive synthesis[20]; in other words, the 'decision process' of any new model is important. It is also important that any new project justification model should include how the risk issue should be treated, and how the intangible benefits for the investment are to be measured.

It is also essential that any new model involves a management team approach with the participation of key functional managers. Such an approach is well recognised for stimulating commitment and achieving more optimal decisions than an individualistic managerial approach. It has been argued that small groups are natural structures and superb agencies for solving problems.[21] It is interesting to note the differences between MBA students (with relatively little experience) and senior managers (with a significant amount of experience) as discovered by Fredrickson[22] in relation to strategic decision-making. Fredrickson's research indicated that the executives preferred to involve people who as a group provided significant expertise in many areas. The students wanted to restrict participation in the strategic decision to only production personnel, but the executives saw the decision as requiring input from individuals with knowledge of a variety of functional and speciality areas.

This therefore suggests that experience favours a multi-disciplinary approach to strategic decision-making. An organisation must be 'agile' enough to function across organisational boundaries.[23] Using a multi-discipline approach creates a much wider knowledge base regarding each investment proposal.

Drawing on the performance management literature, two areas are particularly interesting in the context of this book – economic value added and the balanced scorecard.

Economic Value Added (EVA®)[24] is a financial performance measure. The aim of EVA® is to measure the increase in shareholder wealth and is achieved through the economic value added, which is defined as accounting profit less a charge for capital employed. Accounting profit is not defined in the conventional way. The EVA® model requires some accounting adjustments (164 performance measurement issues have been identified but addressing some 20–25 key issues in detail may only be necessary, with as few as 5–10 key adjustments being made in some cases) to be made to the conventional profit figure. The charge for capital is based on a blend of the after-tax cost of debt and equity. In the target proportions, each would plan to employ rather than the actual mix each actually uses year-by-year. It is argued by Stewart[25] that, by subtracting the cost of capital, EVA® automatically sets aside a return sufficient to recover the value of the capital that has been or will be invested. The cost of equity takes into account market-based risk for the company through the use of the CAPM. EVA® comes somewhere between conventional historical accounting and the NPV (future cashflow) approach. EVA® is, in some respects, similar to the idea of 'residual income'. It, however, possibly differs in that it takes on a more motivational aspect and attempts to reduce the ease of managerial manipulation. As a measure of performance, it aims to motivate managers to create shareholder value. Through the 'accounting adjustments' required to arrive at a 'clean surplus' view of accounting profit, it reduces the opportunity for managers to manipulate the figures.

The notion of economic value is at the heart of maximising shareholder wealth. Any investment appraisal model therefore needs to measure the increase in future economic value that a project has to offer. That value can be measured, in some respects, by the increase in earnings above the true cost of capital that a project is expected to achieve during its economic life. It is the net DCF from a project and represents the increase in wealth available to the shareholders that will be reflected in the growth in dividends and share values.

The Balanced Scorecard developed by Kaplan and Norton[26] takes on a wider perspective to performance measurement than just financial measurement. It is a multi-dimensional performance measure, taking into account the finance, customer, internal business process, and learning and growth perspectives, and linking them to business strategy. In fact, one of its greatest strengths is its emphasis on providing a link between performance measurement and business strategy. The fact that it highlights the importance of other, non-financial measures and provides a 'judgmental/subjective' framework for linking them to business strategy is of particular relevance to establishing support for a new investment appraisal model that takes on both a multi-dimensional and multi-attribute approach.

Both EVA® and the Balanced Scorecard are 'interesting' from the perspective of this book in that they emphasise the importance of the 'process' aspect of any model and take a much wider 'view' than conventional models.

A judgmental approach

Of necessity, any new investment appraisal model will incorporate aspects that will be subjective and judgmental, but it is only by taking this wider approach that we can obtain a broader profile of an investment opportunity. Although conventional economic models, used to appraise capital projects, have been refined over the years, they are still based on data that, in some cases, is subjectively arrived at and are therefore no more accurate than taking a judgmental approach. Decision-making is, in itself, subjective, relying on a manager's life experiences, cognitive feelings, perceptions, and subjective assessments.[27] Intuitive judgement appears to have a significant influence when making strategic investment decisions. If we can express opinions, views, and so on, in actual judgmental values (numbers), we can readily compare one value against another. Although any process in doing this will be more of an art than a science, it does help in bridging the gap between limited objective knowledge and the pressing needs of managers for better information.

Where views and opinions, which naturally require judgmental values, are required from a number of managers, there are three generally accepted models of determining a consensus or near consensus opinion (consensus – general agreement in the opinions held by all or most group members[28]).

(i) *Group discussion model*, where managers meet, exchange their views, and come up with a group judgmental value. The idea is that discussion will take place until all managers are persuaded to accept a single consensus value through argument and persuasion. The danger of this approach is that individual managers may be influenced by over dominant group members, and an individual manager's view will not be recorded. While it is important that a group discussion takes place, where the expertise of individual managers can be tapped and opinions voiced, it is also important that a manager's individual 'opinion' is respected and taken into account.

(ii) *Pooling of individual values model*, where managers are asked individually to supply their judgmental values. These values are then combined in some way to arrive at a single value. This model suffers from the fact that a group member is only given one chance at producing estimated 'values', without the recourse to either the knowledge and expertise of other group members or knowing what other 'values' exist. Under this approach, obtaining wide variances in the judgmental values produced is, in some cases, inevitable, which leads to the problem of devising some form of consensus interpretation.

(iii) *The Delphi model*,[29] where individual managers (experts), who form the Delphi panel, are asked to supply their own judgmental values, opinions, and assumptions on certain issues. The responses obtained from the initial request are then reviewed by a group facilitator, and the feedback is given to managers for their further consideration and appraisal until a near consensus ('a gathering of individual evaluations around a median response, with minimal divergence'[30]) value is reached – usually using some kind of weighted average approach. A group consensus is usually determined using the inter-quartile range (the distance between the first and third quartiles of a distribution – the middle 50%) of values for each individual item being considered. Extreme values – those in the upper and lower quartile ranges – are reviewed again, and each manager, suggesting a value in these outermost limits, is asked to justify their position. These justifications are then sent to all other members of the panel for further consideration of their own position. Sometimes, these extreme values may be excluded from the model. This procedure usually involves three to five Delphi probes (rounds of questionnaires, etc.) before a consensus is achieved.

The whole idea is that, through repeated probes, a convergence of values and opinions will take place around a new median, with very little dispersement. These values are then used to calculate what may be termed a 'correct' or 'true' value. The calculation of this 'correct' or 'true' value may, however, present a problem, as one is faced with taking either an arithmetic average or some kind of weighted average (where individual weights are allocated for each member of the Delphi panel) of the values. These weights could be based on experience or knowledge of how a particular member has reacted to similar situations in the past or based on their known level of expertise, and so on.

It is essential that the group or team facilitator has a good knowledge of group decision-making and is completely impartial, as a danger of this approach is that the person in this position has the opportunity, through controlled feedback, to manipulate future responses by the way in which new questions and reported reactions are phrased, and so on. It has been argued that this person inevitably influences the quality and usefulness of the responses they receive and that rather than viewing this person as a bland figure of enviable sterility, we might better consider their role as a creator, for create they do, rightly or wrongly, poorly or well.[31] Some argue that the danger and possibility of manipulation, intentional or otherwise, is, in the case of a decision Delphi, extreme.[32]

The Delphi model is especially suited to intuitive judgements where reliable objective data is impossible or difficult to obtain. Under this model, managers never meet to discuss their individual views but interact through a group facilitator using the media of telephone, written statements, or questionnaires. Responses from members of the panel are therefore anonymous, thus allowing any manager, who is a member of the panel, to change their position without embarrassment. It has, however, been suggested that in some circumstances the use of 'quasi-anonymity' under which the participants in the panel are named from the very beginning may be appropriate, but their statements, argumentation, and comments, of course, still remain anonymous.

It is assumed that each manager is an 'expert' in their own field of management and can therefore give an informed opinion. This approach is said to reduce the undesirable aspects of group interaction which are identified as disproportionate weighting of views solely due to the force of dominant individuals and the so-called bandwagon effect. The Delphi model is therefore particularly useful where decisions are made in an environment that has strong political or emotional tendencies.

The Delphi approach has been classified into 'classical', 'policy', and 'decision' Delphi. In theory, the basic Delphi approach (called the 'classical' Delphi) aims to achieve a consensus through the unbiased opinion of experts, the 'policy' Delphi aims to define and differentiate views using lobbyists, while the 'decision' Delphi aims to prepare and support decisions. In practice, these strict classifications are very rarely achieved with a combination of each being used. The Delphi approach to decision-making has recently been shown to be useful in many situations, for example in the defining of computer information needs for small businesses, setting priorities for the IT industry, making project funding decisions at

> a national charity, and identifying critical issues and problems in technology education. The use of this approach in the field of capital investment appraisal is an interesting and potentially rewarding proposition.

The use of a judgmental approach to decision-making is endorsed by many academics.[33] Judgement, especially in connection with a project's strategic and risk issues, can be analysed and quantified. Kotler[34] argues that the quantification of judgements yields several important benefits in problem solving. The benefits identified are as follows: (i) managers who express their judgements numerically tend to give more serious thought to the problem, especially if the numbers are a matter of record, (ii) quantification helps pinpoint the extent and importance of managerial differences, (iii) in some cases, due to the lack of 'objective' data, many decision models probably cannot be used if 'judgmental' data was not accepted. Judgmental models also make it easier to quantify subjective appraisal. Quantifying judgmental uncertainty tends to reduce ambiguity.

Judgmental heuristics under uncertainty

There is a general belief that if a person is made aware (possibly through recent familiarity) of a particular kind of risk, this will influence their perception of the risk impact and probability values for any future similar risk. For example, knowing that a train has just crashed killing 100 people will increase, in the mind of the individual, the awareness of train accidents and their possible impact. In such cases, individuals will perceive a higher risk impact and probability value than would statistically be correct. It may be that the statistical probability, based on previous data, shows, for example, that the likelihood of such an event is 1:1,000,000 (train journeys) and that the average number of deaths from such an accident is two, but, asked the question just after such an event has occurred, then the probability of an accident would be seen to be much higher and the impact (as measured by the number of deaths) much greater. In such a case, the perception of risk would be over accentuated. This type of judgmental heuristic is generally known as 'availability', where probability and impact values are influenced by the ease with which the instance or occurrence can be brought to mind. Pre-empting such thought processes by asking managers to look for a particular type of risk, having informed them of what the specific risk is, in a project may also have this kind of influencing effect. It is therefore important that any risk assessment procedure should take into account possible judgmental heuristic biases.

The consensus outcome

Although the consensus-performance literature is inconclusive in its findings, there is some evidence to reinforce the view that interaction and participation of senior functional managers in group decision-making generally lead to greater commitment and, as a result, increased effectiveness. It has also been shown that demographic heterogeneity and homogeneity in the structure of management groups interact differently in the determination of group consensus outcomes. Furthermore, it has been shown that organisational demography is an important, causal variable that affects a number of intervening variables and processes and, through them, a number of organisational outcomes. There is also some evidence to suggest that the demographic characteristics of a group will influence the consensus outcome of that group. So, not only are we concerned with the functional disciplines (e.g. Finance, IT specialists, Production, and Marketing) of group members, but we are also concerned with the 'other' demographic characteristics (basic social attributes) that group members may possess. In many cases, while a company will make a conscious decision as to the functional areas of managerial responsibilities (and the skill levels required to carry out such duties), the broader demographic heterogeneity or homogeneity of the management group/team is often just allowed to evolve. It is therefore important for any judgmental model to be structured in a way that takes into account the demographic diversity of management team structures. While the 'consensus outcome' from a management team will influence the effectiveness of that team, the 'consensus process' (the process by which a consensus is reached) plays an important part in maximising this effectiveness. The process of arriving at a management team consensus is therefore important, as it will influence the quality of the consensus outcome.

In creating any new investment appraisal model, which involves a team approach and therefore makes use of group decisions, it is important that the procedure does not allow the process of 'groupthink'[35] to develop. Groupthink epitomises the situation where individual group members are more concerned with gaining the approval of other group members rather than seeking sound solutions to the problem being investigated. Individual member loyalty to the group is seen as of prime importance, with members avoiding controversial issues and being reluctant to question unsubstantiated arguments. This creates a feeling of group solidarity but prevents members from discussing the real issues involved. Only a superficial examination of the facts is undertaken with a limited exploration of the issues and risks involved. Groupthink has been described as a deterioration of mental efficiency, reality testing, and moral judgement that results from in-group pressures.[36] This in-group pressure is one of conformity, where group members wish to remain amiable with each other, reassuring a sense of solidarity and concurrence on all matters. Any member who may step out of line is soon brought back into the fold. It appears that certain groups, because of their structure, are more prone to groupthink than others. Groupthink may well be a natural phenomenon and could therefore exist from the very creation of a group. The important thing is that groupthink is recognised where it exists and that steps are taken to reduce its influence within the group. Without fully exploring the risks and strategic benefits of an investment proposal, management will be unable to make an informed decision, and allowing groupthink to develop will be one way of restricting the information-seeking exercise.

While conflict between the various managerial functions may exist in many organisations, it is important that it is maintained at a constructive 'level of tension', in order to ensure group effectiveness and efficiency, with managers still strongly expressing their own points of view. Conflict should therefore be maintained at a controllable level. Controlled conflict is one way of avoiding groupthink.

In the next three chapters, we look in depth at the problems managers are facing in the appraisal of ICT projects, identifying the weaknesses of the traditional models, and approaches to investment appraisal. This leads us to the development of the FAP model and its recommendation as a pragmatic solution to the various problems, not only with respect to ICT projects but to all medium to large-scale capital investments.

2
The Perception That ICT Projects Are Different

The importance of investing in ICT cannot be over emphasised.[1] ICT consists of all technical means to handle information and aid communication, including computer and network hardware and software.[2] Recent research emphasises the strategic importance of new technology or infrastructure, for example computer systems projects, with 70% of survey respondents having experience of the appraisal of such projects.[3] Now, more than ever, effective business strategy centres on aggressive, efficient use of information technology.[4] Expenditure on ICT projects has been growing at a rapid pace over the past two decades, while investment in non-ICT projects (other than commercial real estate) has, in comparison, been in decline. Despite the global downturn, ICT is the world's fastest-growing international industry.[5] The appraisal of ICT projects, however, continues to present a problem. ICT projects are multidimensional constructs requiring a multidimensional approach to their appraisal.[6]

This chapter reports on research[7] into current ICT and non-ICT appraisal practices of trading organisations in the Czech Republic, looking specifically at the perception of ICT projects being 'different' and the current financial and risk appraisal models used. If one accepts that ICT projects are no different from non-ICT projects, then it could be argued that the appraisal models used should be the same. On the other hand, if ICT projects were very 'different', then the conventional appraisal models may be inadequate.[8]

Background

As a result of the perceived deficiency in the conventional financial (e.g. NPV, IRR, and PB) and risk appraisal models to incorporate some important factors involved in the justification of new technology capital projects and the increasing complexity of such projects, a number of multi-attribute appraisal methodologies, incorporating weighting and multi-attribute utility theory, have been developed to look at such projects in a more sophisticated way.

Any new multi-criteria ICT investment appraisal model should include not only the financial consequences of the investment but also the non-financial data and risk factors.[9] Such an approach should not only include the financial data but also present the risks according to a number of categories and give a score value to the non-financial criteria, presenting the data in an investment profile,[10] as proposed in the FAP model.[11] In Chapter 11, we introduce an 'IT score' as a fourth dimension to the FAP model as a way of selecting the most appropriate supplier(s) of ICT software and hardware. It is also important that any new approach to the appraisal of ICT capital investments should include a more strategic view of such investments.[12]

Option theory, which emanated from the financial/securities markets, is now seen as applicable not only to financial investments but also to investments in real assets.[13] Three notable examples would be (i) the option to make follow-on investments (a growth option) if the immediate investment project succeeds, (ii) the option to abandon the project (an abandonment option) and sell the project's assets, and (iii) the option to wait and learn (a deferment option) before investing. While option valuation models[14] have been developed for the financial/securities markets, they are not seen by all managers as directly applicable to ICT capital investments. It is also argued that some managers may not be able to use some option valuation models because of their mathematical complexity[15] – even if the financial data required by such models is available. While some, who put forward tools for quantifying some option values, argue that it is a certain philosophy of project management – more so than precise quantification – that comprises the essence of options thinking.[16]

In support of the conventional financial models, it has been shown, through a case study,[17] how previously unquantifiable intangible benefits can be valued and included in the NPV calculations. It is also shown how cashflow uncertainty and risks can be included in the economic model through the use of probability theory and sensitivity analysis.

The literature suggests that ICT investments differ, in many respects, from non-ICT capital investments and that, as a result, possibly their appraisal should be different. It is argued that information technology investment is different, because information technology is different.[18] It has been argued that IT projects (including systems development projects and enterprise resource planning systems) have a number of distinctive characteristics[19] and that conventional economic appraisal models are inappropriate, because information technology projects are different from other, more traditional cost-saving projects.[20] ICT investments are perceived to produce a greater contribution towards increased productivity than non-ICT capital investments.[21] However, there are those who argue that there is a lot of hype about ICT that can cloud the decision-making process.[22]

The appraisal of ICT (as with IS/IT) projects is not without its problems; costs and benefits are difficult to identify and quantify in financial terms, and intangible benefits may be significant.[23] There are those who argue that there are hidden costs with IT projects that are underestimated or left out of the appraisal altogether,[24] which supports the argument that ICT projects have hidden costs and intangible benefits that are not captured by conventional financial appraisal models.[25] Such investments are said to present operational difficulties, which are not present in the more traditional capital projects.[26] Two significant differences of IT investments, which have been put forward, are (i) IT involves a wide range of strategic benefits that are hard to quantify and (ii) circumstances surrounding IT investment criteria are subject to increasingly rapid change.[27]

IT projects are said to present a different risk profile.[28] A case-study research[29] (which we discuss in great detail in Chapter 11) identifies the following risk factors as being important to a professional organisation when appraising an ICT capital project: failure of system to function as planned, losing or corrupting data during conversion, delay of system coming on line, misunderstanding of bespoke programming requirements between the professional body and its suppliers, and possible conflict over user acceptance of new IT skill requirements. A cross-industry survey[30] confirms important ICT risk characteristics as misunderstanding of system specification between technology experts and non-technical users, availability of required skills, planning timescale, demands of customer, information quality, project complexity, and quality of supplier. While some of the risk factors are similar to those that would be incurred with non-ICT projects, there are clearly those that are specific to ICT projects.

There is also the suggestion that the strategic nature of IT projects offers such benefits as improved productivity and performance, competitive advantages, assistance in the development of new businesses, improvement in organising and managing firms, and development of new business.[31] IT projects are perceived to be 'distinctive' in that they are an enabler to the creation of new ventures and support for business change.[32] In fact, it is argued that the benefits from ICT are more to do with business change than the technology itself.[33] ICT projects are said to offer a competitive advantage in a global economy.[34] ICT has more of a global perspective than some non-ICT projects, and even in (if not, as a result of) the current global recession, there is acceleration in the transition to a global digital marketplace.[35]

The literature therefore supports the view that ICT capital projects are different in four main respects: (i) cashflow ascertainment, (ii) project-specific risk, (iii) strategic relevance, and (iv) appraisal difficulties.

In both theory and practice, the term 'ICT evaluation' has a multitude of meanings. In this book, we use the term 'appraisal' to refer to the initial process of project justification (the procedure prior to the investment decision), while the term 'evaluation' relates to an ongoing post-investment exercise, a post-implementation review of achieved benefits.[36] Appraisals are necessary to assist practitioners in determining which projects are appropriate (and should therefore be accepted) and which projects are inappropriate and should be rejected.[37]

In this chapter, we look specifically at whether there are perceived differences between ICT and non-ICT projects as the literature suggests and at the appraisal methods currently used by Czech Republic organisations in project selection with the aim of determining if these differences (if any) have an influence on the models used. We therefore focus on two research questions:

1. 'Is there a perceived difference between ICT and non-ICT projects?' – looking at four of the issues raised in the literature, strategic relevance, appraisal difficulties, project-specific risk, and cashflow ascertainment.
2. 'Are the appraisal models, and their levels of importance, used in both ICT and non-ICT project appraisals the same?' – looking specifically at the financial models and the assessment of project specific risk.

We also look at the reasons for not carrying out a formal appraisal of all ICT and non-ICT projects. This research should help to determine if the current conventional appraisal models are adequate to appraise ICT capital projects.

Research methodology

A factual and attitudinal postal survey was conducted involving 625 organisations based in the Czech Republic. Eighty-one valid responses were received giving a response rate of 13%. This response rate, although low, is in line with earlier surveys of this kind.[38] The respondents comprised of 46 chief financial officers, 12 chief executive officers, 13 IT/administration managers, and 8 other managers from a range of areas of responsibility (2 respondents did not state their area of responsibility). The respondents had worked an average of 12 years with their current employer.

The object of the survey was the identification of current practices in respect of the appraisal of both ICT and non-ICT projects and the opinions of senior executives on a number of important issues regarding such practices. Here we focus on the issues relating to ICT projects being 'different' from non-ICT projects. This is the only survey to simultaneously address the appraisal issues concerning both ICT and non-ICT projects in the Czech Republic. The survey design is based on the UK questionnaire as reported in Chapter 3. The advantages and disadvantages of this type of survey are well known, but it still provides a useful data collection tool.[39]

The questionnaire was divided into four parts together with a brief introduction by the researcher and the prominent display of the participating university's logo. The prominent display of university affiliation was made to highlight the academic importance of the research as distinct from a 'commercial/trade' survey.

Part 1 of the survey consisted of questions aimed at identifying important characteristics of the respondents and their organisations. It was also aimed at identifying the type of ICT investments made in the last ten years and the investment appraisal policies of each organisation with regard to ICT and non-ICT projects.

Part 2 of the questionnaire consisted of questions concerning the most recent ICT project appraised by their organisation. This part of the survey was aimed at identifying the size of project, team involvement, assessment of financial costs and benefits, project-specific risk, and strategic aspects of the project.

Part 3 of the questionnaire consisted of questions concerning the most recent non-ICT project appraised by the organisation of which the respondent was familiar.

Part 4 of the questionnaire consisted of a number of statements on a wide range of topics relating to the appraisal of ICT projects and investment appraisals in general. The respondents were asked to agree or disagree with each statement based on their own experience and in so far as it may reflect their organisation's investment policies. A Likert-type scale of 1 to 4 was used. The possible responses offered were 'strongly agree' and 'agree' for a positive response and 'disagree' and 'strongly disagree' reflecting a negative response. It was decided to use a four-point scale to avoid the possible tendency for some respondents' to take a middle-line approach. Support for an 'even' (without a centre point) scale is given in the literature.[40]

Research results and discussion

We look first at the perceived differences between ICT and non-ICT projects. We then examine the various economic and risk models used in their appraisal, together with strategic assessment, in order to determine if such differences affect the investment appraisal models used or their levels of importance.

The perceived differences between ICT and non-ICT capital projects

We now look at the perceived differences between ICT and non-ICT capital projects as revealed by the respondents' answers to four of the statements posed in the survey document. Respondents completed this part of the questionnaire based 'on their own experience and in so far as it may reflect their organisation's investment policies'.

IT projects are accepted because they are an essential part of corporate strategy.[41] The literature also points to the view that the strategic importance of ICT, for some organisations, is low.[42] From our research, the strategic importance of investing in ICT projects is, however, not in dispute. Eighty-five per cent of those respondents who expressed an opinion stated that their organisation either formally or informally assessed the strategic aspects of such investments. It is whether such projects are deemed more strategically important than some non-ICT projects that may be an issue. As shown in Table 2.1, the respondents' opinions (mean 2.8442) to the statement, 'Investing in ICT projects has more of a strategic bias than some other capital projects', suggest that there is agreement with this statement. Sixty-nine per cent of the respondents agreed with this statement; 16% 'strongly agreed', while no respondent actually 'strongly disagreed'. In addition, from a question on strategic appraisal, we discovered that a larger number of organisations assessed the strategic implications from investing in ICT projects (85% of respondents) than non-ICT projects (76% of respondents). On this basis, it could be argued that ICT projects are seen to be more strategically important than some non-ICT projects, and as a result perceived to be 'different'.

Table 2.1 Opinion statements

Statement	a	b	c	d	mean
Investing in ICT projects has more of a strategic bias than some other capital projects	12	41	24	0	2.8442
Evaluating (appraising) investments in ICT projects poses a number of problems that investing in 'other' assets does not	11	48	16	1	2.9079
Investing in ICT projects presents a higher level of risk than investments in more traditional capital projects	8	31	37	1	2.5974
Projected cashflows from ICT projects are more difficult to determine than those in respect of investments in non-ICT capital projects	14	44	15	4	2.8831

Note: Level of agreement with each statement: a = 'strongly agree'; b = 'agree'; c = 'disagree'; and d = 'strongly disagree'.

The argument that ICT capital investments are perceived to be different and pose unique appraisal problems is supported by the positive agreement (mean 2.9079) to the statement, 'Evaluating (appraising) investments in ICT projects poses a number of problems that investing in "other" assets does not present' (Table 2.1). Seventy-eight per cent of the respondents (who expressed an opinion) agreed with this statement; 14% 'strongly agreed'; while only one respondent 'strongly disagreed'. Although a large number of respondents agree with the assumption that ICT projects pose a number of unique problems, it is not clear how significant these 'problems' are. However, the perception of a 'difference' between ICT and non-ICT projects is clearly indicated. These 'problems' stem from the fact that ICT investments have outcomes that are usually difficult to foresee, difficult to estimate, and even harder to express in quantifiable terms.[43]

Support (although at a low level) is also shown with regard to the perception of project risk in respect of ICT projects, in that a positive response (mean 2.5974) was given to the statement, 'Investing in ICT projects presents a higher level of risk than investments in more traditional capital projects' (Table 2.1). The results show that 51% of respondents gave a positive answer, with 10% strongly agreeing to the statement, while only one respondent 'strongly disagreed'. This supports the view that IT projects incorporate many different types of risk, which are difficult to identify at the appraisal stage,[44] again indicating that ICT projects are perceived to be different.

The belief that the identification of cashflows from ICT projects is difficult to determine is evidenced by the positive (mean 2.8831) reply to the statement, 'Projected cashflows from ICT projects are more difficult to determine than those in respect of investments in non-ICT capital projects' (Table 2.1). Seventy-five per cent of the respondents agreed with this statement of which 18% 'strongly agreed', with only 5% strongly disagreeing. It may not be possible to anticipate all potential IT/IS benefits at the appraisal stage.[45] As technology becomes more sophisticated, we can safely say that we may never have a total understanding of the full range of costs and benefits of information technology.[46] It is also argued that some benefits from investing in IT are more associated with business change than the technology itself.[47]

Whether the perceived difficulty in cashflow identification from ICT projects supports the view that ICT projects are 'different' is debatable, as other non-ICT projects (e.g., investments in advanced manufacturing technology (AMT)) present similar cashflow identification problems.[48] It may be, however, that advanced technology (AT) projects in general are significantly different from non-AT projects. However, the fact that ICT projects are seen as 'change enablers' may suggest that ICT projects are different. AMT projects are usually plant specific, while ICT projects have a much wider organisational (and global) spread. With respect to ICT supply-chain projects, these, in some cases, link a number of organisations together. On this basis, we would argue that ICT projects are perceived to be different.

Financial, risk, and strategic assessment of ICT and non-ICT projects

We now look at the various models and approaches, used by the responding organisations to our research, in the appraisal of both ICT and non-ICT projects, with the aim of identifying any significant variations that would support the view that ICT projects are different.

From a question on formal guidelines, our research shows that a larger number of organisations are shown to have formal guidelines for non-ICT projects ($n = 55$) than ICT projects ($n = 46$). Forty-six organisations (i.e. all those who had formal guidelines for ICT projects) had formal guidelines for both IT and non-ICT projects. Eleven (24%) stated that these guidelines were not the same for both types of projects. This indicates a difference between ICT and non-ICT projects.

Table 2.2 Reasons given for not carrying out a formal appraisal of all ICT and non-ICT projects

Reason	**ICT projects (n = 28)**		**Non-ICT projects (n = 22)**	
	(n)	**%**	**(n)**	**%**
Project value and size	19	67.9	15	68.2
Operational urgency	16	57.1	12	54.5
Insufficient time and choice	9	32.1	5	22.7
Mandatory projects	7	25.0	4	18.2
Replacement projects	2	7.1	4	18.2
Other (no further details given)	2	7.1	0	0

Note: (i) Thirty-one respondents did not carry out a formal appraisal of all ICT projects. Three respondents' did not give any reason why (ii) Twenty-seven respondents did not carry out a formal appraisal of all non-ICT projects. Five respondents' did not give any reason why.

A larger number of organisations conducted a formal appraisal of all non-ICT projects (62%) than all ICT projects (60%). The reasons given for not appraising all projects are shown in Table 2.2. The two main reasons given are (i) Project value and size, 67.9% ICT projects and 68.2% non-ICT projects and (ii) Operational urgency, 57.1% ICT projects and 54.5% non-ICT projects. Insufficient time and choice is seen to be higher with respect to ICT projects at 32.1% compared with 22.7% for non-ICT projects. This difference is not significant (the z-score is 0.7361). The p-value is 0.4593. The result is *not* significant at $p < 0.05$. Mandatory projects and replacement projects are low down on the scale of reasons for not appraising all ICT or non-ICT projects. From Table 2.2, it can be clearly seen that there is no significant difference between the reasons given for either ICT or non-ICT projects.

The importance of the financial appraisal of information technology projects is well stated in the IT, information management, and financial literature.[49] While each financial model aims at assessing the 'acceptability' of a project, each looks at 'acceptability' from a different perspective, and consequently some models are not merely substitutes for others. Acceptability can be viewed from a 'value' perspective, in which case the NPV is the most appropriate model to use. Both the IRR and ARR are more a measure of performance and reward criteria, while the PB aims to measure project liquidity. The perceived weaknesses of some of these models have resulted in the development of 'modified' models, such as the MIRR, the profitability index (PI), and the discounted payback (DPB). While some of the models used (i.e. NPV) are supported

Table 2.3 Financial models used in appraising both ICT and non-ICT projects

ICT projects			Non-ICT projects		
Model	**(n)**	**Ranking**	**Model**	**(n)**	**Ranking**
DPB + PB*	66	3.4921	DPB + PB*	65	3.5968
PB	48	2.5397	PB	46	2.5645
NPV	29	1.4127	NPV	25	1.2097
ROI/ARR	24	1.1587	DPB	19	1.0323
DPB	18	0.9524	IRR + MIRR*	20	0.8710
IRR	14	0.5397	ROI/ARR	18	0.8710
IRR + MIRR*	14	0.5397	IRR	17	0.7419
Other	5	0.2222	Other	5	0.2581
PI	5	0.1746	PI	5	0.1935
MIRR	0	0	MIRR	3	0.1290

Note: *The description refers to a combination of related models. Two respondents did not give a ranking to the models they used. Seven ICT and six non-ICT respondents used both the PB and DPB.

by academics, other more pragmatic models (i.e. PB) are favoured by practitioners.

The PB model of investment appraisal continues to be the one most favoured by organisations (Table 2.3). This supports the earlier findings which reported that the PB was the most frequently used model of investment appraisal in respect of new technology projects in the United Kingdom, the United States, and Czech Republic.[50] DPB plus PB ranked first (3.4921) with respect to ICT projects and first (3.5968) with respect to non-ICT projects. In agreement with many academics, the NPV was ranked above the IRR. The NPV was ranked second with regard to both types of projects (ICT rank value 1.4127, non-ICT rank value 1.2097). There is no significant difference (using non-parametric ranking analysis) between the various financial models used with respect to ICT or non-ICT projects, although the Return on Investment (ROI)/ARR has a slightly higher ranking of fourth (1.1587) with respect to ICT projects than sixth (0.8710) for non-ICT projects. This difference is not significant. (The z-score is 1.0632. The p-value is 0.28914. The result is *not* significant at $p < 0.05$.) This would indicate that, as far as financial appraisal is concerned, there is no significant difference between ICT and non-ICT projects. This is contrary to earlier reports[51] in the literature, which suggests that there is a difference in the financial models used in ICT and non-ICT project appraisals. These earlier findings show that more sophisticated models (such as NPV and IRR) are being used in respect of non-ICT projects and less sophisticated models (such as PB) being used for ICT projects.

The literature points to the fact that risk assessment with respect to ICT projects is possibly more important than the financial justification.[52] Financial theory argues that the most appropriate measure of investment risk is obtained by measuring the variance in earnings. This may be appropriate for measuring equity risk, but in practice, with respect to capital investments, models that are more pragmatic are used such as the PB and sensitivity analysis.

Several models are used in industry to identify and assess the level of perceived project risk. Some aim to *identify* risk (primarily from a financial perspective); others aim to *allow for risk*, while others aim to *achieve both functions*. Among the more well-known are the PB, sensitivity analysis, probability analysis (e.g. decision trees), adjustment of the hurdle rate, discount rate, or required PB period, CE–v, CAPM, and option theory.

Our research shows that the most popular method by far of assessing project risk is shown to be PB, used by 30 (94% of those that assessed risk in respect of ICT projects) organisations with respect to ICT projects and 34 (97% of those that assessed risk in respect of non-ICT projects) for non-ICT projects (Table 2.4). PB, as a pragmatic model for assessing risk, only measures time risk.[53] Other models such as sensitivity analysis, probability analysis, and option theory are shown to have very limited use. The three most popular methods for taking risk into account were, (a) adjusting the discount rate used for the NPV, (b) adjusting the hurdle rate with respect to the IRR, or (c) adjusting the required PB period. No use was made of either the CAPM or the CE approach. Sixteen organisations treated risk as a separate issue with respect to ICT projects, while the figure was 12 for non-ICT projects; this difference is not significant. (The z-score is −0. 4446. The p-value is 0.65994. The result is *not* significant at $p < 0.05$.) Nine organisations did not adjust for risk with respect to ICT projects, while the figure was five for non-ICT projects; this difference is not significant. (The z-score is 0.4446. The p-value is 0.65994. The result is *not* significant at $p < 0.05$.) The figures show that there is no significant difference in the treatment of risk between ICT and non-ICT projects.

The strategic importance of investing in new technology projects cannot be over emphasised.[54] ICT investment offers the potential to gain a competitive advantage.[55] As highlighted earlier in the chapter, a larger number of organisations assessed the strategic implications from investing in ICT projects (85%) than non-ICT projects (76%). This is

Table 2.4 Methods used to assess and/or take account of risk: ICT and non-ICT projects

Method	**ICT (n)**	**Non-ICT (n)**
Risk assessment: (ICT 32 organisations; non-ICT 35 organisations)		
Sensitivity analysis	1	6
Payback	30	34
Probability analysis (i.e. decision trees)	2	1
Option theory	0	0
Taking risk into account: (ICT 16 organisations; non-ICT 20 organisations)		
Adjust hurdle rate (IRR)	8	8
Adjust discount rate used	10	11
Adjust required PB period	3	6
Capital asset pricing model	0	0
CE approach	0	0
Other	4	3
Do not adjust for risk and/or treat risk as a separate issue: (ICT 25 organisations; non-ICT 17 organisations)		
Do not adjust for risk	9	5
Treat risk as a separate issue	16	12

Note: It appears that a greater number of organisations formally assess risk (ICT = 32; non-ICT n = 35) than those that take project risk into account (ICT n = 16; non-ICT n = 20).

an interesting finding in that, as we have seen no significant difference in respect of the financial and risk models used in the appraisal of ICT and non-ICT projects, this strategic 'difference' is important, as it may suggest that strategic aspects override the more conventional appraisal models. There is no doubt that strategic 'value' must be included in the appraisal process of information technology projects.[56] Our research suggests that ICT projects may be more strategically important than some non-ICT projects, indicating a difference between the two types of projects.

Conclusion

The importance of ICT investments cannot be over emphasised. The appraisal and justification of such projects is, however, presenting great difficulties, as a result of cashflow uncertainties, high project-specific risk, and strategic influences. One of the frequent claims postulated in the literature is that ICT projects are 'different' and as such should be appraised differently to non-ICT projects. This research set out to test this claim. ICT investments are seen by some to be different in that ICT per se is different.

This is the only survey to simultaneously address the appraisal issues concerning both ICT and non-ICT projects in the Czech Republic. The research, based on this unique survey, gives support to the view that ICT projects are different, especially in the following areas identified in the literature: (i) the cashflows from ICT projects are more difficult to determine than some non-ICT projects, (ii) ICT projects have a higher level of risk than more traditional capital investments, (iii) the appraisal of ICT projects presents greater uncertainties and difficulties, and (iv) ICT projects are seen to be more strategically important than non-ICT projects.

From the empirical evidence, we conclude that ICT projects are, in many respects, perceived to be different from non-ICT projects, confirming the general view in the literature. But, the evidence indicates that, in practice, there is no significant difference in the financial and risk assessment models used in their appraisal. This indicates that any perceived difficulties, which may infer that the projects are 'different', are overcome, to some extent, when it comes to the formal financial and risk assessment stage of project appraisal. On the other hand, this may suggest that organisations are satisfied with their appraisal methods or that they are unaware of alternatives or lack confidence in them.[57] It may also suggest that organisations are being complacent with regard to ICT appraisals and lack the willingness to adopt a more rigorous or analytical approach, supporting an earlier view in the literature.[58]

The importance of the strategic implications and strategic assessment of ICT projects should not be underestimated. While there is no difference in the financial and risk models used between ICT and non-ICT appraisals, there does appear to be a difference when it comes to strategic issues. This difference may suggest that strategic aspects override the more conventional appraisal models.

3

The Appraisal of ICT and Non-ICT Projects: A Study of Practices of Large UK Organisations

As companies become more and more reliant on ICT systems to aid good decision-making, a regular review of their information technology requirements is inevitable. The appraisal of such investments is not, however, without its problems.[1] Arguments have been raised that the traditional methods of financial appraisal are inadequate because ICT investments differ, in many respects, from non-ICT capital investments.[2] The literature shows that some companies now tend to use a greater number of appraisal techniques than in the past, but there is no consensus on the actual combination.[3] The literature also shows that individual appraisal models on their own are now inappropriate and a more hybrid approach is required, one that includes both economic and strategic dimensions of choice.[4] As a result of the perceived failure of some of the traditional methods of capital investment appraisal, managers sometimes base their decisions on 'acts of faith' or, as some researchers report, use less sophisticated financial models to evaluate what must be regarded as sophisticated IT projects.[5] It is argued that the positivist approach to the evaluation of IT projects that places excessive emphasis on accounting aspects may no longer be relevant and that a more 'interpretive' approach should be adopted.[6] Sophisticated investments, such as investments in ICT, may require a more sophisticated approach in their appraisal, with the use of a larger diversity of financial, risk, and strategic assessment models.

The importance of investing in ICT projects, even in the current economic climate, should not be underestimated. In a recent report by Oxford Economics,[7] concern is expressed that European investment in ICT has declined in recent years compared to the expenditure made by US organisations. Since 1991, Europe's stock of ICT capital as a percentage of GDP 'has fallen to around two-thirds of the level in the US'.

The report also states that, 'ICT investment and productivity growth are closely linked, and European countries are lagging other parts of the world in both'. The report goes on to argue that, 'By raising its ICT investment, Europe could see significant economic growth and an ICT Dividend from accompanying productivity growth. If by 2020 Europe built its ICT capital stock to the same relative level as the US, EU GDP would increase by 5%, equivalent to about €760 billion at today's prices.'

In the last 20 years or so, we have seen a greater move to a global economy with many UK companies having branches or subsidiaries overseas. Some UK companies are controlled by overseas parent companies. This globalisation has resulted in the need for a wider use of ICT to increase competitiveness, gain competitive advantages, and reduce costs. More efficient and effective communication results in better decision-making. It is argued that, advances in IT have enabled new competitors to enter existing markets more readily, which has stimulated and strengthened the paradigm of global competitiveness.[8] Senior executives widely believe that 'the current world recession has accelerated the transition to a digital marketplace where emerging economies will increasingly become the centre of gravity' ... 'creating a new global playing field'.[9]

In both theory and practice, the term 'ICT evaluation' has a multitude of meanings. We use the term 'appraisal' to refer to the initial process of project justification (the procedure prior to the investment decision), while the term 'evaluation' relates to an ongoing post-investment exercise, a post-implementation review of achieved benefits.[10] Much of the academic debate over the past two decades on information systems (IS)/IT or ICT capital investment has been focused on either post-investment evaluation or the development and critical examination of appraisal/evaluation methods.

In this chapter, we report on research[11] into current ICT and non-ICT appraisal practices of major organisations trading in the United Kingdom and aim to address some of the myths regarding such practices. It is only by knowing what is actually taking place in industry, and understanding the perceptions of practitioners, that we can pursue purposeful research leading to better decision-making.

Research design

Several important issues concerning the investment in ICT projects have been raised and it is the aim of this research to address some of those issues. The objective of the current research is the identification of current practice in respect of the appraisal of both ICT and non-ICT capital investments, and to elicit the opinions of senior executives, in particular those directly involved in the appraisal of ICT capital projects, on the various issues concerning such investment practices. The following areas of research investigation were selected because of their special significance:

(1) Types of ICT projects appraised and current investment levels.
(2) Formal appraisal of ICT and non-ICT capital projects with respect to financial, risk, and strategic factors.
(3) Differences, if any, between the appraisal of ICT and non-ICT projects
(4) Post audit (evaluation) of capital projects.
(5) The role of Project Champions and their influence at the project selection stage.
(6) Opinions on various issues relating to the appraisal of ICT and non-ICT projects.

A postal questionnaire, designed around a factual and attitudinal survey, was selected as the appropriate research methodology, in order to obtain a wide range of data from a diversity of organisations.[12] An attitudinal and ranking aspect to the survey was adopted, as strictly factual surveys about the extent to which particular techniques are used in investment appraisal do not necessarily reflect the importance attached by management to the use of the techniques. The questionnaire mainly consisted of closed questions. It is believed that this is possibly the only survey to simultaneously address the appraisal issues concerning both ICT and non-ICT projects in the United Kingdom. Although Ballantine and Stray[13] reported on information systems/technology and other capital investment practices, their research was based on two surveys addressed to different individuals within the same organisation but conducted sequentially. The current survey was addressed to a single named individual within each organisation, soliciting information on both ICT and non-ICT pre-investment appraisals and post-audit evaluations.

The questionnaire was divided into four parts (composed of 37 specific questions and nine statements requiring an expressed opinion) together with a brief introduction by the researcher and the prominent display of the participating university's logo. The prominent display of university affiliation was made to highlight the academic importance of the research as distinct from a 'commercial/trade' survey.

Part 1 of the survey (which consisted of questions 1–17) was aimed at identifying important characteristics of the respondents and their organisations, with respect to the respondent's position within the organisation and length of service, business sector, turnover, overseas connections. It was also aimed at identifying the type of ICT investments made in the last ten years, and the investment appraisal and post-audit policies of each organisation with regard to ICT and non-ICT projects.

Part 2 of the survey (which consisted of questions 18–29) was related to questions concerning the most recent ICT project appraised by the organisation of which the respondent was familiar. This part of the survey was aimed at identifying the size of project, team involvement, departmental and/or project champion influences, formal assessment of financial costs and benefits, project-specific risk, and strategic aspects of the project.

Part 3 of the survey (which consisted of questions 30–37) was related to questions concerning the most recent non-ICT project appraised by the organisation of which the respondent was familiar. This part of the survey was again aimed at identifying the size of project, team involvement, departmental influence, formal assessment of financial costs and benefits, project-specific risk, and strategic aspects of the project.

Part 4 of the survey consisted of a number of statements on a wide range of topics relating to the appraisal of ICT projects and investment appraisals in general. Respondents were asked to agree or disagree with each statement based on their own experience and in so far as, it may reflect their organisation's investment policies. A Likert-type scale of 1–4 was used. The possible responses offered were 'strongly agree' and 'agree' for a positive response and 'disagree' and 'strongly disagree' reflecting a negative response. It was decided to use a four-point scale to avoid the possible tendency for some respondents to take a middle-line approach. In this way, they would be forced to 'come off the fence' and give a positive or negative answer. Support for an 'even' (without a centre point) scale is given in the literature.[14]

Research results

Of the 500 questionnaires sent out, 31 were returned 'gone away/address unknown'. Of these, it was possible to re-send 12 to named Financial Directors (FDs) or Chief Executive Officers (CEOs). One questionnaire was returned uncompleted; four were returned spoilt and unusable; one was returned with the comment, 'unable to participate on this occasion';

a letter was received, 'not policy of company to complete questionnaires'; while, four were returned marked, 'please remove Mr .... from your database'. This gave a net target sample of 470 of which 71 valid responses were received, giving a net response rate of 15.1%. This response rate was deemed acceptable, considering the current economic global recession and the strategic nature of the questionnaire, and is in line with, for example, Cotton and Schinski,[15] who achieved a response rate of 16%. The number of usable responses was greater than that of Ward et al.[16] who achieved a usable response of 60, and Ballantine and Stray[17] who achieved a usable response of 56 in the second stage of their research. Some of the respondents took time to add important comments to their questionnaire replies. Some of these comments are reported later in this chapter.

Details of those 42 respondents who requested a copy of the report from this research, together with the 'stated' senior management level of the respondents, confirms that they were senior executives of their respective organisations and would have the depth of knowledge required to answer the questionnaire. The possibility of *non-informed bias* was therefore minimal.

Non-response bias, however, as with all postal surveys, may present a problem if one is of the opinion, for example, that the non-respondents are those that do not appraise their capital projects in any robust manner and have deliberately chosen not to reveal such matters by not completing the questionnaire. We do not necessarily support this view, especially as the organisations classification of the respondents mirrors the 500 target sample, but we do accept that the research results may have some limitations in terms of drawing general conclusions.

Survey results – Part 1

This part of the survey solicited information on the important characteristics of the respondents and their organisations with respect to the respondent's position within the organisation and their length of service, and the organisation's business sector, turnover, overseas connections, the type of ICT investments made in the last ten years, and the investment appraisal and post-audit policies of each organisation with regard to ICT and non-ICT projects.

Respondents' characteristics

The 71 respondents consisted of FDs/CFOs (n = 45); CEOs/managing directors (n = 7); and IT/Administration senior executives (n = 19). It is

Table 3.1 Length of respondents service with current employer (years) (n = 71)

	n	Average	Median	Maximum	Minimum	σ
All [71]	71	9.423	8	39	2	6.422
FD/CFO	45	9.222	8	35	4	5.009
CEO/MD	7	4.857	5	7	3	1.345
IT/ADMIN	19	11.579	8	39	2	9.24

interesting to note that some of the addressed recipients passed on the questionnaire to senior IT executives for completion. Of the 71 respondents, 70 stated that they held positions at the corporate/senior manager level, with one stating that they were at middle management level.

The analysis of the individual respondent's average length of service with their present employer is shown in Table 3.1. This shows that, on average, CEOs/MDs have the shortest length of service with their current employer at 4.9 years (median five) compared with FDs/CFOs who averaged 9.2 years (median eight), and IT/Admin who averaged 11.6 years (median eight). This, to some extent, confirms the view that CEOs are engaged from outside the company, rather than promoted from within, and stay in the position for a relatively short period of time. The relative short period of service among CEOs/MDs is well documented in the literature. It is argued in the literature that executives who only stay in a particular job for a short period of time tend to favour short-term projects in order to enhance their career prospects.[18] Such short-term projects bring short-term gains and are generally perceived to be less risky. This can only be detrimental to the appraisal of ICT projects, which are generally regarded as long-term investments. The longer service, as shown by this research, of finance, IT, and administrative executives may suggest that there is a tendency to train and promote such executives from within.

Organisational characteristics

A business sector analysis shows a wide range of business activities (Figure 3.1), with the largest sector being 'non-food manufacturing and processing' (n = 15), closely followed by 'financial, banks, insurance, and business services' (n = 12). 'Constructions and materials', 'food manufacturing and processing', and 'telecommunications, technology hardware and software' were in the mid-range at n = 7. The remaining business sectors were at the lower end of the scale. This wide range of

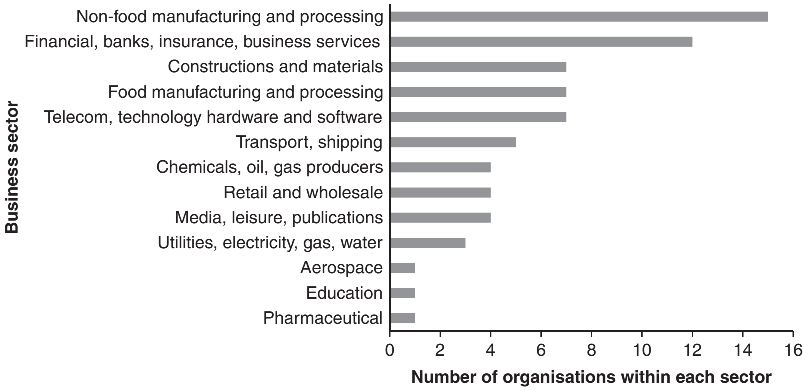

Figure 3.1 Business sector analysis

business activities in the responding firms reflects the diversity of the initially selected target sample of 500 organisations.

Overseas connections

Fifty-seven (80%) organisations have overseas branches or associated companies; 17 of these stated that their investment appraisal policy was influenced by an overseas parent company. This confirms the increasing global nature of many UK trading organisations. This globalisation is said to have resulted in the need for a wider use of ICT to increase competitiveness, gain competitive advantages, and reduce costs. We would argue that in order to survive in this expanding global business environment, organisations not only need to continuingly update their products but they also need to continuingly review their ICT needs in order to combat increased global competition. Globalisation, therefore, emphasises the growing importance of ICT investment.

Turnover

All of the organisations stated that they had an annual turnover in excess of £500 million, which confirms that the survey relates to 'large' UK trading organisations and that the responses, in this respect, are representative of the target sample.

Types of ICT projects appraised in last ten years

Figure 3.2 clearly shows that the organisations that took part in this research were well versed with the appraisal of ICT capital projects. All

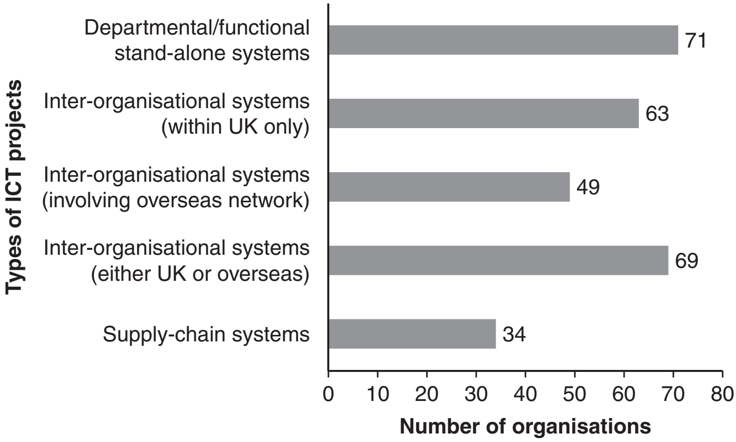

Figure 3.2 Types of ICT projects appraised in last ten years

responding organisations had appraised departmental/functional stand-alone ICT systems in the past ten years, while 63 (88.7%) had appraised UK inter-organisational systems, 49 (69%) inter-organisational systems involving overseas networks. Sixty-nine (97.2%) organisations had appraised either UK or overseas inter-organisational network systems and 34 (47.9%) had appraised supply chain systems. The literature highlights the importance of investing in ICT supply chain systems.[19]

Formal appraisal of ICT and non-ICT capital projects

There is a lack of formal guidelines for appraising ICT projects.[20] Here we must state that in this section and what follows, we adopt the framework of Heemstra and Kosters[21] in distinguishing between formal and informal assessment. The current research shows (Table 3.2) that 66.2% of the responding organisations have clearly defined procedures (e.g. written guidelines produced internally by the organisation) for appraising ICT capital projects, while 70.4% have clearly defined procedures for appraising non-ICT projects. Almost 65% of organisations have clearly defined procedures for both types of projects, of which 43.7% of these organisations stated that the procedures were the same for both types of projects, with 21.1% stating that their procedures differed between the two. This shows that there is no significant difference in the fact that organisations have clearly defined appraisal procedures for both ICT and

Table 3.2 Formal appraisal (n = 71)

Use of formal procedures in respect of:	Number	%
ICT projects	47	66.2
Non-ICT projects	50	70.4
Both ICT and non-ICT projects [split between (i) and (ii) as shown below]	46	64.8
(i) Same procedures for ICT and non-ICT projects	31	43.7
(ii) Different procedures for ICT and non-ICT projects	15	21.1

Note: Formal appraisal refers to clearly defined procedures, for example, written, internally produced, investment appraisal guidelines.

Table 3.3 Reasons given for not carrying out a formal appraisal of all ICT and non-ICT projects

Reason	ICT projects (n = 47)		Non-ICT projects (n = 53)	
	number	%	number	%
Project value and size	43	91.5	49	92.5
Operational urgency*	17	36.2	9	17.0
Insufficient time and choice*	13	27.7	6	11.3
Mandatory projects	12	25.5	13	24.5
Replacement projects**	4	8.5	24	45.3
Other 'not corporate policy to review all projects'	0	0	1	1.9

Note: *Significantly different between ICT and non-ICT at the 5% level; **Significantly different at the 0.1% level.

non-ICT capital projects, but in some cases there is a difference in the detail of the procedures between the two types of projects.

Only 33.8% of the responding organisations conducted a formal investment appraisal of *all* ICT projects. The remaining 66.2% gave one or more of the reasons set out in Table 3.3 for not carrying out a formal appraisal. The figures indicate that project value and size is the most important factor as to whether a formal appraisal is undertaken or not, confirming views expressed in the literature. This also indicates that a formal capital investment appraisal may not be relevant for all ICT investments.[22] Concern, however, must be expressed over the level of some of the other reasons given, especially, 'insufficient time and choice', 'operational urgency', and 'mandatory projects' as a valid reason for not appraising investments.

Only 25.4% of the responding organisations conducted a formal investment appraisal of *all* non-ICT projects. The remaining 74.6% gave one or more of the reasons itemised in Table 3.3 for not carrying out a formal investment appraisal. The figures again indicate that project value and size is the most important factor as to whether a formal appraisal is undertaken or not, with 'replacement projects' coming second followed by 'mandatory projects'. Concern must again be expressed over the level of some of the reasons given as a valid basis for not appraising all capital investments.

Statistically significant differences between some of the reasons given for ICT and non-ICT projects were observed and are noted in Table 3.3. 'Operational urgency' and 'insufficient time' are two of the reasons, which are more prevalent with respect to ICT projects, while 'replacement projects' is more prevalent with respect to non-ICT projects.

Sixty-six per cent of organisations do not conduct a formal appraisal of all ICT projects, and almost 75% do not conduct it for all non-ICT projects. In some respects, the reasons given for non-appraisal between ICT and non-ICT projects differ. Although the main reason given in both the cases is 'project value and size', the reasons of 'insufficient time and choice' and 'operational urgency' are more prevalent with respect to ICT projects, and 'replacement projects' is more common with respect to non-ICT projects. Other researchers have found that a large number of organisations did not have a formal procedure for appraising IT projects but relied on 'act of faith', 'got to do', and 'complying with corporate strategy'.[23] While others report that their findings suggested a fairly widespread lack of formal procedures despite the fact that evaluations of IS/IT investments are still undertaken,[24] it now seems that this situation may, to some extent, have changed.

Having identified that project value and size is the main reason for not formally appraising some ICT capital projects, it is therefore of interest to note that, of those organisations that do not formally appraise all ICT projects, the lowest capital value of the ICT project assessed was £180,000. While no general conclusion can be reached, the cut-off value for this company must be less than £180,000. It is also interesting to note that only 4 out of the 12 'financial, banks, insurance, business service' sector and one out of the seven 'construction and materials' sector give the reason for not formally appraising all ICT projects as value and size of project.

With respect to non-ICT capital projects, it is also of interest to note that, of those organisations that do not formally appraise all non-ICT projects, the lowest capital value of the non-ICT project assessed was

£150,000. While, again, no general conclusion can be reached, the cut-off value for this company must be less than £150,000. It is also interesting to note that 7 out of the 12 ‘financial, banks, insurance, business service’ sector and two out of the seven ‘construction and materials’ sector give the reason for not formally appraising all non-ICT projects as value and size of project.

Post audit

Forty-seven (66.2%) organisations conducted a post audit on *some* capital projects, while only one organisation conducted a post audit on *all* projects, leaving 23 (32.4%) stating that they did not conduct post audits. Although other research[25] concluded that post audits of projects may not be that common in practice, this current research presents a contrary view in that post audits may be more common than originally thought. Farbey et al.[26] also found that few organisations had carried out an *ex post* evaluation of IT projects. However, Ward et al.[27] found that a large number (72%) of their respondents conducted a formal *post-implementation* review with respect to IS/IT projects.

This research, however, highlights the difficulty in conducting post audits on ICT projects, which may account for almost 33% of respondents not conducting post audits. One respondent commented, ‘An issue is the difficulty of applying post investment appraisal to ICT projects. As ever, the major problem with PIA is establishing a meaningful performance baseline that would have pertained had the investment not been made, but this is all the more difficult with ICT projects as they frequently involve major business change.’

Seventeen respondents stated that the post audit revealed ‘significant’ factors, which, in their opinion, should have been known at the pre-investment (appraisal) stage. Factors identified include flawed data in business case, level of risk, constraints on supplier and business capacity, estimated costs/overspend ($n = 8$), not all benefits materialised ($n = 2$), delay, detailed business requirements, supplier specification error, and requirement changes during implementation. An interesting comment made by one of the respondents was, ‘The £120 million non-ICT investment was for new automated plant and machinery – planned benefits from this were only partially realised because the production planning and control processes were not streamlined to take account of the new automated capacity.’ Twenty-two respondents stated that the post audit did not reveal any significant factor that should have been known at the appraisal stage, while nine of the respondents stated that they did not know.

Six of the respondents stated that there were factors revealed in the post audit that, in their opinion, could not have been known at the pre-investment (appraisal) stage. These factors included Lehman's crash, technology interactions, complexity of business change, unforeseen change in market, change in tax legislation, and level of informal business processes that led to underestimating contractor resource requirements. Thirty respondents stated that the post audit did not reveal any significant factor that could not have been known at the appraisal stage, while 12 of the respondents stated that they did not know.

Survey results – Parts 2 and 3

The following responses relate to the most recent ICT and non-ICT projects (of which the respondent was familiar) appraised by the responding organisations.

Project capital cost

The approximate capital cost of the various ICT projects recently appraised showed an average cost of £3,875,450, with the largest project cost being £69.9 million and the lowest cost being £85,000 (the policy of this organisation was to formally appraise all capital projects; it is also of interest to note that the value of this organisation's non-ICT investment was £650,000). With respect to non-ICT projects, four of the respondents (all of whom were IT executives) did not answer this part of the survey.

The approximate capital cost of the various non-ICT projects ($n = 67$) showed an average cost of £4,856,970 with the largest project cost being £120 million and the lowest cost being £130,000 (the policy of this organisation was to formally appraise all capital projects; it is also of interest to note that the value of this organisation's ICT investment was £250,000). Because of the large variation in project size, the results have been presented in three separate groups.

The capital cost of six (8%) ICT projects ranged from £10 million to £70 million (Figure 3.3), with a median of £15.75 million and an average of £25.7 million (it is clear that the 'average' has been distorted by the cost of the largest project). The capital cost of four (6%) non-ICT projects ranged from £12.5 million to £120 million, with a median of £35 million and an average of £50.6 million (again, it is clear that the 'average' has been distorted by the cost of the largest project). The respondent who reported the £120 million project stated that it was for, 'new automated plant and machinery'.

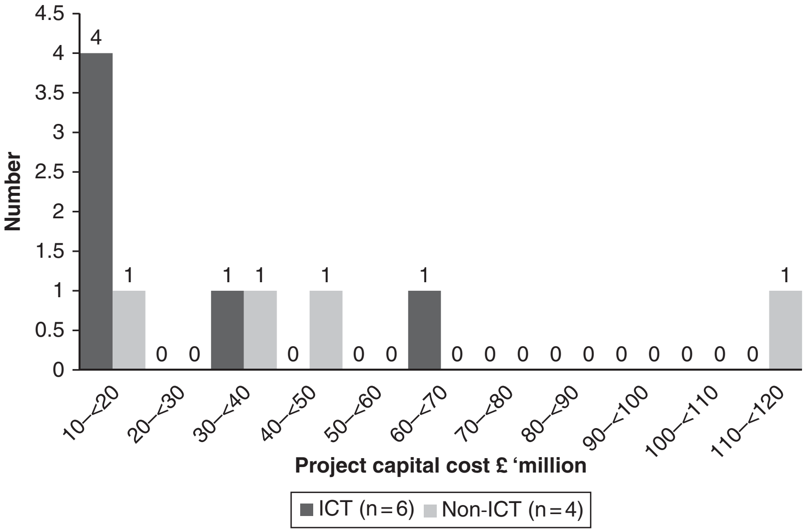

Figure 3.3 Capital cost of all projects above £10 million

Thirty-five (49%) ICT projects ranged from £1.2 million to £8 million (Figure 3.4), with a median of £2.5 million and an average of £3 million. Thirty-nine (58%) non-ICT projects ranged from £1 million to £8 million, with a median of £2 million and an average of £2.9 million.

Thirty (42%) ICT projects had a capital cost of under £1 million, with a median of £510,000 and an average of £513,900 (Figure 3.5). Twenty-four (36%) non-ICT projects had a capital cost of under £1 million, with a median of £313,500 and an average of £433,208.

The median value of all ICT projects was £1.62 million, with an average of £3.875 million. The median value of all non-ICT projects was £1.45 million, with an average of £4.85 million. There was no significant difference between the costs of ICT and non-ICT projects. The wide range in capital values with respect to both ICT and non-ICT projects seems to suggest that the 'most recent' project was selected and not just the most 'significant' project.

Appraisal teams

Sixty-four (90%) of ICT projects were evaluated by an investment appraisal team, with 59 (83.1%) of the respondents being part of those teams. Fifty-eight (86.6%) of non-ICT projects were evaluated by an

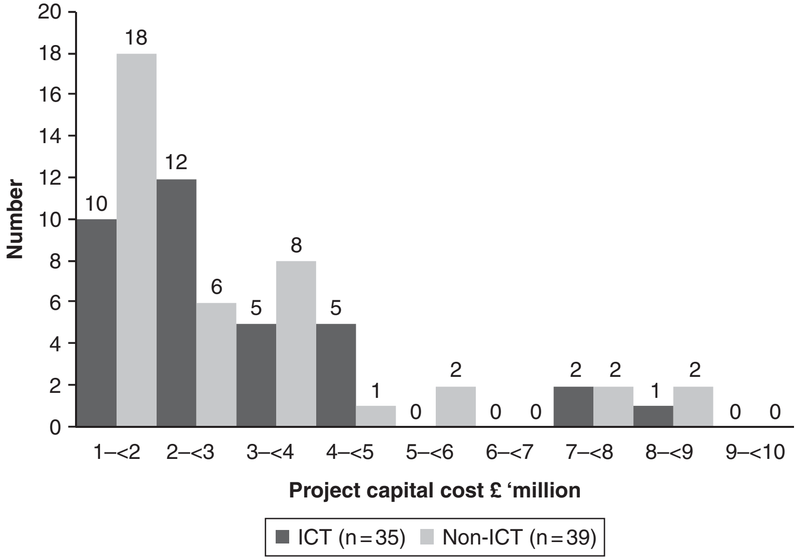

Figure 3.4 Capital cost of all projects between £1 million and £10 million

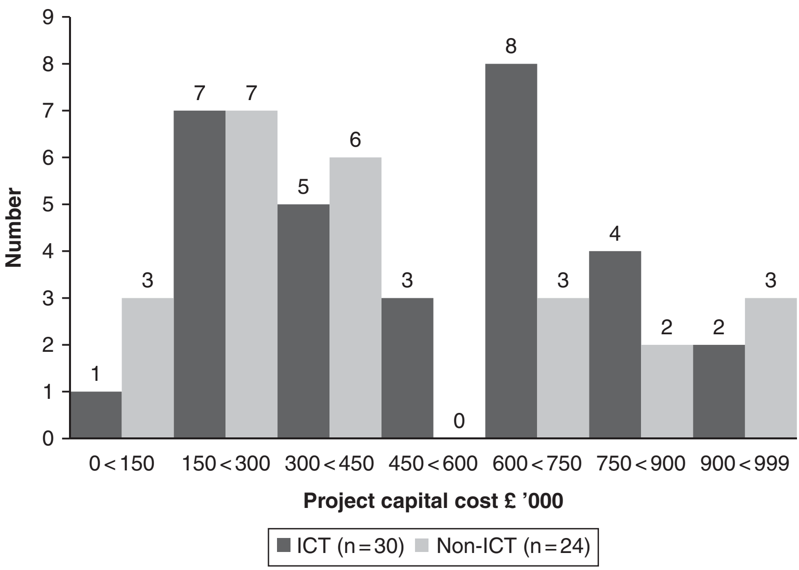

Figure 3.5 Capital cost of all projects under £1 million

investment appraisal team, with 42 (62.7%) of the respondents being part of these teams.

The importance of a team approach to the appraisal of ICT capital projects has been highlighted in the literature.[28] A team approach is well recognised for stimulating commitment and achieving more optimal decisions than an individualistic managerial approach. Small groups are natural structures and superb agencies for solving problems.[29] While the composition of the investment appraisal team is important in respect to the members' varied managerial disciplines, it is also essential to appreciate that their other demographic characteristics (basic social attributes such as age, sex, educational standard, length of service) may be equally important and may well account for the fact that some teams will be more efficient than others.[30] It is therefore encouraging to report that some organisations have adopted what academics prescribe in respect of the use of appraisal teams. This research also shows that these teams are not always made up of the same individuals. At least 11 of the ICT project teams included IT specialists, indicating that demographic characteristics may play an important role in team composition: IT specialists being included in the team because of their expertise and knowledge of ICT.

The research shows that, with respect to non-ICT projects, IT professionals may not always be part of the appraisal team or in fact have detailed knowledge of such investments. A strong team culture with respect to the appraisal of both ICT and non-ICT projects is evidenced by this research.

Departmental influence

With respect to ICT projects ($n = 72$, one respondent stated that two departments – IT and finance – had equal influence), in the respondents' opinion, the following departments had the greatest influence at the project feasibility/appraisal stage: IT department ($n = 43$), finance and accounting ($n = 14$), corporate management ($n = 11$), sales and marketing ($n = 2$), operations, and distribution (Table 3.4). As the various projects relate to ICT investments, then it is reasonable to expect that the IT department would have a significant influence in the early stages of project selection. This is confirmed by the current research; but it is also noticed that finance still has an important influence at this stage of the investment appraisal process. With respect to ICT projects, it may be that the IT department initiates the proposal and/or would have a significant contribution to make to the project's operational effectiveness.

Table 3.4 Departmental influence

Department	**ICT projects (n = 72)**		**Non-ICT projects (n = 68)**	
	number	**%**	**number**	**%**
IT***	43	59.7	0	0
Finance and accounting**	14	19.4	28	41.1
Corporate management*	11	15.3	20	29.4
Sales and marketing	2	2.8	6	8.8
Operations	1	1.4	2	2.9
Distribution	1	1.4	0	0
Supply chain	0	0	2	2.9
Production	0	0	2	2.9
Logistics	0	0	1	1.5
Legal	0	0	1	1.5
Editorial	0	0	1	1.5
Strategy and planning	0	0	1	1.5
Technical	0	0	1	1.5
Merchandise procurement	0	0	1	1.5
Estates	0	0	1	1.5
Product design	0	0	1	1.5

Note: ICT (n = 72), one respondent stated that two departments – IT and finance – had equal influence; while non-ICT (n = 68), one respondent stated that two departments – finance and corporate management – had equal influence. *Significantly different between ICT and non-ICT at the 5% level; **Significantly different at the 1% level; ***Significantly different at the 0.1% level.

With respect to non-ICT projects (n = 68, one respondent stated that two departments – finance and corporate management – had equal influence), in the respondents' opinion, the following departments had the greatest influence at the project feasibility/appraisal stage: finance and accounting (n = 28), corporate management (n = 20), sales and marketing (n= 6), operations (n = 2), supply chain (n = 2), production (n = 2), logistics, legal, editorial, strategy and planning, technical, merchandise procurement, estates, product design (all n=1). It appears that both finance and corporate management have the greatest influence at the project selection stage of non-ICT projects.

Statistically significant differences with respect to some of the 'departments', stated as having a greater influence at the project evaluation stage, between ICT and non-ICT projects were observed and are noted in Table 3.4. 'IT' department is shown to have a greater influence with respect to ICT projects, while 'finance and accounting' and 'corporate management' have a greater influence with respect to non-ICT projects.

The literature shows that both financial and corporate management play a dominant part in project selection, with finance concerned with financial viability and liquidity, and corporate management wishing to select projects that they favour, for whatever reason. The conflict between accountants and other disciplines (e.g., engineers, operational managers, and marketing) is well documented in the literature, yet it is still seen here that accountants have the greatest influence at the project selection stage with respect to non-ICT projects. We would argue that this is to some extent the result of the underlying premise of the economic models used in project appraisals. We would also argue that conventional accounting, with its basic concepts of conservatism and prudence, together with the financial philosophy of adding a risk premium to cover lack of knowledge on the risks in a particular project, results in high hurdle rates, with the inevitable rejection of projects, which may otherwise be viable.

Project champion

A project champion is a person who is dedicated to seeing a project successfully completed, and while it is advantageous to have such a person involved at the implementation stage, he or she can unduly bias project selection,[31] in a way that is epitomised by the optimism bias theory. Optimism bias theory argues that there is a systematic tendency for managers to be over-optimistic about the outcome of planned events. This includes over-estimating the probability of positive events and under-estimating the probability of negative events.[32] Project champions have a major influence in getting the project accepted.[33] This research shows that the respondents are familiar with the term 'project champion'.

With respect to the ICT project recently appraised, 55 (77.5%) of the respondents stated that such a person was involved at the project appraisal stage. Of these respondents, 14 acknowledged that they were the project champion. Seventeen of the respondents believed that the project champion had too much influence on project selection, suggesting that an undue influence may have occurred. Four of the respondents, who accepted that they were the project champion, actually stated that they had too much influence at the project selection stage.

Earlier researchers[34] found that the appraisal of IT projects relied heavily on a project champion to the extent that a large number of projects would not have gone ahead without their support. They also found that, 'it was up to the champion to do whatever he or she thought necessary to gain approval'. We do not advocate that a project champion should be excluded from the appraisal team; we only suggest that any over-enthusiasm on their part for the project should be monitored and taken into account. It is important to include the project champion, who is usually the project's proposer, in the team to elicit factual data and loyal commitment to the implementation of the project.

Formal/informal assessment

With respect to ICT projects, all of the respondents stated that a formal financial review of costs and benefits was undertaken, while 59.2% stated that they formally considered project-specific risk, and 52.1% formally considered the strategic aspects of the project (Table 3.5). Almost 37% informally considered project-specific risk while 42.3% informally considered strategic aspects.

Sixty-seven respondents reported on non-ICT projects. With respect to these projects, 65 (97%) respondents stated that a formal financial review of costs and benefits was undertaken, while 28 (41.8%) stated that they formally considered project-specific risk, and 20 (29.8%) formally considered the strategic aspects of the project. Twenty-five

Table 3.5 Formal/informal assessment of finance, risk, and strategic factors

	ICT projects (n = 71)		**Non-ICT projects (n = 67)**	
	number	**%**	**number**	**%**
Formal assessment				
Finance	71	100.0	65	97.0
Risk*	42	59.2	28	41.8
Strategic factors**	37	52.1	20	29.8
Informal assessment				
Finance	0	0	0	0
Risk	26	36.6	25	37.3
Strategic factors	30	42.3	30	44.8
Formal and informal assessment				
Finance	71	100.0	65	97.0
Risk**	68	95.8	53	79.1
Strategic factors**	67	94.4	50	74.6

Note: *Significantly different between ICT and non- ICT at the 5% level; **Significantly different at the 1% level.

(37.3%) informally considered project-specific risk and 30 (44.8%) informally considered strategic aspects.

Statistically significant differences with respect to the assessment of 'risk' and 'strategic factors', between ICT and non-ICT projects, are noted in Table 3.5. Both 'risk' and 'strategic factors' are seen to be more prevalent with respect to 'formal' assessment of ICT projects than non-ICT projects.

The above figures clearly show that a greater number of organisations *formally* assess both risk and strategic factors for ICT projects than for non-ICT projects.

This confirms that, in many cases, a multi-approach to project appraisal is being adopted.[35] Most, if not all, conventional financial justifications models do not adequately capture the full potential of investing in ICT, a complete appraisal must consider the strategic benefits of the technology and the risk implications of investing in such projects. Evidence from this current research suggests that a large number of organisations appreciate the complexity of ICT investment appraisal and do not just rely on financial models. To this end, it appears that many practitioners have taken on board the views of academics.

Financial appraisal models

With respect to ICT projects (Table 3.6), the PB model of investment appraisal continues to be the one most favoured by organisations, with 62 (87%) companies using one of either of the two versions (discounted or non-discounted). This supports the earlier findings reported in the literature[36] that the PB was the most frequently used model of investment appraisal in respect of new technology projects. The term 'discounted payback' was introduced into the literature in 1965.[37] A full review and synthesis of the PB method of investment appraisal can be found in the earlier literature.[38]

Although the NPV is seen to be preferred to the IRR, when one takes into account the use of the MIRR, the IRR/MIRR is seen to be considered as of greater preference, with 22 ranking it first compared to only 18 with respect to the NPV. The relative 'importance' of these two models is, however, almost identical. In its basic form, the NPV of a project is the sum of all the net discounted cash flows during the life of the project less the present value (PV) of the cost of the project. The IRR model uses the same net cash flows as the NPV model but expresses the result as a percentage yield. The IRR of a project is the discount rate, which reduces the stream of net returns from the project to a PV of

Table 3.6 Financial models used in appraising the most recent ICT project (n = 71)

Model (in order of perceived importance)	Number	Rank				
		1st	2nd	3rd	4th	
PB discounted/conventional (no company used both)*	62	25	21	15	1	3.129
Internal rate of return/modified internal rate of return*	47	22	14	9	2	2.419
Net present value	50	18	17	11	4	2.403
Internal rate of return	40	20	12	7	1	2.113
Discounted PB (using discounted figures)	37	14	12	10	1	1.823
PB (conventional/non-discounted figures)	25	11	9	5	0	1.306
Return on investment/accounting rate of return	26	6	14	4	2	1.226
Profitability index	12	0	1	6	5	0.323
Modified internal rate of return	7	2	2	2	1	0.306

Note: *The description refers to a combination of related models.

zero. Previous research reports have shown that overall the IRR is more popular among practitioners than the NPV.[39] Managers' appear to be more comfortable with the IRR, being able to base their decisions on a percentage figure rather than an absolute NPV figure.[40] One of the reasons for the popularity of the IRR over the NPV may be that it is easier to communicate to non-financial managers.[41]

Twenty-six organisations use the ROI/ARR. This is less than that reported in an earlier study.[42] Nine of those organisations who apply the NPV also calculated the PI (NPV divided by initial cost of investment), while three of those organisation that used the PI did not rank the NPV.

Financial models continue to be widely used in the appraisal of ICT projects, confirming the previous reported research results.[43] We are also of the view that they will continue to be used in the appraisal of such projects, despite the general criticisms in the IT literature against their use.

With respect to non-ICT projects, the PB model continues to be the one most favoured, with 60 (90%) companies using one of either of the two versions (discounted or non-discounted) (Table 3.7). Although the NPV is again seen to be preferred to the IRR, when one takes into account the use of the MIRR, the IRR/MIRR is seen to be considered as

Table 3.7 Financial models used in appraising the most recent non-ICT project (n = 67)

Model (in order of perceived importance)	Number	Rank				
		1st	2nd	3rd	4th	
PB discounted/conventional (no company used both)*	60	22	21	15	2	3.050
Internal rate of return/modified internal rate of return*	44	23	11	9	1	2.400
Net present value	45	17	15	11	2	2.283
Internal rate of return	38	21	10	7	0	2.133
DPB (using discounted figures)	36	11	12	11	2	1.733
PB (conventional/non-discounted figures)	24	11	9	4	0	1.317
Return on investment/accounting rate of return	22	4	13	3	2	1.050
Profitability index	11	0	0	5	6	0.267
Modified internal rate of return	6	2	1	2	1	0.267
Other: If NPV is negative then take other factors into account	1	0	1	0	0	0.050

Note: *The description refers to a combination of related models.
Sixty-seven respondents reported on non-ICT projects. Two organisations did not use any financial model but relied solely on corporate management judgement (strategic assessment).

of greater preference, with 23 ranking it first compared to only 17 with respect to the NPV. The relative 'importance' of the IRR/MIRR against the NPV is also seen to be greater. Twenty-two organisations use the ROI/ARR. Ten of those organisations who apply the NPV also calculated the profitability index, while one of those organisations that used the PI did not rank the NPV. Two organisations did not use any financial model with respect to non-ICT projects but relied solely on corporate management judgement – strategic assessment. One organisation stated that if the NPV was negative they would take other factors into account.

Influences on the DCF discount rate

With respect to the latest ICT project, organisations that used any of the five discounting financial models (NPV, IRR, MIRR, DPB, or PI) (n = 60) took one or more of the factors shown in Table 3.8 into account when arriving at the discount rate (cost of capital) used. The discount rate used in DCF calculations by 48 organisations (80% of those that used a DCF model) was influenced by the opportunity cost of capital. There is

Table 3.8 Factors taken into account when determining the discount rate

Factor	**ICT projects (n = 60)**		**Non-ICT projects (n = 56)**	
	number	**%**	**number**	**%**
Opportunity cost of capital	48	80.0	41	73.2
Taxation	21	35.0	18	32.1
Project-specific risk	18	30.0	16	28.6
Inflation	16	26.7	16	28.6
Organisational risk	9	15.0	11	19.6
Other: Increase costs by 15%	1	1.7	0	0
Other: Contingency cost increase	1	1.7	1	1.8

Note: With respect to ICT projects (n = 71), 60 (84.5%) organisations used one or more of the DCF models. With respect to non-ICT projects (n = 67), 56 (83.5%) organisations used one or more of the DCF models.

general support in the literature for the use of the 'opportunity cost of capital' as the discount rate. Other influences included taxation, project-specific risk, inflation, organisational risk.[44] We would argue, however, that including an allowance for inflation must be taken with care, as the effect of inflation is sometimes ignored in the forecasted cash-flows. Two organisations stated that they arbitrarily increased the cost of the project, to take into account project risk, rather than adjust the discount rate.

Sophisticated financial appraisal models are perceived to be those that use DCF figures. In this respect, as 84.5% use one or more of these models, it may be determined that the responding organisations take a sophisticated approach to the financial appraisal of ICT projects.

With respect to the latest non-ICT project, organisations that used any of the DCF models (n = 56) took one or more of the factors shown in Table 3.8 into account when arriving at the discount rate used. The discount rate used in DCF calculations by 41 (73.2% of those organisations that used a DCF model) organisations was again influenced by their opportunity cost of capital. Other influences included taxation, project-specific risk, inflation, organisational risk. One organisation arbitrarily increased the cost of the project rather than adjust the discount rate.

This research highlights some of the factors, considered by organisations, as having an influence on the 'cost of capital' and the determination of their discount rate, with the opportunity cost of capital being most favoured with respect to both ICT and non-ICT project appraisal.

In line with the accounting literature, the cost of capital forms the basis on which the discount rate is arrived at which is used in the NPV. It is also used as the 'threshold' rate in IRR calculations. There is continuing debate, however, over the 'cost of capital' with perceptions differing widely within and between 'industry' and the 'City'.[45]

Risk analysis

Risk analysis may be considered from two viewpoints, (i) methods used to identify and assess the level of perceived project risk, and (ii) the way this risk can be taken into account. There are, however, some organisations that either do not adjust for risk or treat risk as a separate issue; this is highlighted below, under (iii).

(i) Methods used to identify and assess the level of perceived project risk

With respect to ICT projects, 38 (53.9%) organisations used one or more methods to identify and assess the level of perceived project risk (Table 3.9). The most popular method of assessing project risk, used by 28 organisations, is shown to be 'sensitivity analysis'. A sensitivity analysis approach to the assessment of project risk seeks to identify how sensitive project appraisal measures (such as NPV and IRR) might be impacted upon by possible estimation errors of the gross revenue and the various cost items as well as the cost of capital. This technique will highlight those projects, which through only a small deviation in cashflows from those forecasted produce a high variance in the calculated rate of return. Such projects are said to be highly sensitive.

There is support in the literature for the use of sensitivity analysis.[46] The identification of project risk is not merely a function of the sensitivity or influence on the financial data, but involves a much more detailed analysis of the reasons for risk.[47] While sensitivity analysis may be quite limited and its conclusions tend to suffer from a lack of conciseness, precision, and comprehensiveness, it does remain a useful tool of risk analysis, provided that management are aware of its limitations.[48]

The second most popular method, used by 20 organisations, is shown to be the PB. It is argued that the uncertainty of estimating future cashflows increases with time; the longer the project time, the greater the difficulty in estimating cashflows in the later years. This uncertainty in itself creates a risk in that the ultimate benefits expected from the project may not materialise. To some extent, this risk is identified by the

Table 3.9 Methods used to assess and/or take account of risk

Method	**Number**	
	ICT (n = 71)	**Non-ICT (n = 67)**
Risk assessment: [ICT: 38 (53.5%) organisations] [non-ICT: 33 (49.3%)]		
Sensitivity analysis	28	25
PB	20	19
Probability analysis (i.e. decision trees)	1	1
Option theory	1	1
Taking risk into account: [ICT: 43 (60.6%) organisations] [non-ICT: 40 (59.7%)]		
Adjust discount rate used	25	26
Adjust hurdle rate (IRR)	25	25
Adjust required PB period	21	18
Capital asset pricing model	5	4
CE approach	2	2
Build in contingency	1	1
Risk log and mitigation	1	1
Do not adjust for risk and/or treat risk as a separate issue: [ICT: 23 (32.4%) organisations] [non-ICT: 23 (34.3%)]		
Do not adjust for risk	18	18
Treat risk as a separate issue	6	6

Note: It appears that a greater number of organisations take project risk into account (ICT: n = 43. Non-ICT: n = 40) than those that formally assess risk (ICT: n = 38. Non-ICT: n = 33).

level of the PB period, shorter PB periods indicating a lower risk, while longer PB periods indicate a higher risk. It is generally accepted that the PB method only measurers ‘time risk’ and does not reflect the overall significance of project risk.

Probability analysis (i.e. decision trees) and option theory appear to have limited uses, with only one organisation using one or other of these methods.

With respect to non-ICT projects, 33 (49.3%) organisations, from a sample of 67, used one or more methods to identify and assess the level of perceived project risk. The most popular method of assessing project risk, used by 25 organisations, is again shown to be ‘sensitivity analysis’. The second most popular method, used by 19 organisations, is shown to be the ‘payback’. Again, probability analysis (i.e. decision trees) and option theory appear to have limited uses, with only one organisation using one or other of these methods.

(ii) The various ways project risk is taken into account

With respect to ICT projects, 43 (60.6%) organisations used one or more methods to take risk into account. The three most popular methods for taking risk into account were, (a) adjusting the discount rate used for the NPV, (b) adjusting the hurdle rate with respect to the IRR, or (c) adjusting the required PB period. While some academics argue that these are the correct approaches, others argue that such approaches merely make it more difficult to accept a project.

The most popular method of dealing with risk is to place a more stringent requirement on the customary financial criteria for investment appraisal by expecting a higher rate of return, using a higher discount rate, or shortening the required PB period above those that would have been used for less risky investments.[49] The literature supports the view that risk adjusted discount rates are inappropriate in the appraisal of IT projects.[50] While we have no evidence to indicate on what basis the discount rate was adjusted, respondents comments would suggest that it might be done in an arbitrary way.

Other methods include the CAPM, the CE approach, to build in a contingency allowance, or risk log and mitigation. The CAPM takes into account organisational risk but may not include project-specific risk.

With respect to non-ICT projects, 40 (59.7%) organisations used one or more methods to take risk into account. Again, the three most popular methods for taking risk into account were (a) adjusting the hurdle rate with respect to the IRR, (b) adjusting the discount rate used for the NPV, or (c) adjusting the required PB period. Other methods include the CAPM, the CE approach, to build in a contingency allowance, or risk log and mitigation.

(iii) Some organisations either do not adjust for risk or treat risk as a separate issue

With respect to both ICT and non-ICT projects, 18 organisations do not adjust for risk, while six organisations treated risk as a separate issue. This supports the view expressed over 50 years ago, that project risk should be assessed independently of financial appraisal, and the rate-of-return figure should remain inviolate and should be complemented by a secondary factor indicative of the risk, thereby keeping sight of both economic effect and risk.[51] This, however, is not the general view of academics, who argue that the discount rate should incorporate a risk factor.

The figures in Table 3.9 show that a greater number of organisations, in respect of both ICT and non-ICT projects, take project risk into account than formally assess risk. This suggests that subjective judgement plays a large part in the risk assessment process for many organisations. The figures clearly show that there is no real difference, between ICT and non-ICT projects, in the way organisations treat project risk.

Other factors considered during the investment appraisal stage

The factors shown in Table 3.10 were considered by the responding organisations at the appraisal stage of the most recent ICT and non-ICT capital projects. The main factor considered, with respect to ICT projects, was improvement to management information offered by the project [n = 66 (93%)]. This was followed by the strategic importance of the project [n = 59 (81.1%)]. Improved operational efficiency [n = 49 (69%)] was also seen as an important factor. Two other factors that were considered, but deemed to be not as important, were 'competitive advantage offered by the project' and 'legal/government requirements'.

The main factor considered, with respect to non-ICT projects, was improved operational efficiency offered by the project [n = 61 (91%)]. This was followed by the strategic importance of the project [n = 43 (64.2%)]. Two other factors that were considered, but deemed to be not as important, were 'competitive advantage offered by the project' and 'legal/government requirements'.

Statistically significant differences between some of the 'other factors' considered during the project selection stage with respect to ICT and non-ICT projects are noted in Table 3.10. 'Improved management information' and 'strategic importance' are rated higher with respect to ICT projects, while 'improved operational efficiency' is rated higher with respect to non-ICT projects.

The research shows that 'improved management information' is clearly important with respect to ICT projects, while 'improved operational efficiency' is more important with respect to non-ICT projects. Although 'strategic issues' are also seen to be important with respect to both types of projects (having been placed second in both cases), such issues appear to be relatively more important with respect to ICT projects.

The research confirms that some organisations rely on other, more strategic, factors in addition to the financial appraisal with respect to both ICT and non-ICT projects.

Table 3.10 Other factors considered during the project selection stage

Factor	ICT (n = 71)		Non-ICT (n = 67)	
	Number	%	Number	%
Improved management information***	66	93.0	0	0
Strategic importance of the project*	59	83.1	43	64.2
Improved operational efficiency**	49	69.0	61	91.0
Competitive advantage offered by the project	28	39.4	27	40.3
Legal/government requirements	14	19.7	15	22.4

Note: *Significantly different between ICT and non- ICT at the 5% level; **Significantly different at the 1% level; ***Significantly different at the 0.1% level.

Survey results – Part 4

This part of the survey consisted of a number of statements on a wide range of topics relating to the appraisal of ICT projects and investment appraisal in general. This chapter reports on some of those statements. Respondents were asked to agree or disagree with each statement based on their own experience and in so far as it may reflect their organisation's investment policies. The possible responses offered were 'strongly agree' and 'agree' for a positive response and 'disagree' and 'strongly disagree', reflecting a negative response.

The PB model of investment appraisal has been the subject of considerable comment and criticism in the literature.[52] An important concern of the PB model is the fact that it encourages a short-term view. This concern is especially relevant with respect to the appraisal of ICT projects, which are of a long-term nature. There is support (mean 2.7606) for the statement, 'The Payback model of financial appraisal encourages a short-term view' (Figure 3.6). Of the 44 respondents who supported the statement that the PB model encouraged a short-term culture, 39 (89%) of these respondents also reported that they used the PB model in their appraisal of ICT capital projects. The use of the PB model may result from the fact that managers are under both external and internal pressure to produce short-term results. The preoccupation with short-term results may influence some managers to sacrifice crucial new technology investments with substantial long-term benefits in order to show impressive short-term results.[53]

The overall disagreement (mean 1.9155) with the statement 'the "Payback" model of financial appraisal is unsuitable for evaluating

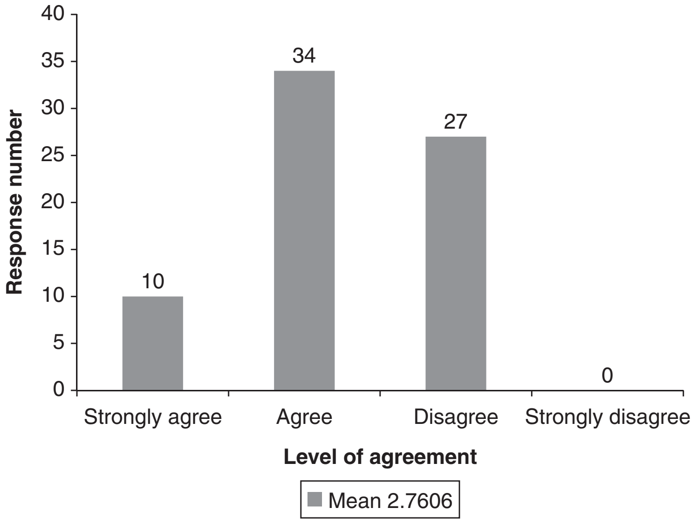

Figure 3.6 Statement: The 'Payback' model of financial appraisal encourages a short-term view

investments in ICT' clearly indicates that the respondents are of the opinion that the PB is suitable for the appraisal of ICT projects (Figure 3.7) even though, or possibly because, they accept that it encourages a short-term business culture. The overall negative response to this statement indicates, to some extent, that the respondents have given serious thought to the various statements and not just 'agreed' with them all. Support for the PB is also confirmed, earlier in this chapter, by the large number (87%) of respondents who use the PB/DPB models in the appraisal of ICT projects. This support is contrary to academic opinion, which highlights the many defects of the PB model.

There appears to be some conflict between academics, on the one hand, who develop theoretical models and practitioners who demand models that are more pragmatic. It was concluded from a recent survey of chief financial officers that 'sophisticated financial decision-making techniques are not practical – they have unrealistic assumptions, cannot be explained to top management and are difficult to apply'.[54] Researchers have attempted to develop evaluation measures for examining the effectiveness of IT. Some of these measures, however, though having academic value, have the problems of being esoteric and difficult

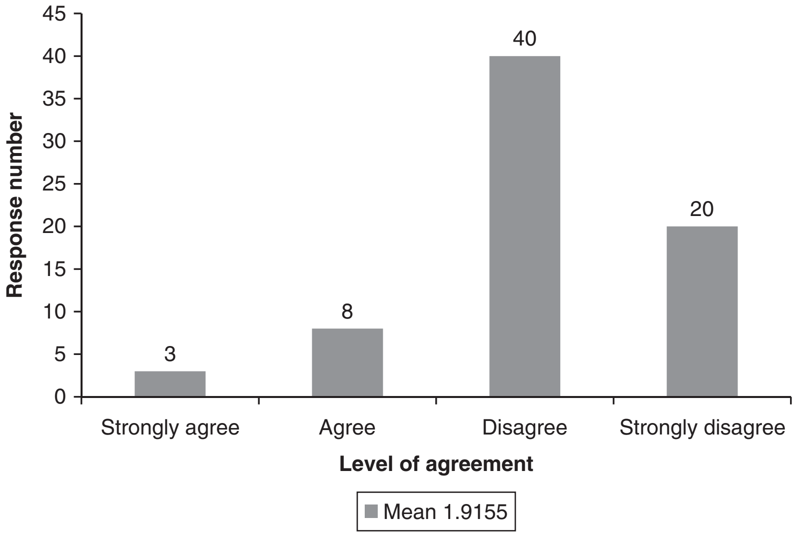

Figure 3.7 Statement: The 'Payback' model of financial appraisal is unsuitable for evaluating investments in ICT

to operationalise.[55] This conflict is highlighted by the strong agreement (mean 2.8873) with the statement, 'Many of the appraisal models available to assess capital projects are too theoretical and difficult to apply in the real world' (Figure 3.8). Fifty-five (77%) respondents agreed with the statement of which eight 'strongly agreed'. The above view is also supported by a comment made by one of the respondents, 'conventional appraisal techniques are widely regarded as being inadequate for ICT projects, but there is no consensus on alternative techniques'. The second part of this comment reinforces the need for a consensus on 'alternative techniques' and for a more pragmatic approach to be adopted.

The argument for a more pragmatic approach to the appraisal of capital assets is further highlighted by the overwhelming support (mean 3.2254) for the statement, 'A single practical (pragmatic) appraisal model that links together, finance, project-specific risk, and strategic issues would make the evaluation of ICT projects more meaningful' (Figure 3.9). Seventy (99%) respondents agreed with the statement of which 17 'strongly agreed'. The strategic appraisal and justification of ICT projects goes beyond the standard return on investment and other short-term financial models.

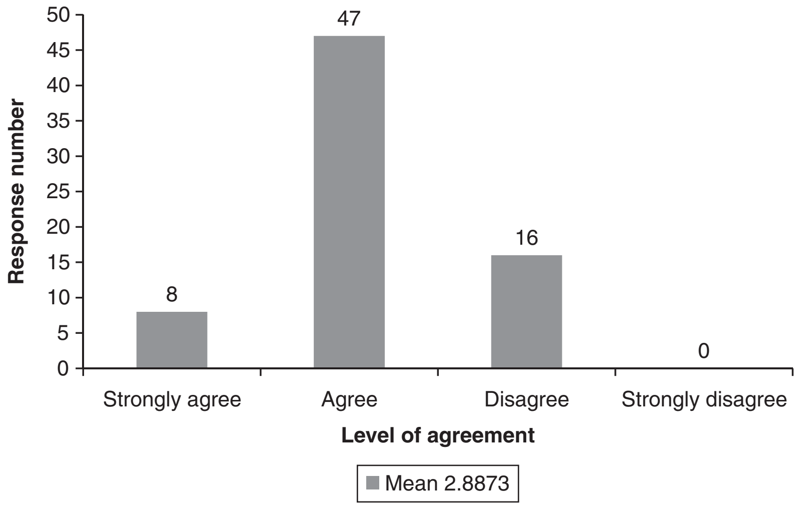

Figure 3.8 Statement: Many of the appraisal models available to assess capital projects are too theoretical and difficult to apply in the real world

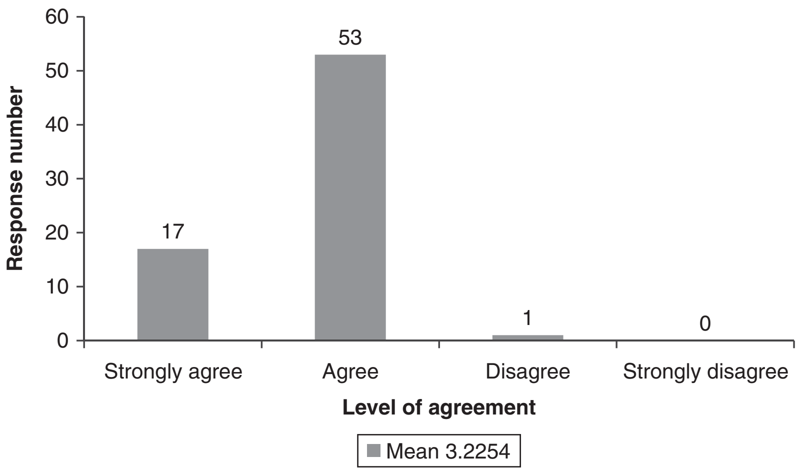

Figure 3.9 Statement: A single practical (pragmatic) appraisal model that links together finance, project-specific risk, and strategic issues would make the evaluation of ICT projects more meaningful

The more complete appraisal of these projects requires the incorporation and consideration of strategic, operational, and economic factors. Elements of project risk also need to be considered.

One of the respondents, however, comments, 'In my experience the only successful way of appraising major ICT projects is as part of the business planning round building both costs and benefits into the business model and appraising the business plan as a whole rather than ICT projects individually. This of course depends on management having the vision to see the necessity of the ICT investment as a key enabler of the overall business plan!' We would argue that appraising the 'business plan' would benefit from a 'pragmatic' appraisal model, such as the FAP model.

The fast pace of economic and technical change currently being experienced by many organisations is seen to be making it more difficult to appraise capital projects. This is evidenced by the very strong support (mean 3.1549) for the statement, 'Today's capital projects are more difficult to evaluate because of the faster rate of economic and technical change now being experienced by many organisations' (Figure 3.10). Sixty-six (93%) respondents agreed with the statement of which 16 'strongly agreed'. This reinforces the view put forward[56] that the decision-making process has become strategic because of 'the

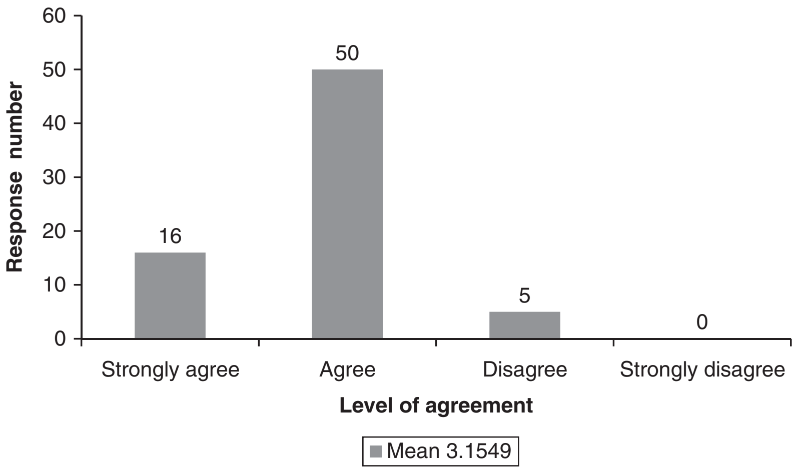

Figure 3.10 Statement: Today's capital projects are more difficult to evaluate because of the faster rate of economic and technical change now being experienced by many organisations

accelerating change in the environment of contemporary organisations'. The strong agreement to this statement also infers that investment appraisal difficulties and problems are not just restricted to ICT projects but relate to all capital projects.

Conclusion

The research points to a continuing globalisation and the increasing need for ICT as a result. It also supports the premise that the most senior executives only stay in a particular job for a short period of time. Concern over the possible undue influence of a project champion during the project selection stage is also highlighted. It also appears that many practitioners believe that the existing investment appraisal models are too academic and are not practical – they make unrealistic assumptions, cannot be explained to top management, and are difficult to apply.

Earlier research showed that post audits were not that common in practice. The current research, however, presents a contrary view claiming that post audits may be more common than originally thought. The importance of post audits is also recognised, in that significant factors, which should have been known at the investment selection stage, are shown to have been revealed through a post audit. In addition, important factors, which possibly could not have been known at the pre-selection stage, were also identified. In the main, the factors identified point to deficiencies in the financial models used especially in the identification of costs and benefits. This may also reflect over optimism on the part of the appraisal team members and give further support to the optimism bias theory, which we have referred to earlier in this chapter. This is an area that would benefit from a follow-on research study.

There is strong evidence to indicate that as a result of its ranking and popularity, PB is an important model used in the financial appraisal and risk assessment stages of capital investment procedures of both ICT and non-ICT projects. This is despite the concern expressed in the literature over the inappropriateness of the PB model in the appraisal of capital projects, especially new technology projects. The ROI/ARR holds some support, especially with respect to ICT projects, but evidence suggests that its popularity may be less than previously reported. It was expected that as ICT investments are classed as sophisticated, then sophisticated financial models would be used in their appraisal. However, the sophisticated DCF models appear to be unsuitable, or less preferred by management, in the appraisal of ICT projects with managers looking more to the unsophisticated PB model. There is a general belief, shown in the literature, that the non-sophisticated models such as PB support the sophisticated IRR/NPV models of investment appraisal. This research, however, suggests the reverse in that the IRR and NPV act in a supportive role to the PB. This research also shows that the NPV and IRR are favoured to the same extent, with possibly the IRR/MIRR showing only a slight preference.

There is strong support also for the use of capital investment appraisal teams and that the make-up of these teams does not always consist of the same individuals. There is confirmation that the appraisal of ICT capital projects involves, in many instances, IT specialists, which is what one would have expected. It is also shown that, with respect to non-ICT projects, IT specialists may not be part of the appraisal team.

Only half of organisations attempt to identify and assess the level of perceived project risk, with sensitivity analysis being the most favoured model followed by the 'payback', while a greater number take risk into account. Probability analysis and option theory appear to have limited uses, while the CAPM and the CE approach are used less than originally thought. There appears to be no significant difference between either ICT or non-ICT project appraisals in this respect. The evidence suggests that some companies are taking risk into account without formally assessing its level and importance. Some organisations are treating risk as a separate issue or do not make any adjustments for risk. Those that do make some adjustments for risk in the appraisal models used are making it more difficult to accept such projects.

The present rate of economic and technological change makes it more difficult to appraise most capital projects, not just ICT investments. It is essential to evaluate the financial, risk, and strategic aspects of all investments. Specific technical aspects of ICT should also be considered, as is the case with many other projects. The research confirms that organisations are, however, now taking a more sophisticated approach to investment appraisal in general, and not just relying on financial appraisal models – a more formal strategic and risk assessment is being undertaken.

The research presents evidence of the formal financial and risk assessment models used in the appraisal of both ICT and non-ICT capital projects. It shows that, based on the 'rankings' of the financial models used and the usage of risk assessment models; there was no significant difference between ICT and non-ICT appraisals. Although in this chapter we discover that both a formal and informal assessment of strategic factors are undertaken, we do not identify, in any great detail, the approach adopted, or the models used, by the various organisations to the appraisal of strategic issues. It may be that strategic issues are perceived to be more important than the financial and project-specific risk issues.

The extensive nature of the survey has allowed us not only to conclude (as far as our sample is concerned) that there is no significant difference between the financial and risk models used to appraise ICT and non-ICT projects but to explore many other important issues regarding the appraisal and post-investment evaluation of such projects. Because of this wider investigation, we are able to conclude that there are significant differences between the two types of projects in respect to other important appraisal/evaluation issues. Some of these issues relate to, for example, reasons given for not carrying out a formal appraisal of all ICT and non-ICT projects; departmental influence; formal/informal assessment of risk and strategic factors; the importance of other factors considered during the project selection stage. This research has therefore been enriched by the wider aspects explored and the discovery of many important issues.

4
Evaluating ICT Project Risk: An Exploratory Study of UK and Czech Republic Practices

Although business is about accepting risks, the identification and assessment of project-specific risk is possibly one of the most controversial topics in project management theory and practice. While attempts have been made to include risk assessment as part of the financial appraisal process, this appears, to some extent, to have been unsuccessful. Baldwin[1] argues in fact that 'the rate-of-return figure should remain inviolate and should be complemented by a secondary factor indicative of the risk, thereby keeping sight of both economic effect and risk'. Risk and financial evaluations are two separate factors, and each will have an influence over the other, but their assessment should remain separate.[2] It is important, however, when allowing for risk in appraising capital projects to make it not merely more difficult to accept a project.

Over the years, Baldwin's advice has largely been ignored, with academics looking for ways in which to incorporate a risk factor in the financial appraisal models, an example being the CAPM. Discount rates used in DCF calculations have been increased to allow for risk, while shorter PB periods have been required for those projects perceived to carry a higher risk. These measures, however, may just make it more difficult to accept a project.

Project-specific risk is an important factor when appraising capital projects, because ignoring it can result in high-risk projects being accepted with catastrophic consequences. The literature shows that this is possibly more important with regard to new technology projects, such as ICT, than the more traditional capital projects. Recent research shows that assessing project-specific risk was an important issue with respect to ICT projects.[3] Risk is always an important issue, although in good times forgetting it is easy, but an organisation will suffer the consequences later.[4] The perception of risk and the way it is dealt with may also be influenced by 'systemic short-termism'.[5]

This chapter reports on current research into the risk assessment practices of both UK and Czech Republic organisations who have recently undertaken an appraisal of ICT and non-ICT capital projects.[6] We hope to enrich the literature with valuable insights into the treatment of risk with regard to ICT and non-ICT projects and believe that this is the first investigation simultaneously to study such practices in the United Kingdom and Czech Republic. We believe that this evidence further supports the use of the FAP model.

Research methodology

This research is based on a factual and attitudinal survey conducted simultaneously in both the United Kingdom and the Czech Republic. Seventy-one valid responses were received with regard to the United Kingdom and 81 in respect of the Czech Republic. In general, the survey document was designed to make it clear that it was an academic study and not a commercial/marketing exercise. Statistical analysis of the factual survey in connection with project risk is based on the χ^2 Test. The attitudinal part of the survey was centred on a series of statements with responses based on a four-point Likert-type scale.[7] A two-tailed t-test is used for analysing the differences in means between the UK and Czech Republic respondents views. A standard crosscheck analysis was undertaken to verify the compatibility of the data (e.g., those organisations that reported that they 'adjusted the discount rate' to take risk into account, actually used the NPV in their financial appraisal). The object of the survey was the identification of current practices in respect of the appraisal of both ICT and non-ICT projects and the opinions of senior executives on a number of important issues regarding such practices. This chapter reports on the risk aspect of project appraisal and is part of a much larger research study,[8] some of which is reported in earlier chapters.

Results and discussion

Although risk results from uncertainty, risk and uncertainty are theoretically not synonymous.[9] Risk involves situations where the probability of a particular outcome is known, while uncertainty exists when the probability is not known.[10] Risk is the consequence of taking an action in the presence of uncertainty, while uncertainty is the manifestation of unknown consequences of change.[11] Risk exists in economic analysis because each input element has a number of possible outcomes, thus relating risk to uncertainty of outcome.[12] Risk is the probability of an undesirable outcome, while uncertainty exists when the prior outcome of a random event is not known.[13] Risk is the combination of individual uncertainties that have an impact on a project's objectives.[14] Although uncertainty may exist, it may not necessarily result in an undesirable outcome and as a result may not present a risk.

Risk is therefore negative, and manifests itself in an unsatisfactory outcome. Support of this argument may be traced back to Abraham de Moivre (1667–1754), a French scientist. De Moivre's work *De Mensura Sortis* was first published in 1711 (in *Philosophical Transactions* – a Royal Society publication) and, according to Berstein,[15] 'is probably the first work that explicitly defines risk as chance of loss' and quotes from *De Mensura Sortis*, 'The Risk of losing any sum is the reverse of Expectation; and the true measure of it is, the product of the Sum adventured multiplied by the Probability of the Loss.' Del Cano and de la Cruz[16] also confirm this view of de Moivre's work when they state that Moivre 'defined, for the first time, the term "risk" as the possibility of loss or damage'. Risk is the prospect of adverse events that result in bad consequences.[17] The term 'risk', as used in this chapter, relates to 'uncertain events', which if they occur will have a negative impact on the outcome of a project.

Financial theory argues that the most appropriate measure of investment risk is obtained by measuring the variance in earnings. This may be appropriate for measuring equity risk, but in practice, with respect to capital investments, models that are more pragmatic are used, such as PB and sensitivity analysis.

Several models are used in industry to identify and assess the level of perceived project risk. Some aim to *identify* risk (primarily from a financial perspective), others aim to *allow for risk*, while some others aim to *achieve both functions*. Among the more well-known are: the PB, sensitivity analysis, probability analysis (e.g. decision trees), adjustment of the hurdle rate, discount rate, or required PB period, CE-v, CAPM, and option theory.

An interesting observation of the data (Table 4.1) from our research suggests that more UK organisations take risk into account than actually assess risk. The question must therefore be asked, 'If risk is not assessed, how can it be taken into account'? This would indicate that some organisations subjectively adjust the discount rate or required PB period based on their perception of risk rather than a formal assessment. This does

Table 4.1 Approaches used to assess and/or take account of risk

Approach/Model	**ICT**		**Non-ICT**	
	UK (n = 71)	**CZ (n = 59)**	**UK (n = 67)**	**CZ (n = 54)**
Risk assessment	(n = 38)	(n = 32)	(n = 33)	(n = 35)
Sensitivity analysis	28	1	25	6
PB	20	30	19	34
Probability analysis (i.e. decision trees)	1	2	1	1
Option theory	1	0	1	0
Taking risk into account	(n = 43)	(n = 16)	(n = 40)	(n = 20)
Adjust hurdle rate (IRR)	25	8	26	8
Adjust discount rate used	25	10	25	11
Adjust required PB period	21	3	18	6
Capital asset pricing model	5	0	4	0
CE approach	2	0	2	0
Other	1	4	2	3
Do not adjust for risk and/or treat risk as a separate issue	(n = 23)	(n = 25)	(n = 23)	(n = 17)
Treat risk as a separate issue	6	16	6	12
Do not adjust for risk	18	9	18	5

Note: Of the UK organisations, 71 stated that they used at least one of the above approaches with respect to ICT projects and 67 with respect to non-ICT projects. While in the Czech Republic, the figures were 59 for ICT projects and 54 for non-ICT projects.

not appear to be the case with organisations in the Czech Republic; a greater number adopting one or more of the risk assessment models rather than making any risk adjustment; we explore this issue later in the chapter.

Techniques used in the identification and assessment of project risk

There are a number of models used in industry to identify and assess the level of project risk. Our investigation was aimed at the well-known and used models (Table 4.1):

(i) Payback

The PB model, which is normally regarded as a financial appraisal model, is also seen as a popular method of identifying the level of project risk.[18] It is argued that the uncertainty of estimating future cash-flows increases with time; the longer a project's life, the greater the difficulty in estimating cashflows in later years. This uncertainty itself creates a risk in that the ultimate benefits expected from a project may not materialise. To some extent, this risk is identified by the level of the PB period; shorter PB periods indicating a lower risk, while longer PB periods indicate a higher risk.[19] While PB may be a measure of 'time risk', it is ineffective as a general measure of project-specific risk. It has been argued that one of the strengths of the PB model is its simplicity.[20]

Earlier research showed that although the PB model continued to be used as a measure of riskiness, its importance was said to be in decline with more explicit risk evaluation criteria being used.[21] This view is not, however, supported by Lefley and Sarkis,[22] who found that although other risk evaluation criteria were being used, the PB model was the *most* popular method of risk assessment used by UK and US manufacturing companies in their evaluation of new AMT projects.

It is also argued in the literature (see, for example[23]) that the PB discourages long-term investments, such as investments in new technology, and is an ineffective strategy for controlling risk; in fact, it could actually increase risk dramatically.

Twenty (28.2%) UK organisations used this approach with respect of ICT projects and 19 (26.8%) with respect to non-ICT projects. This was in marked contrast with the Czech Republic organisations; 30 (50.1%) organisations using it for ICT projects and 34 (63%) for non-ICT projects (Table 4.1). The figures also indicate that while there is no apparent difference between the UK use of PB in respect of ICT and non-ICT projects, as far as the Czech Republic is concerned, there is a greater use of the PB approach for non-ICT projects (63%) when compared with that of ICT projects (50.1%).

(ii) Sensitivity analysis

With all capital investments, there will be a range of possible outcomes from each investment opportunity and, as a result, a range of possible financial returns. A sensitivity analysis approach to the problem will identify how sensitive the *projected* cashflows are to changes in the *forecasted* cashflows. Sensitivity analysis has been shown to be the most used risk assessment model in respect of UK organisations when assessing IS/IT and 'other' capital projects.[24]

This approach has more of a pragmatic nature rather than being based on financial theoretical concepts. The technique will highlight those projects, which through only a small deviation in cashflows from those forecasted produce a high variance in the calculated rate of return. Such projects are said to be highly sensitive and therefore present a greater risk. Twenty-eight (39.4%) UK organisations used this approach with respect to ICT projects and 25 (37.3%) with respect to non-ICT projects. This was in marked contrast with the Czech Republic organisations with only one (0.02%) organisation using it for ICT projects and six (11.1%) for non-ICT projects (Table 4.1). This may suggest that Czech Republic organisations are less sophisticated in their approach to risk assessment than some UK organisations.

(iii) Probability analysis

Probability analysis identifies the level of risk by estimating the probability distributions of the cashflows from a project and calculating the 'expected' values that can be used to arrive at the 'expected' NPV of the project. Decision trees (developed in the 1940s) illustrate the fact that often decisions are sequential in nature in that once a certain eventuality has occurred then the decision-maker is faced with another set of problems. By placing a probability value at each branch in the decision tree, a prediction of the risk/profitability profile of a project can be calculated. By multiplying the 'probability' value with the 'profitability' value, it is possible to arrive at what is known as an 'expected' value. As the number of paths through the decision tree increases, so does the complexity of the model until it gets to the situation where it becomes unmanageable.

It is argued in the literature that decision trees have 'practical limitations in the real world' and that they 'can easily become an unmanageable "decision-bush" when actually applied in most realistic investment settings'.[25] Probability analysis was only used by one UK company to assess both ICT and non-ICT capital projects, while with respect to the Czech Republic, two organisations used this approach for ICT projects and one for non-ICT projects (Table 4.1). This may indicate that 'probability analysis' may not be seen by practitioners as a practical solution to the assessment of project-specific risk and may, as the literature suggests, be 'unmanageable' in the real world.[26]

(iv) Option theory

Some capital investments have 'real options' which can offer benefits that may increase the attractiveness of a project. Taking an 'options' approach may also have the effect of increasing or decreasing the perceived level of project risk. Option theory was developed in response to the trading in derivatives on the financial markets, but is now seen to have implications in capital investment appraisals. Options have a unique attribute in that they are only exercised if they are beneficial; they therefore hold positive characteristics.

Typical 'options' with respect to capital investments include: (a) the option to make follow-on investments (growth options) if the immediate investment project succeeds, (b) the option to abandon a project, (c) the option to wait (and learn) before investing, and (d) the option to reduce the size of the initial project. The abandonment option offers a financial value should the project fail within the early stage of its life and therefore helps to reduce the perception of risk. Table 4.1 shows that only one organisation used the option approach and that was in the United Kingdom, and they used this approach for both ICT and non-ICT projects. This may well suggest that practitioners perceive 'option theory' as unsuitable or that they are unfamiliar with the approach.

Earlier research indicates that some Czech Republic managers ignored real options citing reasons as complexity of calculations, complicated prediction of input parameters, mistrust of calculations, and complicated interpretation of results.[27] However, we believe that an options approach to capital investment appraisals will give a pragmatic dimension to the assessment of project risk. While it may be difficult, in some instances, to arrive at a financial options value, the fact that the various types of options are explored will be beneficial and improve the decision-makers perception and understanding of project risk.

With respect to the risk assessment models used by UK organisations, there was no statistically significant difference between the assessment of ICT and non-ICT projects. This also applies to the organisations in the Czech Republic. However, when one compares the United Kingdom with the Czech Republic, in respect to the various risk assessment models used, there is a significant difference, at the $\alpha = 1\%$ level [$\chi^2_{calc}(3) = 26.0835$; $\chi^2_{1\%}(3) = 11.345$], between the two countries.

While the United Kingdom has a marked preference for the 'sensitivity analysis' approach, the Czech Republic strongly favours the less sophisticated PB model, with all its imperfections. This does not mean that the United Kingdom does not favour the PB model, but it does so to a lesser extent than the Czech Republic. While there is no apparent difference between UK organisations' use of PB in respect of ICT and non-ICT projects, as far as the Czech Republic is concerned, there is a greater (12.9 percentage point increase) use of the PB approach for non-ICT projects than ICT projects.

There was also a greater (11.08 percentage point increase) use of the 'sensitivity analysis' approach with respect to Czech Republic organisations in their risk assessment of non-ICT projects compared with ICT projects. The two approaches (probability analysis and options theory), recommended by some academics, are seen to have very little support amongst practitioners, both in the United Kingdom and Czech Republic.

Taking risk into account

There are a number of approaches used in industry to take risk into account when appraising capital projects. Our investigation was aimed at the better known and used techniques, but we also included two of the approaches (CE-v and CAPM) recommended by some academics (Table 4.1):

(a) Adjustments to the hurdle rate, discount rate, and required PB

The literature shows that it is common practice for organisations to adjust their capital budgeting techniques for risk by shortening the PB period, raising the required rate of return, or raising the discount rate in computing the NPV.[28] It is argued in the literature that the discount rate should be based on the weighted average cost of capital (WACC), although some changes may be needed to cover project-specific risk.[29] The same researcher also argues that the adjustments made by management for a specific risk profile for the project under consideration remain mainly an art based on intuition and experience rather than scientific statistical methods.

Although we observed, as identified earlier in the chapter, that a greater number of organisation in the Czech Republic actually 'assessed' (n = 32) risk than 'adjusted' for risk (n = 16), it is interesting to note that while 30 organisations used the PB model, only three stated that they actually 'adjusted the required payback period' to take risk into account with regard to ICT projects. A similar observation is made with respect to non-ICT projects, with 34 using the PB and only six making any 'adjustment' to the required PB period.

A more important observation, however, is that there is little evidence to suggest on what basis Czech Republic organisations adjust discount rates when they largely depend on the PB model for the assessment of risk. One could surmise, however, that they use the PB to identify the level of risk and then, based on the level of the PB period, subjectively adjust the discount rate or required hurdle rate accordingly; longer PB periods resulting in higher discount rates for those that use one of the DCF models. It also appears that an equal number of UK organisations use PB as a risk assessment measure as those that adjust the required PB period to take risk into account.

(b) CE approach

One of the methods used to take account for risk in the estimating of the forecasted cashflows is to apply a risk factor to the cashflows and to arrive at a CE-v. The certainty–equivalent, as considered in the economic literature, stems from expected utility (EU) theory and can be represented, from the view point of an agent who sells a random amount X, as the real number z such that $u(z) = \mathrm{E}[u(X)]$, where u is a utility function. Utility theory (which, according to del Cano and de la Cruz,[30] can be traced back to the work of Jeremy Bentham, 1748–1832) attempts to quantify the decision-maker's attitude to risk and to depict the results on a utility curve. It attempts to translate monetary consequences into utility values. If the decision-maker's attitude to risk can be quantified, then risk aversion can be incorporated into the decision-making process.

The literature shows that the CE-v is arrived at by reducing the risky cashflows by a CE factor to arrive at a risk-free cashflow.[31] The CE factor is achieved by comparing the risk-free discount rate with the risk-adjusted discount rate. Using this approach, the final NPV for a project is the same as under the standard DCF approach, where the uncertain cashflows are discounted at the risk-adjusted discount rate. The effect of reducing the cashflows to arrive at a CE-v is offset by the reduction in the discount rate to a risk-free rate. The difference between the risk-free discount rate and the risk-adjusted discount rate is a measure of the required risk premium. This, in effect, links the more theoretical approach of the CE method with the rule-of-thumb approach of subjectively adjusting the discount rate.

By using the concept of CE-v, it is possible to separate the timing and risk adjustments in the determination of the discount rate to be used in the evaluation process.[32] This view is supported by the argument that the CE-v model allows a separation of the risk-adjusted process from the discounting process. It is then possible to adopt a risk-free discount rate and to avoid the possibility of compounding risk adjustments unintentionally.[33] It is, however, argued that a CE does not necessarily reflect risk.[34]

Table 4.1 shows that only two organisations used the CE-v model and that was in the United Kingdom, and they used this approach for both ICT and non-ICT projects. This may suggest that although there is some academic support for this approach, practitioners have not taken it on board.

The main disadvantage of this method is the subjectivity that is applied to the determination of the risk factor used in the CE formula to calculate CE-v cashflows. There is also a danger that the discount rate used in the DCF calculations (to calculate the NPV or act as a threshold for the IRR) may include an allowance for project risk and is not therefore a risk-free discount rate.

(c) Capital asset pricing Model

The CAPM is derivable from modern portfolio theory (MPT). Theory suggests that there is a direct relationship between the level of risk and the level of acceptable returns from an investment in that the higher the level of risk, the higher the level of returns that would be expected.[35] The lower the level of expected returns, the lower the level of acceptable risk. This relationship is generally assumed to be linear,[36] in that each incremental increase in risk is associated with an increase in expected return. It assumes that the decision-maker is prepared to accept a higher level of risk only if there is a possibility of a much higher level of return, and that he will only accept a low return (one equal to, or just above, the organisation's cost of finance) if it is associated with a low level of risk.

Table 4.1 shows that five UK organisations used the CAPM in respect of ICT projects and four UK organisations used this approach for non-ICT projects. No Czech Republic organisations used this approach. The low usage of the CAPM may suggest that it has failed to live up to its early promise as a practical tool for estimating capital project risk–return relationships. This confirms a view expressed in the literature that the use of the CAPM is much less than one would expect.[37] Reasons for not using the CAPM include 'lack of familiarity with the technique' and 'lack of understanding of how to use it'.

There was no statistically significant difference [χ^2_{calc} (5) = 0.6693; $\chi^2_{5\%}$ (5) = 11.07], with respect to the way UK organisations take risk into account between the assessment of ICT and non-ICT projects. This also applies to the organisations in the Czech Republic [χ^2_{calc} (3) = 1.0239; $\chi^2_{5\%}$ (3) = 7.815]. However, when one compares the United Kingdom with the Czech Republic, in respect of ICT projects, there is a significant difference, at the $\alpha = 5\%$ level [χ^2_{calc} (5) = 12.935; $\chi^2_{5\%}$ (5) = 11.07], between the two countries. There was, however, no significant difference [χ^2_{calc} (5) = 5.5064; $\chi^2_{5\%}$ (5) = 11.07] between the two countries in respect of non-ICT projects. It is, however, observed that fewer organisations in the Czech Republic make any adjustment to take risk into account than organisations in the United Kingdom. The two approaches (CE-v and CAPM) recommended by some academics are seen to have very little support among practitioners who continue to rely on the less-sophisticated approaches.

Non-adjustment for risk or treating risk as a separate issue

Twenty-three UK and 25 Czech Republic organisations indicated that they did not adjust for risk and/or treated risk as a separate issue with respect to ICT projects, while, with respect to non-ICT projects, the numbers where 23 and 17 respectively (Table 4.1). The figures show that a greater number of UK than Czech Republic organisations do not make any adjustment to the financial models to take risk into account. While, with respect to those organisations that treat risk as a separate issue, a greater number is seen to be in the Czech Republic, none of the UK or Czech Republic organisations who stated that they 'did not make any adjustment for risk' in respect of both ICT and non-ICT projects actually assessed risk. While, with respect to the Czech Republic organisations that stated that they 'treated risk as a separate issue', four assessed risk for ICT projects and three for non-ICT projects, none of the UK organisations that 'treated risk as a separate issue' assessed risk.

There was no difference between the number of UK organisations that either 'do not adjust for risk' or 'treat risk as a separate issue', with respect to ICT projects and non-ICT projects. There is no significant difference with regard to Czech Republic organisation [χ^2_{calc} (1) = 0.1976; $\chi^2_{5\%}$ (1) = 3.841] in this respect. However, when one compares the United Kingdom with the Czech Republic, in respect of both ICT and non-ICT projects, there is a significant difference, at the $\alpha = 5\%$ level [ICT projects: χ^2_{calc} (1) = 7.5282; $\chi^2_{5\%}$ (1) = 3.841 and non-ICT projects: χ^2_{calc} (1) = 8.3975; $\chi^2_{5\%}$ (1) = 3.841]. It appears that Czech Republic organisations, rather than 'adjust' for project risk, are more likely to treat risk as a separate issue; this supports the earlier findings of the author.[38]

Opinion statements

As part of this research, an attitudinal survey was undertaken based on a number of opinion statements. Two of those statements are presented here, the statistical results of which are given in Table 4.2. The first statement is, 'Evaluating investments in ICT projects poses a number of problems that investing in "other" assets does not present.' It is argued that these problems may present an increase in project risk.

Both UK and Czech Republic respondents agreed with this statement (UK, mean 3.0; Czech Republic, mean 2.9079) and there was no significant difference between the views of each group of respondents ($t = 1.0325$). The second statement is, 'Investing in ICT projects presents a higher level of risk than investments in more traditional capital projects.' While there was a strong agreement from UK respondents

Table 4.2 Statistical analysis of responses to opinion statements

Statement	**UK**					**CZ**					**t-values**
	a	**b**	**c**	**d**	**mean**	**a**	**b**	**c**	**d**	**mean**	
Evaluating investments in ICT projects poses a number of problems that investing in 'other' assets does not present	6	59	6	0	3.000	11	48	16	1	2.9079	1.0325
Investing in ICT projects presents a higher level of risk than investments in more traditional capital projects	22	33	15	1	3.0704	8	31	37	1	2.5974	3.9544*

Note: Level of agreement with each statement: a = 'strongly agree'; b = 'agree'; c = 'disagree'; and d = 'strongly disagree'. *A significant difference at the $\alpha = 1\%$ level (reject H_0, that means are equal).

(mean 3.0704) to this statement, there was a neutral response with respect to the Czech Republic respondents (mean 2.5974).

This difference was significant at the $\alpha = 1\%$ level ($t = 3.9544$). This lower level of perceived project risk, with respect to ICT projects, among Czech Republic respondents may indicate that, in their view, the 'problems' associated with ICT projects do not necessarily present a higher risk. This view also supports the earlier figures, which showed that the number of Czech Republic organisations 'assessing' risk for ICT projects was less than that for non-ICT projects. A similar observation was made with respect to 'risk adjustments' in respect of such projects.

Conclusion

The lack of support from practitioners for the more sophisticated and possibly theoretical risk evaluation models, such as probability analysis, option theory, CE-v, and CAPM, and, with respect to 'sensitivity analysis', by Czech Republic organisations is to some extent understandable, when one considers that risk is itself 'subjective' and its identification and assessment relies, to a large extent, on management perception.

It was expected that as ICT capital projects may, to some extent, be perceived to be more sophisticated than non-ICT projects, that a more sophisticated approach would be made in its risk assessment. This has been shown not to be the case. While respondents from UK organisations see ICT projects as presenting a higher level of risk, this is not the perception of the respondents from Czech Republic organisations, and although the appraisal of ICT projects is seen to be more problematic, this does not necessarily present a higher risk.

Evidence suggests that there is a difference between the risk approaches of the two countries, and, in some respect, between ICT and non-ICT projects. An important observation is that there is little evidence to suggest on what basis Czech Republic organisations adjust discount rates when they rely heavily on the PB model for the 'assessment' of risk. It appears that Czech Republic organisations, rather than 'adjusting' for project risk, are more likely to treat risk as a separate issue, a risk approach, which has some academic support. There is some evidence to suggest that an increase in project sophistication results in a decrease in the sophistication of risk models/approaches used.

We would argue that this research also highlights the differences in the business culture between the United Kingdom and the Czech Republic. In the United Kingdom, there has for many years prevailed a culture of rewards (bonuses, etc.) based on short-term performance.[39] While this is, to a lesser extent, now being seen in the Czech Republic, the reasons for its introduction are perhaps different than that for the United Kingdom. We believe that the Czech Republic short-term culture is based especially on the processes of transformation of the Czech Republic economy, from a state-owned to a free market economy, that brought along a high degree of uncertainty and the necessity to concentrate on operational and tactical issues.

Moreover, we would argue that current economic difficulties constitute another serious encouragement for the current short-termism. As a result, UK managers may see project-specific risk as more of a personal risk (the failure or long-term nature of some ICT projects having a direct bearing on their own financial benefits), while managers in the Czech Republic see this risk as more of a corporate risk. This may be the reason why a larger number of Czech Republic managers do not see the investment in ICT projects as presenting a higher risk, even though managers in both countries see such projects as being problematic. The greater sophistication in the assessment of risk by UK managers, therefore, may just reflect their desire to see how the risk will affect their financial benefits.

We believe that this research provides valuable insights into the way both UK and Czech Republic organisations deal with project-specific risk, in respect of ICT and non-ICT capital projects, and presents data and practitioners views, which are lacking in the financial and ICT literature. Investing in ICT capital projects involves, in many cases, a high capital commitment and can present a number of problems not present in more traditional capital investments. However, such problems do not necessarily involve higher risks.

Risk must be assessed, and it is important that we critically examine the risk practices adopted by organisations and understand their implications. We argue that risk assessment should be based on a serious attempt to identify and evaluate the nature of project-specific risk and recommend the use of the FAP model.

5
The Development of the FAP Model

It is clear from the literature that managers prefer, when evaluating any single investment proposal, to use a number of financial appraisal and risk assessment models rather than rely upon any single model, no matter how much that model may be theoretically justified. We believe, however, that the use of any single appraisal model can lead, in certain instances, to adverse selection, as subordinate managers learn to modify their projections to maximise the acceptability of their proposals by overstating benefits and minimising costs and risks. We would argue that a multi-appraisal regime would be useful in mitigating such behaviour. There is also evidence to show that techniques developed for both the assessment and treatment of risk are not as widely used as some would like to believe. This may indicate that the issue of risk is not taken seriously by some organisations. There also appears to be little consensus as to which models should be used when a combination modelling approach is adopted. Each model has some unique quality to offer the decision-maker; however, inappropriate combination modelling may lead to confusion and overcompensation for such factors as, for example, project-specific risk.

We present the FAP model, which has been developed to mitigate the problems inherent in traditional single or combination modelling approaches. The FAP model looks at a capital investment project from a financial, risk, and strategic viewpoint. While the model incorporates some of the more traditional approaches to investment appraisal, it also includes new techniques and modifies others to create a combination model that captures more of the complexity of the decision-making process, reinforces principles of good governance within the appraisal process, and mitigates adverse selection. The FAP model achieves this by forcing a structure upon the decision-making process which we, along with others, believe will serve to maximise the quality of the decisions that managers actually make.[1]

The research path followed in the development of the FAP model

The research approach in developing the FAP model followed a clear path (which is summarised in Figure 5.1), starting from the firm foundation of earlier studies,[2] which, with the literature review, (i) supported the need for a new approach to the appraisal of capital investments, (ii) highlighted the perceived deficiencies and concerns over some existing investment appraisal models and, (iii) helped to identify the requirements of any new model.

The second stage involved the conception of the FAP model. The model was then exposed to critical comment through publications in both the academic research literature and professional journals.[3] The critical comments led back to the development stage and resulted in some modifications (e.g. the inclusion of the net present value profile (NPVP)) to the model.

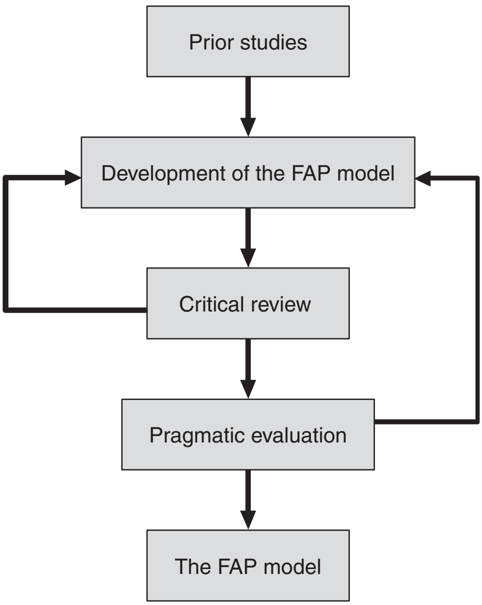

Figure 5.1 The research path

The next stage involved the pragmatic evaluation of the model through presentations and questionnaire responses again resulting in some minor modifications (e.g. making more explicit how 'real options' are catered for) to the model. Adopting a case-study approach to reinforce the external validation of the FAP model extended this evaluation. The final stage resulted in the completion of the FAP model in its current form.

Although the research in developing the FAP model was diverse in its subject matter, it is united by its research methodology – a system of explicit rules and procedures upon which research is based and against which claims for knowledge are evaluated.[4] From a pragmatic point of view, knowledge is not just acquired through empirical observation, more important than observation and the content it yields is the method of science. This method includes observation, but contains in addition a way of doing things that has direction and keeps thought moving with experience.[5] Research methodologies, especially for the social sciences, are constantly being updated and improved and it is hoped that the pragmatic/normative approach used in the development of the FAP model will allow the reader to follow the research path and come to the same conclusions: (i) there is a need for a new capital investment appraisal model, and (ii) the FAP model satisfies that need.

This book produces verifiable evidence to substantiate (i) the perceived weaknesses of some of the existing capital investment appraisal models and (ii) the need for a new multi-attribute capital investment appraisal model. We strongly argue that the FAP model, developed from this research evidence and supported by pragmatic data, addresses many of the perceived problems concerning the appraisal of capital projects.

By adopting a pragmatic approach, the author was keen to establish, using a range of theoretical insights and prior research, a model that would have a high level of acceptability. The model has been revised and adjusted not only to keep it within the bounds of what is theoretically reasonable but also to maximise its acceptability to the user firm. Fundamentally, the FAP model is normative and prescriptive in that it is concerned with what *ought* to be done rather than what *is* actually done.

Conceptual reasoning

In practice, the appraisal of capital projects consists of two intersecting problems: first, the *complexity* of the investment decision, and second, the *financial* consequences of the proposed project upon the value of the firm.

The word 'complexity' refers to the quality or state of being complex, while the word 'complex' is derived from the Latin word *complexus* and means to entwine, embrace, composed of two or more related items, parts, or constituents. This results in a state of complexity by the interweaving or interaction of the various parts. Although it is generally assumed that 'complexity' is synonymous with 'complicated' (both consisting of two or more related parts), we would argue that this is not exactly the case, as complexity is more about the *interaction* of the various parts and their *embeddedness* within each other. The word 'complicated' infers that there is a logical process to becoming uncomplicated (or simple) by separating the individual parts, thus, if this is the case, then the addition of the individual parts will make up the whole.

Although it is generally felt that to reduce the level of complexity all one has to do is to separate the various elements of the interacting parts, this, however, has proved not to be so easy, as the act of interweaving (or embeddedness) is like the roots of closely planted trees as they search out for water and nourishment. On the surface, the trees look independent (appear to stand on their own), but under ground, the picture is more complicated and difficult to untangle with their roots so entwined together. We argue that, like the trees, as various related parts become interwoven or embedded within a firm, this embeddedness results in a kind of synergy, which may produce either positive or negative results, so that the whole does not just become an addition of the individual parts.

We therefore argue that complexity is the first dimension of investment decision-making that any modelling procedure must accommodate. Project complexity can result in the creation of greater instrumental value as opposed to intrinsic value and is, in our terms, a function of the degree of entanglement possessed by an asset and the level of uncertainty that such entanglement imparts to the economic outcome of the firm.

The second dimension of interest to us is the degree of cash generation and its timing that a particular investment promises to impact on the firm and the uncertainty attached to the resulting cashflows. Tradition informs us that the economic value of a project is the NPV of cashflows resulting from an individual project and that the value of a firm is equal to the PV of all future economic profits discounted at the firm's opportunity cost of capital. Conventional approaches to capital investment appraisal assume that managers can disentangle the contingent cashflows from a project from the existing asset structure of the firm. This, in practice, however, is not always an easy task given the potential degree of embeddedness of a proposed asset.

As firms mature through growth and longevity, there is a potential for assets to become more deeply embedded resulting in even greater complexity.

There will naturally be those capital projects that are more complex or embedded within the fabric of an organisation than others. Some, for example, straightforward plant replacement projects may be at the least complex end of the scale being evaluated using a conventional financial appraisal approach. Other plant replacement projects may, for example, involve the restructuring of working practices and the alteration of the operational configurations of the business with inevitable greater complexity. There are also those projects that will be high cash-generating, while on the other hand, others will be low cash-generating.

The positioning of the FAP model

It is within this somewhat pragmatic relationship between complexity and financial uncertainty that we attempt to position the FAP model, together with the conventional capital investment appraisal models, using a project evaluation matrix.[6]

As complexity and uncertainty about project cashflows increase, from a pragmatic point of view, we would expect managers to apply additional techniques to support the traditional DCF approach. Sensitivity analysis, Monte Carlo simulation, and the use of risk adjusted discount rates are methods among others that have been developed to accommodate risk. However, for very basic cash-generating projects with very low complexity and relatively short life, rule-of-thumb methods such as PB may be the only appraisal model necessary. Greater project complexity may, however, result in more strategic factors being considered, with attempts being made to value such strategic benefits in financial terms. Although efforts have been made to place a financial value on all strategic benefits, this may not always be possible. For certain projects, an 'options' approach to the financial valuation of some project benefits (options) may also be considered appropriate.[7]

The evaluation of low cash-generating projects may be based on such models as cost/benefit analysis with respect to low-complexity projects, through strategic score models, and again finally to an options approach (this time looking at what may be termed 'strategic options') for high-complexity projects.

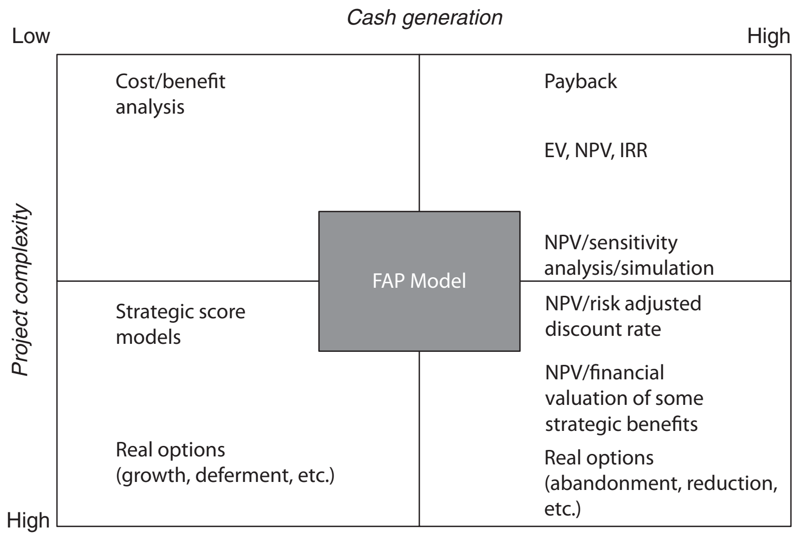

Figure 5.2 The positioning of the FAP model

This leaves a central area within the project evaluation matrix (Figure 5.2) covering projects that are medium cash-generating but have various levels of complexity; projects that have strategic benefits, which are difficult to quantify in financial terms, and project-specific risks that cannot just be ignored but need to be analysed and evaluated. This central area of the matrix is where the FAP model is most suitably positioned, although, as will be discussed later, the model can be applied in other, more diverse, areas of the matrix.

As complexity increases, and as projects become less cash-generating, the conventional investment appraisal models (such as PB, NPV, and IRR) may become less applicable.

A basic rule-of-thumb model, such as the PB, may be appropriate as a single measure in some instances, for example, in evaluating those projects that are relatively high cash-generating, with a low capital cost, low levels of cashflow uncertainty, low project complexity, and low specific risk. The NPV is appropriate, especially for higher cash-generating projects with longer lives, where the cashflows can be reasonably determined with some degree of certainty and the project has a low/medium level of complexity. As cashflow uncertainty and project complexity increases, it is necessary to apply other measures, either to take account of this increased uncertainty/risk or place a financial value on the intangible/strategic benefits.

Currently, the identification of project-specific risk is, in the main, achieved by determining a project's PB period or by analysing the financial data through the measurement of its 'sensitivity' to variations. Risk is then taken into account either by reducing the required payback period in line with the perceived increase in risk or, with respect to the DCF models, by increasing the hurdle rate of the IRR or the discount rate used to calculate the NPV. Here, risk is being defined as cashflow uncertainty that will increase as project complexity increases.

With greater project complexity, some strategic models play an important role in 'topping-up' the financial benefits from a project. Such models attempt to convert strategic benefits into monetary values. These models may be classified as 'secondary-supportive models', as they consider the financial issues first, and accept a project on this basis, or, if a project does not meet the financial acceptance criterion first time around (possibly from project complexity), then a value is placed on the strategic benefits which is then used to support the financial justification.

Some, possibly high complexity, capital investments have 'real options', which can offer benefits that may increase the attractiveness of a project. These 'options' can be viewed from three perspectives; (i) those options that would be considered as part of the initial screening of a project (e.g., does the project fit in with corporate or business strategy), (ii) those options that may be considered before any possible project rejection (e.g., project deferment and the possibility to reduce the size of the initial investment), and (iii) those options that create 'benefits' once a project has been accepted. Some of these benefits may be valued in financial terms, while other benefits may be more of a strategic nature that may not be so easily valued in such terms.

Progressing down to the bottom of the right-hand side of the project evaluation matrix, two important options have been highlighted as giving 'financial' value. The option to abandon a project once it has been accepted (abandonment values) and the option to reduce the size of the project (reduction in capital cost).

If it is seen that once a project is started the returns are much less than those forecasted, then the project may be abandoned, and the value received from the sale of the equipment that is no longer required giving the firm what is termed an 'abandonment option'. This option is valuable where abandoning a project may be possible and selling-off assets rather than continuing with a project that is yielding negative NPVs.

Abandonment values (AVs) identify the possibility of a 'bailout' scenario and give a wider perspective to project risk. AVs also give an indication of a project's liquidity and when considering large, high complexity projects, managers prefer those projects with a high abandonment value.

A firm may also have the option of reducing the size of the initial project once it has become apparent that a scaled-down version would be preferable, based on the acquired knowledge at the time. This type of option (a reduction option) will reduce the capital cost of the project and may reduce the level of risk that the organisation is exposed to.

Moving towards the low cash-generating side of the project evaluation matrix, away from the central position, 'other' project benefits need to be looked at, which, in some cases, may only be evaluated from a judgmental stance and represented by a 'points' or 'score' value. Such models as cost/benefit analysis and strategic score models are used in the evaluation of these projects.

Cost/benefit analysis is usually applied to what may be described as 'social' projects, where social costs and benefits are evaluated for a public capital investment, but it is also used in industry in the evaluation of service and other infrastructure projects. There seems to be two approaches in practice to cost/benefit analysis. First, the costs of the project are determined and the benefits are also valued in financial terms to see if they exceed the costs. The second approach, while determining the cost of the project in exactly the same way as the first, measures the benefits on a 'points' scale. The total points value is divided into the total cost of the project to arrive at a 'cost per one point in value'. The lower this cost, the more favourable is the project.

When progressing to lower cash-generating, higher levels of project complexity, there may be more of a reliance on strategic 'score' models. Some strategic models seem to infer that strategic factors are more important than financial factors, and that, possibly, a project should be accepted on strategic grounds even though it may not satisfy the financial criteria through a conventional financial appraisal of the project. These models may be described as 'primary-supportive models', where considerations are given to the strategic issues first, and a project is accepted on this basis, overriding the financial evaluation. The strategic issues being of primary importance while the financial data acts in a supportive role.

As the level of project complexity increases, more 'strategic' options may be available. One option, termed a 'growth option', is to make follow-on investments if the immediate investment project succeeds.

The fact that an organisation has undertaken the initial project will place that organisation in a position either to 'follow-on' and take advantage of future returns or halt further investment.

A further strategic option is what is called a deferment option, the option to wait (and learn) before investing. While the decision to invest may be irreversible, the decision to defer an investment, however, can be reversed. The value of waiting must, however, be set against the sacrifice of earlier profits. An organisation that continues to wait may lose any competitive advantage that the project offers.

While the preferred way of dealing with real options is to place a financial value on them and include them in the DCF calculations,[8] some options ('growth' and 'deferment') may be seen more from a strategic perspective. For example, the growth option may be treated as a strategic benefit (and valued in 'score' terms) rather than attributing a financial value to it.

With the increase in cashflow uncertainty and project complexity, evidence shows that more weight is placed on judgmental factors and less reliance is placed on the results from the conventional appraisal models such as NPV.[9] Some academics argue that the conventional appraisal models fail to capture many factors involved in the justification of capital projects support this.[10] In such circumstances, managers may move away from the pure 'financial' appraisal models to the adoption of judgmental 'score' models. There is, however, a transition stage where the bulk of capital projects rest, a stage where both financial and judgmental score models merge. It is in this position that a multi-attribute model, such as the FAP model, is ideally suited.

A team approach

An essential part of the FAP protocol[11] is the establishment of a capital investment appraisal team, which includes key functional managers of the organisation together with an 'independent' team facilitator (group leader). It is vital that the team facilitator is unbiased towards each project and can act impartially. The team facilitator must not be confused with a 'project champion' who is a person heavily committed to a project and totally biased towards its acceptance.[12]

While the composition of the investment appraisal team is important in respect to the members' varied managerial disciplines, it is also essential to appreciate that their other demographic characteristics (basic social attributes such as age, sex, educational standard, length of service, etc.) may be equally important and may well account for the fact that some teams will be more efficient than others.[13] Also of importance is the level of managerial diversity in relation to the perceived environmental uncertainty (PEU) – the degree to which managers differ in their perception of the uncertainty of their organisation's external business environment.[14] It is therefore the responsibility of the team facilitator to aim at maximising team efficiency based on their knowledge of the demographic characteristics of the team members.

The constituent parts of the FAP model

The FAP model incorporates three sub-models; the net present value profile (NPVP), the project risk profile (PRP), and strategic index (SI). What is particularly important, however, is the dynamic FAP 'protocol'.

Like any other investment appraisal model, FAP incorporates the basic details of the proposed investment – the capital cost of the project, the project's estimated useful life, and the cost of capital.

However, the FAP model is a multi-attribute information model based on a profiling protocol and is therefore more dynamic in its approach than many of the existing conventional investment appraisal models.

A prerequisite of the FAP approach is the need to formulate a detailed conception of the firm's overall corporate and business strategy, and that the analysis and review of this strategy should be an ongoing exercise. Each firm should also consider the maximum level of project-specific risk that it is prepared to accept. All projects that do not fit into the overall corporate and business strategy of the organisation, and those projects deemed to be too risky (we will look at the aspect of 'too risky' when we consider the PRP in Chapter 8) should be screened out at an early stage in the capital investment evaluation process, and only those projects that pass this initial screening should be considered in greater detail.

The FAP model consists of four protocol components (other than the FAP protocol itself), which together form the investment profile for each capital project. The four components are (1) Basic data input – the capital cost of the project, the cost of capital, and the project's estimated life, (2) The NPVP, which gives a profile of the conventional NPV model by incorporating the DPB, the discounted payback index (DPBI), and the marginal growth rate (MGR), (3) The PRP, which is a risk management protocol, aimed at the project definition stage, that is designed to identify and evaluate project-specific risks, and (4) The SI, which is used to identify and evaluate project-strategic benefits and link them with the firm's overall business strategy.

6
The FAP Model – Basic Data

In this chapter, we explore some of the basic data requirements for implementing the FAP model. Our primary concern will be with the inputs to the financial elements of the decision-making process that follows the well-worn path of the NPV approach. This method of investment appraisal is recognised as being the one technique which gives a spot estimate of the value added promised by a given investment opportunity. Under very limited assumptions, the NPV of the incremental cashflows implied by a given investment decision when discounted at the firm's opportunity cost of capital provide the economic value of the project to the firm. With all the usual caveats in place, under free information and competitive markets, this increment in value contingent upon an investment decision should be translated into a corresponding increase in the market value of the firm. However, theory is one thing, practice another, and it is to the data requirements of the FAP model that we now turn our attention.

The capital cost of the project

The process of calculating the capital cost (investment outlay) of a project is well defined and understood and should therefore present few problems to the experienced accountant or project manager. The capital cost will be the value that represents that part of a project's expenditure that is capitalised as a fixed asset in the accounts of the company after following standard accounting practice guidelines. All other costs are treated as revenue expenses and are offset against the positive cashflows from a given project. By adopting this approach, a consistent definition of the capital cost of a project can be achieved.

For projects with a long start-up period, the capital expenditure may be spread over a number of years. However, this presents little difficulty in appraisal terms. There are broadly two ways of dealing with this:

Table 6.1 The capital cost for a project with a four-year set-up time (a)

Year	**Actual cost (£)**	**Compounding rate 8%**	**Compound value (£)**
−3	396,590	1.3605	539,561
−2	492,600	1.2597	620,528
−1	539,710	1.1664	629,518
0	221,100	1.0800	238,788
Totals	**1,650,000**		**2,028,395**

Note: The compounding rate is equal to the project's discount rate. In line with common practice and taking a conservative view of costs, the actual expenditure is assumed to be made at the beginning of each year.

(i) The rolling expenditure program can be compounded at the appropriate rate (i.e. the discount rate used in the NPVP – see Chapter 7) to the point at which the project is expected to start making a return (which is deemed year 0). Although the historical cost will be entered in the FAP model, a note of the compounded cost for such projects should also be included. Table 6.1 gives an example of the compounding approach and shows that while the historical financial cost of a project is £1,650,000, its compounded cost, based on a four-year set-up time, is £2,028,395. It is this second, larger figure, which should form the basis of the NPVP calculations.

The advantage of this approach is that it presents the decision-makers with a clear estimate of the value of the capital invested in the project at the point the project commences to generate a return. The disadvantage is that the resultant NPV is calculated at that date rather than the date at which an irrevocable decision to invest is made. From this point of view, the second approach is preferred.

(ii) In order to maintain the integrity of the NPV as a spot estimate of the value added to the business by a given investment decision, the preferable treatment is to discount the capital flows to the point at which the decision is made, as shown in Table 6.2.

The two approaches can be reconciled by discounting the capitalised investment under method (i) at the discount rate that gives the same answer as method (ii):

$$\text{Discounted value of capitalised investment} = £2{,}028{,}395/1.08^4$$
$$= £1{,}490{,}931$$

Table 6.2 The capital cost for a project with a four-year set-up time (b)

Year	Actual cost (£)	Discount rate 8%	Discount value (£)
0	396,590	1.0000	396,590
1	492,600	0.9259	456,111
2	539,710	0.8573	462,714
3	221,100	0.7938	175,516
Totals	**1,650,000**		**1,490,931**

Note: With this approach, year '0' denotes the point at which the first commitment to the capital investment is made; year '1' is the sum of the capital expenditure in the first year which is assumed to arise at the end of the year in question and so forth to the end of the capital investment cycle.

However, in terms of assessing the value added to the firm at the point at which the investment is made, the second approach described above is to be preferred.

The impact of taxation

Taxation impacts upon the calculation of NPV by altering the firm's assessment of its taxable profits after capital allowances where appropriate. It does this in the following way:

(i) The capital expenditures incurred may be eligible for capital allowances (either first year or writing down) which mitigate the firm's overall assessment for tax. Likewise, at the end of the project, any unused capital allowances may be recoverable or, where the original equipment is dismantled and sold, a balancing charge may then become due.
(ii) The operating cashflows from the project will either increase the firm's annual profit or loss chargeable to tax.
(iii) The cost of capital may need to be corrected to take into account the tax shield arising from debt and any other 'above the line' capital sources.

The correction to the expected capital investment (i) is straightforward when a 100% first-year capital allowance is available, assuming the expenditure flows as described in the previous tables.

In the example shown in Table 6.3, it is assumed that the tax benefit in terms of reduced tax payments on the firm's overall liability is received in the year of investment. In practice, the incidence of the tax cashflow

Table 6.3 The capital cost for a project mitigated by a 100% first year allowance (FYA) and 40% corporation tax liability

Year	Actual cost (£)	FYA	Mitigation of tax liability (40%)	Net capital cost	Discount rate 8%	Discounted value
0	396,590	396,590	158,636	237,954	1.0000	237,954
1	492,600	492,600	197,040	295,560	0.9259	273,667
2	539,710	539,710	215,884	323,826	0.8573	277,629
3	221,100	221,100	88,440	132,660	0.7938	105,310
Total	**1,650,000**					**894,559**

may well be different to the incidence of the capital investment and that would need to be modelled into the calculation of the NPV.

Normally, however, capital allowances consist of both a first year allowance (FYA) and a writing down allowance (WDA). WDAs are calculated on a reducing balance basis under the 'pooling method' or on a straight-line basis. Because of the different varieties of taxation treatment that may be required, it is important to ensure that any modelling of cashflows is done on the basis of the best available tax advice.

Working capital

In principle, any additional working capital requirement brought about by the decision to invest should be included as part of the operating cashflows arising from the project and not as part of the capital expenditure itself. In practice, it can be very difficult to disentangle the changes in working capital from the firm's overall requirements, especially where changes in credit policy and cash holding are entailed.

For most companies, especially those that are on an expansion programme, working capital can be an important issue, and the neglect to forecast increased requirements can have a damaging effect and may place the company in a vulnerable position. With regard to machine replacement projects, which may have little effect on the sales volume of a company, the working capital requirements may virtually be unaffected. In contrast to this scenario is the project which is aimed at expanding the turnover of the company, as this will have a big impact on working capital. The demand on working capital will also be progressive, as the company continues to expand. It is not therefore advocated that the calculation of working capital requirements should be ignored, but this should be incorporated as an ongoing analysis of the financial planning of the company. The argument is whether it is appropriate, or even practical, to include such figures in the capital cost for each project being considered.

There are, however, those capital investments that are made which aim at reducing stock levels. In such cases, as there is a clear financial benefit through the reduction in warehousing space, labour, and other stockholding costs, these benefits should be included in the financial appraisal aspect of the FAP model; and, for those projects that require an increase in stockholding, then a charge should be included to cover the various costs of such an increase. For example, any capital cost incurred in increasing warehousing facilities, as a direct result of a capital project, should be included in the capital cost of that project, while ongoing non-capital costs (e.g. Labour, building rates, cleaning, heating, and lighting) should be reflected in the forecasted cashflows.

The cost of capital

In line with the accounting literature, the cost of capital forms the basis on which the discount rate is arrived at which is used in the NPVP calculations in the FAP model. In the FAP model, the determination of the cost of capital is the responsibility of corporate management. There is, however, continuing debate over the ‘cost of capital’ with perceptions differing widely within and between ‘industry’ and the ‘City’.[1]

As a company draws its finance from a number of sources, it is argued that it may be appropriate to adopt the WACC approach. In fact, the WACC is the most generally accepted model of calculating the cost of capital.[2] However, concern has been expressed that, in certain circumstances, using this approach may give the wrong signal.[3] And, some would argue, that a firm’s WACC should only be applied in project evaluations if the risk profile of the project is a ‘carbon copy’ of the risk profile for the firm as a whole, otherwise the WACC should be ‘adjusted’ to take into account the difference in risk.[4]

Some accountants would argue that, especially in respect of large projects, it might be more appropriate to use the marginal cost of finance approach, while others advocate that the opportunity cost of capital should be used. The CAPM has been developed to arrive at a cost of capital (discount rate) which is of particular relevance to risky projects, but while it is theoretically sound, it has yet to be universally accepted by industry. However, some finance academics have doubted the validity of the CAPM, with some academics arguing that the empirical validity of CAPM is still a matter of debate.[5]

It would, however, be incorrect to try and identify a particular source of funds with each project, as this would lead to the acceptance of low yielding projects at the time of low costs of finance while some higher yielding projects would be rejected during times of high costs of capital. This argument is based on the fact that when the short-term cost of capital is low, say 5%, then projects with a yield of 5.5% may be accepted, yet when the short-term cost of capital is higher, say 11%, then projects with a yield of 10.5% would invariably be rejected. Accepting projects on this basis would also directly influence the future cost of finance from other sources. Increased gearing will have the result of decreasing the WACC, but after a point high gearing will have a negative effect and cause the WACC to rise, as investors perceive a higher risk of the company becoming insolvent if it cannot pay its loan commitments. High gearing will also result in wider fluctuations in earnings available to ordinary shareholders.

It is interesting that with the pressure on companies to report more 'accurate' profit figures, through a clear directive to reduce the scope for 'creative accounting', this may have the side effect of increasing the WACC. As the scope for including various expenses as 'extraordinary items' and as other measures are introduced to reduce the opportunity for creative accounting, then this can only result in greater fluctuations in the earnings-per-share-figures of companies and lead to more volatile company share prices. This will inevitably affect the expected P/E ratio. A company likes to report a steady increase in earnings-per-share each year, but this may not be as easy to manipulate in the future as it has been in the past. The increasing dilemma that the accountants will face in the future will be the choice between WACC based on book values, with its generally accepted drawback of possible influence through balance sheet manipulation, and the preferred WACC based on market values, which will be influenced by greater fluctuations in reported profits, with the inevitable greater volatility in share prices.

There are, however, those projects which, because of their sheer scale and individualistic nature, result in some companies establishing a new division or subsidiary company to administer them. In such a case, the financial structure of the new division or subsidiary company may dictate the 'cost of capital' and therefore the discount rate to be applied in the evaluation of the project. It may be that once the end of the economic life of the project has been reached, the division/company is then liquidated (the purpose for its creation/incorporation being achieved). Such an example may be the incorporation of a company to administer the extraction of a particular material from a given site. In such an instance, a source of finance may be directly identified to a particular project. But even in such a case, this would inevitably have some influence on the overall cost of capital in respect of the parent company and the group as a whole. There are also those projects that may attract some kind of government financial aid, by the way of grants and/or loans with low interest rates. Regarding grants, these can be dealt with through the normal cashflow calculations. Low interest rate loans will have a direct influence on the cost of finance for the particular project and must be accounted for.

Accounting records may show that a company is currently borrowing at an interest rate of 10%, while, for the same company, the medium-term WACC may be in the region of 9%, and the opportunity cost of capital (estimated over the life of the project and based on the value of the best investment alternative forgone) of around 12%. The opportunity cost of an investment (also termed 'the opportunity cost of capital' – based on the returns available from government securities and ordinary shares) is estimated at 8.75%. All of these alternative ways of calculating the cost of capital present a dilemma as to which one should be accepted for use in the capital investment appraisal situation. Over the years, all of these alternatives have been advocated, with opinion now focusing in favour of some form of opportunity cost of capital approach.

It appears that some companies in the United Kingdom and the United States use a single discount rate when appraising capital projects and that this rate includes an allowance for risk. By accepting a single discount rate, which has been arrived at by adding a premium that represents the return required to cover the maximum amount of risk acceptable by the company, the company is in effect, on the one hand, denying itself the opportunity to accept low-risk projects with lower returns but, on the other hand, accepting projects that offer high returns which may have higher risks. By adopting this approach, there is a danger that a company will bias its acceptance towards high-risk projects. If the return on low-risk projects is greater than the cost of capital, then accepting such projects will increase the shareholders' wealth, but this opportunity is not available to those companies that adopt single, high-risk-adjusted discount rates.

Whatever approach to the calculation of the cost of capital is adopted, the figure arrived at, and used in the FAP model, should not include an allowance for project-specific risk. A view endorsed by both academics and practitioners who argue that for discounted cashflow calculations, 'risk' is intended only to refer to 'systematic' risk, it does not include 'project specific' risk, no matter how great.[6]

In the FAP model, the cost of capital forms the discount rate used in the NPVP. As the discount rate is used to calculate the economic return[7] and not as a project risk 'threshold barrier', then the cost of capital should be calculated accordingly. This will then reflect the true economic return from a project. It is then left to management to decide if this return (together with the other features of the FAP model) is acceptable, and they will inevitably be influenced by the opportunity cost of capital (estimated over the life of the project and based on the value of the best alternative forgone or the alternative rate for a similar financial market investment), together with the specific risk and strategic implications of each project under consideration. Calculating the cost of capital is hardly a simple task and it seems the difficulty is only compounded by including a premium to cover project-specific risk.

A project's estimated life

It is important to estimate the life of a project based on the concept of 'useful economic life'. This will represent the period during which a company can expect to receive economic benefits from a given project. Some projects will of necessity be short-life investments while others will benefit from a much longer timescale.

All projects have a finite life, and while it may be difficult to estimate it precisely, managers must make a conscious attempt to do so. In the FAP model, projects with an estimated life of more than 20 years may be stated as such, with figures calculated for this 20-year period only, and an estimated cash inflow in year 20 to cover the residual value[8] of the project at that time. When this 20-year rule is applied, the life of a project should be entered in the FAP model, as 20+ with the full estimated life entered in parenthesis after this figure. For example, if the full estimated life of a project is 35 years then the figure for the life of the project will be entered as 20+ (35). This will indicate that although the calculations have been based on a 20-year lifespan with a residual value included in year 20 which represents the financial returns from year 20 to year 35, the full life of the project is estimated at 35 years.

It is accepted that there are those organisations, especially in the oil exploration and industrial extraction industries, that may very well have capital investments with lifespans of well over 20 years, but as the FAP model is aimed more at manufacturing and processing organisations, it is felt that a 20-year rule is appropriate. This does not, however, stop such companies from modifying the FAP model to fit in with their specific needs, as no model should be inflexible.

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

While the traditional capital investment appraisal models, such as the NPV, are theoretical models from which normative decision rules can be derived, the FAP model offers a normative protocol that specifies the processes managers ought to follow to maximise the value of their investment choices. The NPV aims to identify those projects that will increase shareholder value by allowing for project risk through the discount rate used in its calculation and by increasing the cash inflows for the strategic benefits. It looks at those aspects of an investment decision that can be quantified in financial terms. The FAP model aims to address the wider aspects of an investment decision that will impact on the firm. Not only does it identify the implications for shareholder value from a given investment, but it also looks at the total issue of risk from a corporate management perspective. Because the FAP model (through the PRP – developed in Chapter 8) looks at a project's specific risk from this perspective, it would be incorrect also to allow for 'specific' risk in the discount rate used in the NPV. For if it did, it would be allowing for risk twice. A firm is also concerned with its competitive strategic position through its capacity to create competitive advantages. So the FAP model (through the SI – developed in Chapter 9) highlights the strategic benefits looked for in each capital investment opportunity and then goes on to assess their 'worth' within each project. In the FAP model, the financial evaluation is achieved with the aid of the NPVP which incorporates the NPV.

The NPV will highlight those projects that increase shareholder value, but this is normally based on the assumption that there is no restriction to the amount a company can invest and that it may therefore invest in all projects that show a positive NPV. As this is not a practical assumption, the NPV fails because it does not fully take into account the magnitude of the capital investment required to produce this increased value; it may not identify the most advantageous combination of projects when there is a capital shortage. In reality, companies are faced with many types of capital investment situations and are also burdened with constraints such as liquidity, perception of risk, and time factors, to name just a few. There is no doubt, however, that the NPV is conceptually more sound than the IRR, but on its own, and in certain circumstances, it too may not give the right signal to management.

In spite of all the efforts to convince managers that the NPV is the 'correct' model to use, most surveys show that they continue to prefer the IRR.[1] Although several modified versions to the IRR have been developed, they too have been condemned by some academics even though such modifications are an improvement on the conventional IRR. No single investment appraisal model will, however, give the right answer in all investment situations, and the NPV is no exception. This is reflected again in recent research, which shows that companies now use a greater number of financial appraisal techniques than in the past, but with no consensus on the actual combination.[2] This increase in usage has been attributed to the increase in computer software that is now readily available to perform the basic calculations of the various financial appraisal techniques such as PB, ARR, IRR, and NPV.

After initially including the MIRR,[3] the DPB, the DPBI and the ARR, in the financial appraisal part of the FAP model,[4] it was soon realised that what had been done was to select most of the conventional financial appraisal models but leaving out the NPV.

Renewed stimulation to rethink the approach on the financial evaluation aspect of the FAP model was influenced by Keef and Olowo-Okere.[5] It was perceived, from this article, that there would be a strong academic objection (and correctly so) if the FAP model excluded the NPV, but including the NPV would have resulted in using all of the conventional financial evaluation models. A rethink on the issue resulted in the development of the NPVP, which is a sub-model of the FAP model. Feedback was encouraging, with a letter being published in *Accounting Technician* (January 2000) stating, 'Lefley's research at the University of London is a valued contribution in the field of investment appraisal'.

There is considerable debate in the literature over the 'correct' discount rate to be used in DCF calculations.[6] It is not, however, within the scope of this book to extend this debate further. The NPVP uses a discount rate that is not adjusted for project-specific risk and is therefore in line with recent thinking. Booth, in his comments regarding the setting of discount rates, states, 'For DCF calculations, "risk" is intended only to refer to "systematic" risk... it does not include "project specific" risk, no matter how great.'[7]

Bengtsson argues that while some traditional financial models, which use a risk-adjusted discount rate, may handle the effects of systematic risk in an appropriate way, this approach has its shortcomings when considering the complex specific risk structure of some projects and other models, which avoid the problem of estimating a risk-adjusted discount rate, may be more appropriate.[8]

The NPVP

The NPV may now be seen in a different light with the establishment of the NPVP. The NPVP extends the NPV by incorporating the DPB, the DPBI, and the MGR, into a financial profile of an investment opportunity. The NPVP shows a natural progression from NPV to MGR.

$$\text{NPVP} = [\text{NPV} \Rightarrow \text{DPB} \Rightarrow \text{DPBI} \Rightarrow \text{MGR}]$$

Before the actual calculation of the NPVP, cashflows are agreed by the investment appraisal team. It is the 'agreed' cashflows that enter the NPVP protocol (Figure 7.1). The figure shows clearly the corporate management involvement at both the beginning and end of the NPVP protocol. At the beginning, they are responsible for establishing corporate policy that includes the determination of the discount rate used in the DCF calculations. At the end of the protocol, they are asked formally to consider and approve recommended projects. The actual protocol, although overviewed by corporate management, is carried out by the FAP investment appraisal team.

It is important that any financial appraisal model should include the assessment of two fundamental issues; it should identify those projects that are beneficial to the long-term interests of the shareholders/owners, and it should measure both a project's time-risk and its liquidity, which are interrelated. Regarding some projects, however, a third issue of 'the abandonment option' may also be relevant, making it necessary to calculate abandonment values.

It is important to measure the economic return from a project by identifying those projects that, having taken into account the time value of money, produce a return greater than the organisation's cost of capital.

Part of a project's specific risk, but by no means the whole risk, will be identified as a time-risk. The longer it takes to recover the initial cost of the investment, the more likely the increase in risk that the returns from

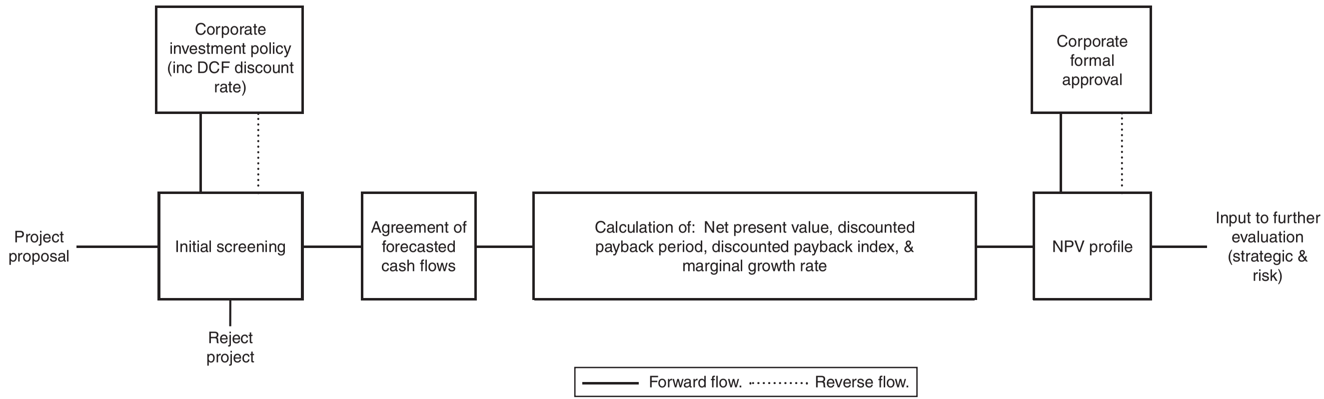

Figure 7.1 The NPVP sub-model

the project may not materialise in later years. This time element will also affect the liquidity of a project – the time it takes to place management back into its original financial position before it made the investment.

The abandonment option may be valuable with respect to those projects in which, once started, it is found that the returns are much less than originally forecasted, and it would be better to abandon the project and sell the assets (adopting a bailout scenario) rather than continue incurring losses. Highlighting abandonment values (AVs) at the initial stage of the project evaluation will further assist with the measurement of liquidity and also give a wider perspective to the identification of project-specific risk.

The NPV, the DPBI, and the MGR will identify the various aspects of a project's economic return, while the DPB will measure a project's time-risk and, together with the AVs, the liquidity issue.

The determination of the NPVP

To arrive at the NPVP, it is imperative that the discount rate used in its calculation has not been inflated to cover a project's specific risk or an organisation's infrastructure costs and so on. Having established this important assumption, it is then possible to extend the NPV (which can now be regarded as a statement of expected economic profitability from a project[9]) to include the DPB, DPBI, and finally to arrive at a MGR. Through this process, it is then possible to obtain an NPVP, a profile that, together with the AVs, will encapsulate all the important aspects required to make a sound financial judgement on each capital project.

In the simplified example (Table 7.1), a project (project reference KC: 197) under consideration has a capital cost of £30,000 with an estimated useful life of ten years. The scrap value of the equipment, estimated at £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 10%. For simplicity, the figures in the example ignore taxation and inflation, and the scrap value is included within the cash inflow figure for year 10. From this data it can be seen that, with a capital cost of £30,000 and a total discounted net cash inflow of £83,771, the project has a positive NPV (present value of net cash inflows less capital cost of the project) of £53,771. This is the gain, in PV terms, that the company can expect to achieve if it accepted 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

Table 7.1 Calculation of the NPVP

Capital cost of project £30,000						
Year	**Net cash inflows from the project**				**Abandonment option**	
	Net cash inflow (£)	**Discount factor 10%**	**PV of net cash inflows (£)**	**Cumulative PVs (£)**	**Abandonment values (£)**	**Discounted AVs (£)**
1	10,000	0.9091	9,091	9,091	10,000	9,091
2	15,000	0.8265	12,398	21,489	7,500	6,199
3	15,000	0.7513	11,270	32,759	3,000	2,254
4	15,000	0.6830	10,245	43,004	Abandonment option:	
5	15,000	0.6209	9,314	52,318	The company has determined to highlight each project's AVs for the first three years of its life, and that if the average of the discounted AVs over this period is greater than 30% of the project's original capital cost, it will classify the AVs as '**high**', between 30% and 10% as '**medium**', and below 10% as '**low**'.	
6	15,000	0.5645	8,467	60,785		
7	15,000	0.5132	7,698	68,483		
8	15,000	0.4665	6,998	75,481		
9	15,000	0.4241	6,362	81,843		
10	5,000	0.3855	1,928	83,771		
Totals	135,000		83,771			

Calculations:
NPV: (PV of net cash inflows – capital cost of project) = (£83,771 – £30,000) = £53,771.
DPB = [2 + (8,511/11,270)] = 2.75 years.
DPBI = (PV of net cash inflows/capital cost of project) = (£83,771/£30,000) = 2.7924.
$\text{MGR} = [(\text{DPBI})^{1/n} - 1] \times 100 = [(2.7924)^{1/10} - 1] \times 100 = 10.81\%$.
$\text{AVs} = [(9,091 + 6,199 + 2,254)/3]/30,000 \times 100 = 19.5\%$. Classification = Medium.

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 PB approach, as it takes into account the future value of money.

It can also be seen how important it is to use an *unadjusted* discount rate, for if the discount rate had been adjusted to include project-specific risk, then there is the possibility of overcompensating for risk if perceived project-specific risk is also taken into account in the determination of the *required* PB period. Under this scenario, the discounted PB period will increase because of the higher discount rate, while the required PB period is reduced. An important objective of the DPB is to measure a project's liquidity, and this will not be achieved if the discount rate is inflated above the cost of capital.

In the example, the DPB is calculated as follows: The cumulative discounted net cash inflows to the end of year 2 are £21,489, which shows a PB period greater than two years. The company then needs to achieve a further discounted net cash inflow of £8,511 (£30,000 – £21,489) to arrive at the actual PB period. As the discounted net cash inflow during year 3 is £11,270, which is greater than that required to break-even, the additional PB period is 8,511/11,270 (0.75) giving a total PB period of two years plus $0.75 = 2.75$ 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 less than three 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 that 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 the project will be 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 4.0 shows that the initial cost will be recovered four times.

A weakness of the PB model (whether conventional or discounted) is the fact that it ignores the cashflows after the PB period. By including the DPBI, this weakness is eradicated because the total cashflows from a project are now taken into account. In the example, the DPBI can be calculated by dividing the capital cost of the project into the PV of net cash inflows (£83,771/£30,000), which gives a figure of 2.7924. This means that the project recovers its original cost almost three times.

The next stage in the development of the NPVP is the calculation of the MGR which is reached through the DPBI where $\text{MGR} = [(\text{DPBI})^{1/n} - 1] \times 100$. 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 (PV) 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 identical, if these projects have different economic lives, the MGR will be lower for the longer life project. In the example, the MGR is 10.81% $\{[(\text{DPBI})^{1/n} - 1] \times 100 = [(2.7924)^{1/10} - 1] \times 100\}$ and is a measure of the project's rate of net return.

The MGR is not a substitute for the NPV but is a natural extension of it and should act in its support. Some managers are more comfortable with a DCF approach based on a rate of return rather than one based on value.[10] With the NPVP they are given both.

The NPVP also highlights the AVs for the early years of a project's life together with a graded 'classification'. In the example, the AVs for the first three years of the project's life are £10,000, £7,500, and £3,000 respectively, which after discounting are £9,091, £6,199, and £2,254 respectively. The company has agreed a 'classification' scale for AVs based on the following criterion: *High* – if the average AVs for the first three years of the project's life is greater than 30% of the initial capital cost of the project; *Medium* – if the figure is between 10% and 30%; *Low* – if the figure is below 10%. The AV classification for this project is 'Medium' $[\{(9,091 + 6,199 + 2,254)/3\}/30,000 \times 100 = 19.5\%]$.

Once the NPVP has been determined (Table 7.2), it is then left to management to decide if a particular project is acceptable, bearing in mind the perceived level of project-specific risk (using the PRP), any strategic benefits derived from the project (using the SI), and the company's liquidity situation.

In the example given, the project has a positive NPV of £53,771 and a short discounted PB period of two years and nine months. It recovers the initial cost of the investment almost three times and has an MGR of 10.81%. It also has a 'medium' classification for the AVs. This therefore seems a desirable project from a financial aspect.

Table 7.2 NPVP

NPV	£53,771
DPB	2.75 years
DPBI	2.79
MGR	10.81%
AVs	Medium

For those managers who wish to determine the MIRR, it is a simple calculation[11] from the NPVP.

The NPV profile

$$[\text{NPV} \Rightarrow \text{DPB} \Rightarrow \text{DPBI} \Rightarrow \text{MGR}] \Rightarrow \text{MIRR}$$

The MIRR for the above example is 21.89%. $[(1 + \text{MIRR}) = (1.1081 \times 1.10) = 1.2189$, therefore $\text{MIRR} = (1.2189 - 1) \times 100 = 21.89\%]$. (The reader is referred to Appendix 2 for a fuller presentation of the link between the MIRR and the NPVP).

The advantage of the DPB over the PB

Many textbooks give only a cursory mention to the DPB model of investment appraisal, although recent research shows that it is a popular and important model in both the United Kingdom and the United States. In a recent survey,[12] 54% and 65% respectively of UK and US manufacturing companies made use of the DPB, while 25% of UK and 33% of US companies stated that it was the most 'important' model used, outranking the two main discounted cashflow models of IRR and NPV.

The two main defects of the conventional PB are well acknowledged in the literature as its inability to take into account the time value of money and the fact that it ignores the returns after the PB period. The DPB addresses the time value factor, but it makes no attempt to address the second issue because it is not a measure of a project's profitability and has never professed to be; it is a measure of liquidity and time-risk.

As the DPB uses discounted returns, it will always show a longer PB than the conventional PB, which uses actual returns.

The following example will illustrate the two models (PB and DPB) in more detail. A company is considering two projects, the financial details of which are shown in Table 7.3. Project 'A' shows increasing returns in the first three years and then, through the anticipated increase in competition, expects a drop in sales revenue to a level figure (ignoring inflation) for the remaining life of the project. Project 'B' is able to benefit from an initial competitive advantage, but this is short lived as competitors are expected to move into the market at the end of year 1. Both projects have an estimated life of eight years with an identical capital cost of £280,000.

If the company used only the conventional PB model of financial appraisal when considering the liquidity and time-risk aspects of a

Table 7.3 Comparison of the PB and DPB models

Year	Project A				Project B			
	Capital Cost: £280,000				Capital Cost: £280,000			
	Revenue returns from the project				Revenue returns from the project			
	Actual (£)	Discount factor*	PV (£)	Cum. PVs (£)	Actual (£)	Discount factor*	PV (£)	Cum. PVs (£)
1	60,000	0.8929	53,574	53,574	160,000	0.8929	142,864	142,864
2	80,000	0.7972	63,776	117,350	60,000	0.7972	47,832	190,696
3	140,000	0.7118	99,652	217,002	60,000	0.7118	42,708	233,404
4	60,000	0.6355	38,130	255,132	60,000	0.6355	38,130	271,534
5	60,000	0.5674	34,044	289,176	60,000	0.5674	34,044	305,578
6	60,000	0.5066	30,396	319,572	60,000	0.5066	30,396	335,974
7	60,000	0.4523	27,138	346,710	60,000	0.4523	27,138	363,112
8	50,000	0.4039	20,195	366,905	50,000	0.4039	20,195	383,307
Totals	570,000		366,905		570,000		383,307	

**Note*: Cost of capital = 12%.
Conventional PB period: Project A = 3 years; Project B = 3 years.
Discounted PB period: Project A = Just under five years; Project B = Just over four years.

capital investment decision, there would be no difference between the two projects, with each project showing a PB period of three years.

However, taking into account the time value of money and using the DPB model, a different picture emerges, with project 'A' showing a discounted PB period of just under five years, and for project 'B' of just over four years. This clearly gives the signal that, in respect of the liquidity and time-risk aspects of an investments decision, project 'B' is preferred. The reason for this is obviously the difference in the profile of the returns in the first three years of each project's life, with project 'A' showing lower initial returns than project 'B'. The higher the cost of capital, the greater will be the difference in the DPB figures when there are varying project returns, and also in the difference between the PB and DPB.

The DPB, as a measure of a project's time-risk, is conceptually more sound than the conventional PB. Where the higher returns from project 'A' are seen to be in years 2 and 3, for project 'B' the highest return is in the first year. Under the PB, both projects have the same conventional PB period of three years with no consideration being given to the actual makeup of the returns during this period.

The danger of using the NPV as a single financial criterion

Using the NPV as a single criterion of investment appraisal can ignore some vital financial aspects of a project. Table 7.4 shows that while all four projects (W, X, Y, and Z) have the same NPV of £50,000 and would therefore give the same accept/reject and ranking signals, the NPVPs of the various projects reveal vital differences.

While having two projects with the same NPV is possible (projects 'W' and 'X'), the pattern of the cash inflows may be significantly different for each project. Even if the economic life and capital cost of the projects are identical, one project may have the bulk of its cash inflows at the beginning of its economic life (project 'W') while the other (project 'X') may have them towards the end. Using the NPVP, this will be highlighted by the DPB. In the case of project 'W', the DPB is one year and four months, while the DPB for project 'X' is two years and eight months. On this basis, other things being equal, project 'W' would be preferred to project 'X'.

Where the capital costs of the projects are different, but the NPVs are identical (see for example projects 'X' and 'Z'), the DPBI and MGR will highlight the effect of this difference. It can be seen that project 'X' has a DPBI of two and an MGR of 18.92%, while with respect to project 'Z' the

Table 7.4 NPVPs of four projects, all with the same NPV

Year	**Project net cash flows after discounting at 10%**			
	W	**X**	**Y**	**Z**
0	£ −50,000	£ −50,000	£ −50,000	£ −100,000
1	+40,000	+10,000	+20,000	+45,000
2	+30,000	+20,000	+20,000	+40,000
3	+20,000	+30,000	+20,000	+35,000
4	+10,000	+40,000	+20,000	+30,000
5			+20,000	
NPV Profile				
NPV	£ +50,000	£ +50,000	£ +50,000	£ +50,000
DPB	1 year 4 months	2 years 8 months	2 years 6 months	2 years 5 months
DPBI	2	2	2	1.5
MGR	18.92%	18.92%	14.87%	10.67%

DPBI is 1.5 and the MGR is 10.67%. This therefore indicates that under severe capital expenditure restrictions, project 'X' may be preferred to project 'Z'.

The effect of any differences in a project's economic life, as with projects 'X' and 'Y', will be highlighted by the MGR. In the example, project 'X' has an MGR of 18.92% while project 'Y' has an MGR of 14.87% suggesting a possible preference for project 'X'.

It is therefore important that a financial profile approach be adopted, rather than just relying on the NPV as an absolute figure. A wider profile, such as the NPVP, gives a more meaningful analysis of the financial merits of an investment opportunity than relying solely on the NPV.

Conclusion

By including the NPVP in the FAP model, management are able to take into account any liquidity restrictions that a company may have. They may also be more flexible in their approach in general to capital investment appraisals, by placing different emphasis on the constituent parts of the NPVP to fit any particular investment situation. The NPVP not only includes the NPV, favoured by academics, but also includes the DPB, the DPBI, and the MGR, which may be more acceptable to practitioners. The NPVP also has the advantage of highlighting the abandonment values for each project. Abandoning a project after initiation may result in a significant cash inflow and may help to reduce perceived project-specific risk and improve project liquidity. Using the conventional NPV, as a single investment appraisal tool, may ignore some vital financial aspects of a capital investment opportunity, such as abandonment values that are often overlooked.

8

The FAP Model – The Project Risk Profile (PRP)

Risk can result from many sources, and it is often difficult to identify the drivers of risk in respect of each capital project being evaluated. Although risk will have financial implications, project-specific risk is not limited to errors in forecasting cashflows but the much wider risk 'elements' of a capital project. These risk elements are the 'elephant traps' which, in the case of significant strategic projects, have the potential to destroy the firm. The recognition of such elements is a subjective and judgmental process that will be influenced by the prejudices and biases of each manager involved in the evaluation process.

The term 'risk', used in this book, relates to 'uncertain events', which if they occur will have a negative impact on the outcome of a project. The term relates more to uncertainty than the conventional definition of risk used in the financial literature. Following the pioneering work of Markowitz[1] and others, risk has been regarded as a statistical property of a distribution of outcomes. Markowitz also introduced the idea that risk is also an interdependent phenomenon, which can only be understood within the portfolio of relationships (financial or otherwise) in which it occurs. In the FAP model, through the PRP, greater reliance is placed upon well-informed and rigorously scrutinised judgement rather than just upon the formal statistical estimates of future outcomes. Support for this approach is derived from the risk management literature. Williams[2] argues that risk is the combination of individual uncertainties that have an impact on the overall objectives of the project.

The problem with many project-specific risks is that they have unique qualities that can only be 'valued' on a judgmental basis, as no past data are available to determine, with any degree of statistical accuracy, their true impact or probability of occurrence.

The assessment of risk is subjective – and it is doubtful that it can be otherwise – in that it is dependent on management's attitude to, and acceptance of, the perceived risk of each project. The managerial assessment of risk is also likely to have a strong Bayesian element. This means that managers, when assessing the likelihood of future perils occurring, will bring into play their 'prior' beliefs and a range of conditional assessments of the evidence available to them before forming their judgement about the risk attaching to particular outcomes.

Risk questions that need to be answered

Within the FAP framework, project-specific risk must be identified and evaluated for all major projects. Knowing where this risk is coming from is important, together with its relevance to the overall success or otherwise of the project. Is the organisation risk-averse or risk-taking? How much risk is it prepared to accept? It is only the 'acceptable' project-specific risk – the risk that will eventually have to be managed – that needs to be evaluated in greater detail, for if a project has an unacceptable level of risk (after all reasonable steps have been taken to reduce its risks) then it should be rejected. What are the specific risks for each project? It is only by the identification of such risks that management will be in a position to take the necessary steps to reduce them. Managers can only 'manage' those risks that they believe exist. Which manager will be in control of each specific risk, and what is his/her individual level of project risk exposure?

The FAP protocol seeks to place a 'value' on each type of risk to highlight the level of its 'importance' in determining the overall risk of the project. The assessment of the level of performance focuses on two issues: (i) the risk exposure for any particular managerial area of responsibility, and (ii) the level of risk impact irrespective of the probability of occurrence. We also need to know, the variation in the particular risk probability and impact values given by managers. This will highlight the differences in the opinions and risk values (RVs) of the managers involved.

A logical approach to risk evaluation therefore focuses on a project's key risk elements. The risk management protocol embedded within the FAP model is aimed at the project definition stage and the outcome is the creation of the profile (PRP). The PRP is a vital component of the FAP protocol.

The project risk profile

Under the PRP (Figure 8.1), the identification and evaluation of project-specific risks are undertaken by an evaluation team (which includes

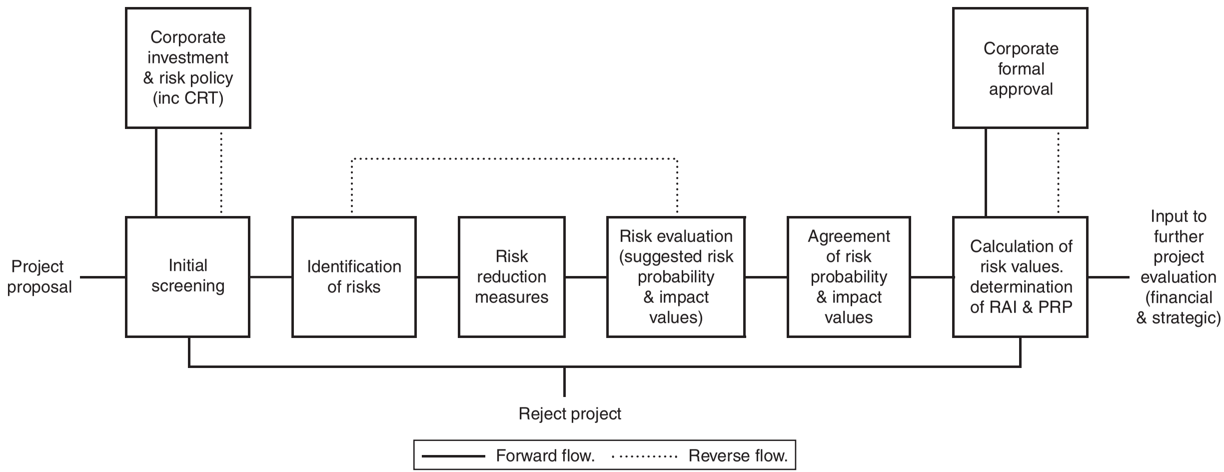

Figure 8.1 The PRP sub-model

functional managers), the members who form an integral part of the FAP protocol. Each team member has the duty of identifying risk elements for his/her own specific area of responsibility. Risk elements are perceived adverse events that may occur and not just ill-defined areas of difficulty. Once the perceived key risk elements have been identified, the next stage is to take steps to mitigate their impact. At this stage in the protocol, the option to reduce the size of the project or the option to delay the project may be considered where some element of extreme risk is identified. When this has been achieved, the formal quantification stage of the protocol can be undertaken which involves *suggestion*, *evaluation*, and *agreement* on the determination of departmental (managerial areas of responsibility) RVs, from which a risk area index (RAI) and risk profiles are determined. This is a continuous cycle of activity that is only completed when a consensus on the RVs is reached.

Estimating the Risk Area Index

The RAI part of the PRP is arrived at as a consensus of management opinion on the basis of their interpretation of the perceived level of project-specific risk. This index is shown as a negative figure on a scale of 0 to –10, with zero representing no risk, –5 being average risk, and –10 being high risk. Showing the RAI as a negative figure highlights the threat posed by the risk elements concerned. Risk is negative because it presents a threat. Uncertainty, in itself, only becomes a risk when there is the possibility of a negative outcome.[3] Only the negative aspect of uncertainty is taken into account when assessing project-specific risk. Project-specific risk can therefore only be assessed through managerial judgement based on, among other things, experience and the perception of risk factors. It is of necessity a subjective judgement.

The corporate risk threshold

Within the PRP, it is only the ‘acceptable’ level of risk that is of interest, for if the final level of risk (after taking any measures to reduce or eliminate it) is unacceptable to the company, the project should be rejected. It is therefore necessary to introduce a ‘corporate risk threshold’ (CRT) into the calculations, so that the scale of 0 to –10 refers only to the ‘degrees of acceptable risk’, with –10 representing the greatest risk the company is prepared to accept from any single risk area. The CRT represents the cut-off point for risk acceptance.

If the impact on a project from a specific risk element is estimated at 55 (on a scale of 0 to 100, with 100 representing the greatest impact) and, after applying a disutility factor,[4] has a disutility impact value

(DIV) of 60 and its probability of occurrence is estimated at 10%, then the level of 'importance' is calculated as 60 × 10% = 6. A CRT level of 'importance' is calculated by determining the maximum amount of project-specific risk, from any single risk area, that a company will accept. By adopting a CRT level of, say six, a company is in effect saying that it is prepared to accept all projects that have either a 10% probability of incurring an impact with a DIV of 60 on a project from a specific risk area, or a 60% probability of incurring an impact with a DIV of 10, or any other similar combination. Each company will have its own level of risk acceptance, and therefore its own CRT level, depending on whether it is a risk taker or is risk averse.

Within the FAP protocol, risk areas are first identified, matched to areas of managerial responsibility, giving each functional manager (who is a member of the project evaluation team) the opportunity to identify and evaluate the risk characteristics specific to his/her own field of expertise, for each project being evaluated. This, with a corporate risk overview, will give a dynamic and structured approach to the protocol of risk identification and assessment.

Risk areas might include the following for examples

Production

What is the level of risk associated with the actual production of the product? Will the performance of the new machinery be as expected in relation to output and so on? Will the final product meet the specification and quality standards required? Consideration will also have to be given to any risks involving production manning, skill levels, retraining, labour relations and the effect of change, and so on.

Marketing and sales

What is the risk that the product will not meet the marketing sales expectations?

Environment

What are the risks of any downside effects from waste and noise pollution or possible breach of any environmental legislation, and so on?

Personnel

What effect will any change in working practices have on morale, working and trade union relationships, and so on?

Transport

What effects will the project have on transportation? – this could be a key issue if a company is changing over to a just-in-time (JIT) philosophy with greater demands on logistics.

It is important to appreciate that some project-specific risk elements will have a greater impact on a project's outcome than others; not all risks will have an equal level of importance. The 'importance' of an individual project-specific risk element can be measured as the product of the probability of risk occurrence and its impact on a project's outcome, where impact is defined as the perceived magnitude (after applying a disutility factor) of the consequences in relation to project failure that the particular risk will have on the project as a whole. Some risk elements will have a high probability of occurrence and a low level of impact, while, conversely, other risk elements will have a low level of probability but a high level of impact.

An RV for each risk area is calculated as the sum of the total levels of risk 'importance' for that area, expressed in relation to the company's CRT level of importance, multiplied by –10. For example, if the total level of importance for all the key risk elements for a particular risk area is 3 and the CRT level is 6, the RV, for that risk area, would then be calculated as $3/6 \times -10 = -5$.

A firm will therefore have a number of risk areas that will match the areas of managerial responsibility. Within each risk area, for each project under consideration, there will be a number of key risk elements. An overall RV is arrived at for each area. This produces a profile of RVs for each project. From this profile, the highest RV for any single risk area becomes the RAI for that project. This protocol recognises the well-known principle that a chain is only as strong as its weakest link. The RAI identifies the weakest link, as being the most vulnerable (the area with the highest risk potential) risk area. The profile structure of the PRP also makes it possible to identify the risk element that has the highest level of impact on the project; and, by recording each team member's perception of the level of risk impact and its probability of occurrence, calculating the coefficient of variation to measure the variance in the perceived risk impact and probability values is also possible. This will give a measure of the 'degree of disagreement'.[5] The PRP therefore produces a risk profile for each proposed project.

The protocol for determining a project's PRP

Proposals (in the form of a proposal document) in respect of capital projects recommended are sent to each member of the project evaluation team. Team members are then requested to identify the project's key risk elements relating to their own individual areas of responsibility – risks that they have control and influence over. Having considered the ways in which these risks may be reduced, each member then determines for their own areas suggested values for the likely probability of the risk actually occurring, and the level of *impact* that each risk will have on the project as a whole. Once this is done, a risk evaluation document is completed by each member of the team and sent back to the team facilitator.

The risk evaluation document will include a full description of the key risk elements and a narrative of the way that each risk will impact on the project, together with the team member's initial suggested risk probability and impact values. When all the risk evaluation documents from each of the team members have been completed, the team facilitator collates the information and sends a report to each member of the team asking him/her to evaluate the risks which have been identified by recording his/her own suggested risk 'probability' and 'impact' values on a copy of the report. This information is then sent back to the team facilitator.

At this stage in the protocol, each member is only aware of 'identifying' manager's RVs, which may naturally influence his/her own suggested values. It is important that at this initial stage in the protocol, the team facilitator identifies similar risks, so that duplication is avoided, and also seeks any clarification necessary to avoid confusion. In order to achieve a greater understanding of the perceived risk elements, the team facilitator may wish to have a meeting with certain or all of the team members on an individual basis. The information is again collated by the team facilitator and sent back to each team member.

At this stage, all team members are fully acquainted with the other team members' opinions and risk 'values'. Each team member is then given the opportunity to revise his or her own 'values' in the light of this additional information. The information documents are then returned to the team facilitator for the final time.

The initial part of the PRP protocol, as described above, adopts what may be called a quasi-Delphi approach, where each member identifies and considers project-specific risk elements without reference to any of the other members in the team and submits his/her individual opinions and values to the team facilitator. Under the conventional Delphi approach, the 'experts' who form the Delphi panel work in complete anonymity, but with respect to the PRP protocol, the team members who constitute the Delphi panel are known to each other, hence the term 'quasi-Delphi' is used. The team facilitator collates the risk information and solicits 'values' from each member of the team. After the final round of the quasi-Delphi protocol, quasi-anonymity gives way to formal debate and open discussion.

As the appraisal team is made up of members from diverse disciplines and with varied demographic characteristics, their views are likely to differ. It is therefore important through a process of debate[6] to examine and synthesise these differences, if the team is to perform effectively.[7] In the absence of debate, the team may not be able to draw on the diverse knowledge and experiences of its members.[8] The team facilitator, in order to achieve maximum effectiveness through controlled conflict, will moderate the amount and intensity of the debate protocol.

It is after the initial stages in the proceedings that the first meeting (at which the key risk aspects of the project proposal are considered) of the project evaluation team is convened. At this meeting, new risk elements may be introduced and appropriate steps are taken to reduce the level of project-specific risk wherever possible. Members are then given the opportunity to revise their original suggested risk 'probability' and 'impact' values. Behavioural aggregation of knowledge – involving interaction and contact between the team members – allows for the sharing of knowledge and produces a common information base that reduces differences and improves predictions.

Having identified the major risk elements of a project, it is important that steps are taken to minimise this risk exposure. As the importance attached to a given risk element is a product of the probability of the risk occurring and the impact of that risk on the project if it does occur, then risk may be lessened by (a) reducing the probability of occurrence or (b) by reducing the level of its impact (which may include the option of transferring the risk to a third party). It is the level of the 'minimised' risk that is eventually given an RV.

When this phase of the protocol has been performed, those team members, whose risk probability and impact values are in the upper or lower quartiles, are asked to justify their position. It is during this intermediate stage in the protocol that members may again wish to amend their 'values' based on new information and debate. When all the arguments have been voiced and final values arrived at, the team facilitator will deem that a consensus has been achieved. From this the agreed risk, 'probability' and 'impact' values are calculated using a weighted average approach. Merkhofer[9] argues that this approach can improve assessment quality. He also supports the validity of aggregating subjective probability distributions representing the opinions of a number of 'experts'.

The PRP protocol places a responsibility on each team member to identify the key elements of project-specific risk relating to their own area of responsibility, but places a team responsibility on arriving at the RV. By adopting a 'team' rather than an 'individual' management approach to the determination of the RV, the influence of the excessive risk-averse and risk-taking members of the team will be reduced and a more unified corporate risk approach achieved.

Although team members will be influenced by the values given by the team member in whose area the particular key risk elements are associated, recognising that each member will have an 'opinion' of his/her own on the magnitude of the risk involved is important. In this way, a profile, which is placed on record, of each member's opinions and RVs is achieved. The final stage in the PRP protocol is for the team facilitator to calculate the RVs (after applying a disutility factor to the various risk impact values) and determine an RAI together with highlighting the most 'extreme' risk impact and value. The highest degree of variance in the team members' opinions is also identified.

This 'risk profile' is considered by the evaluation team and, if agreed, accepted as their interpretation of the profile of the perceived project-specific risks. If the risk profile is unacceptable, then the team may consider two further options of either reducing the size of the project or delaying the project. Both these options have value in reducing the perceived risk of a proposed project. The team will also be conscious of the project's 'abandonment values', as identified through the NPVP part of the FAP model, which will also influence their risk awareness.

Calculation of the PRP

As an illustrative example, a project involving new manufacturing equipment is considered by a chemical company's project evaluation team. This team consists of a team facilitator (whose main task is to administer the FAP protocol) and five team members (functional managers/executives) from production, marketing and sales, environment (this is seen as an important managerial area of responsibility in relation to risk, because of the company's involvement in toxic chemicals), personnel, and transport. Having identified the various risk elements, the final 'suggested' risk probability and impact values are determined and the 'agreed' values are calculated for each risk element using a weighted average approach. The team member responsible for a particular risk area has, in this example, a weight of '2' applied to their suggested values within that area, while all other team members have no weighting applied to his/her suggested values. This weighting is applied to give greater importance to the values suggested by the team member responsible for the particular risk area – it is to reflect his/her higher level of expertise and responsibility in that area. Although a weight of '2' is used in the example, a higher weight may be applied if greater emphasis on the value is required. Table 8.1 shows the risk probability and impact values for four of the project's key risk elements. The shaded boxes highlight the values suggested by the team member responsible for the risk area in which the specific risk is associated. Applied to the impact value is a disutility factor, to reflect the greater importance of high impact values and arrive at a DIV.

The probability of risk occurrence is based on values between 0 and 1, where '1' represents 100% probability of occurrence (0.10 therefore represents 10% probability of occurrence). The impact of risk on a project is measured on a scale of 0 to 100, with '100' representing the greatest impact. The 'agreed' values are the weighted averages of the individual team member's 'suggested' values. It is also possible to calculate the variance in the team members' perceived values for risk impact and probability of occurrence. This gives a measure of the level of any difference in opinions and perceptions between each manager, and highlights the level of variance in the values used to calculate the 'agreed values'. This variance may represent a further attribute to the level of risk, in that the importance of risk may be understated. The highest risk impact value will also be highlighted at this stage.

Risk 'importance' is calculated as the product of the probability of the specific risk occurring and its DIV. The RV for a specific risk area is calculated as the sum of the total levels of risk 'importance', expressed in relation to the company's CRT level of importance (which in the example has been agreed at 7), multiplied by -10 (representing the highest level of risk acceptability). In the example (Table 8.2), it can be seen that with respect to the production risk area, the risk importance rating is calculated at 1.844; and, by applying a CRT level of 7 to this figure, an RV for this area of -2.63 ($1.844/7 \times -10$) is established. An RV is then arrived at for each risk area, from which the risk profile for the project is established.

From this profile, the highest area RV becomes the RAI for the project (Table 8.3). In the example, the RAI is -4.17, which is in the environmental risk area. The RAI identifies the highest risk area and therefore,

Table 8.1 Calculation of the 'agreed' risk probability and impact values for key risk elements

	Management areas of responsibility – Suggested values					Agreed values	Variance
	Production	**Marketing and sales**	**Environment**	**Personnel**	**Transport**		
Risk area [Production]. *Risk element (1)*							
Probability	0.12	0.14	0.11	0.07	0.09	0.11	22.8%
Impact	9	8	8	11	10	9.17	12.7%
*DIV**	9.13	8.08	8.08	11.26	10.19	9.31	
Risk area [Production]. *Risk element (2)*							
Probability	0.14	0.12	0.10	0.14	0.18	0.14	19.5%
Impact	7	6	4	5	6	5.83	18.2%
DIV	7.05	6.02	4	5	6.02	5.86	
Risk area [Marketing and sales]. *Risk element (3)*							
Probability	0.09	0.07	0.06	0.09	0.10	0.08	17.9%
Impact	14	12	13	17	16	14.0	12.9%
DIV	14.57	12.36	13.46	18.02	16.85	14.60	
Risk area [Marketing and sales]. *Risk element (4)*							
Probability	0.10	0.07	0.08	0.09	0.07	0.08	14.2%
Impact	11	12	10	8	8	10.17	16.3%
DIV	11.26	12.36	10.19	8.08	8.08	10.39	

*The DIV is arrived at after applying a disutility factor to the suggested impact value.
The shaded boxes highlight the values suggested by the manager responsible for the risk area.
The *degree of variance* is the *coefficient of variation* in the suggested values.
This protocol continues for all other risk areas, e.g. Environmental, Personnel, and Transport.

Table 8.2 Calculation of departmental RV

Details of key risk elements	Probability of risk occurrence [0–1]	Disutility impact value [0–100]	'Importance' rating/RV
Production			
risk element (1)	0.11	9.31	1.024
risk element (2)	0.14	5.86	0.820
Total 'importance' rating.			1.844
Agreed production risk area RV [1.844/7 × −10]			RV −2.63
Marketing and sales			
risk element (3)	0.08	14.6	1.168
risk element (4)	0.08	10.39	0.831
Total 'importance' rating.			1.999
Agreed marketing and sales risk area RV [1.999/7 × −10]			RV −2.86
Environment			
risk element (5)	0.15	11.71	1.757
risk element (6)	0.14	8.3	1.162
Total 'importance' rating.			2.919
Agreed environment risk area RV [2.919/7 × −10]			RV −4.17
Personnel			
risk element (7)	0.07	7.92	0.554
risk element (8)	0.09	11.47	1.032
Total 'importance' rating.			1.586
Agreed personnel risk area RV [1.586/7 × −10]			RV −2.27
Transport			
risk element (9)	0.05	7.67	0.384
risk element (10)	0.04	3.83	0.153
Total 'importance' rating.			0.537
Agreed transport risk area RV [0.537/7 × −10]			RV −0.77

Note: To arrive at an RV for each risk area, a CRT (which in this example is 7) factor is applied to the total 'importance' rating for each area, so that only 'acceptable' risk is measured on the RAI scale of 0 to −10.

by definition, all other risk areas will either be equal to or lower than this RAI.

In the example, the highest 'agreed' impact value is 14.0 (with a degree of variance of 12.9% and a DIV of 14.6), which is in respect of risk element (3) in the marketing and sales risk area. The highest variance

Table 8.3 Determination of the PRP

Risk areas (Departments/areas of responsibility)	**Risk value/profile**
Production	−2.63
Marketing and sales	−2.86
Environment	−4.17
Personnel	−2.27
Transport	−0.77
Project *risk area index* [Environment]	RAI = −4. 17
The project RAI is based on the highest risk value shown in the risk profile.	
Extreme 'risk impact' – area and value:	Marketing & Sales: 14.0 (Variance 12.9%)
Highest variance	Prob: Risk element 1. Production. 22.8%

(22.8%), regarding the 'suggested values' is in respect of the probability values for risk element (1) in the production risk area.

Judgmental heuristics under uncertainty

As outlined in Chapter 1, there is a general belief that if a person is made aware (possibly through recent familiarity) of a particular kind of risk, this will influence his or her perception of the risk impact and probability values for any future similar risk. In such cases, individuals will perceive a higher risk impact and probability value than would statistically be 'correct'. Tversky and Kahneman[10] refer to this type of judgemental heuristic as 'availability', where probability and impact values are influenced by the ease in which the instance or occurrence can be brought to mind.

The PRP protocol, however, overcomes, to some extent, the influence of this problem through using a weighted average to calculate the risk probability and impact values suggested by each team member. The effect of over valuing these factors by 'familiarity' is therefore reduced.[11] Extreme values are also identified at the initial quasi-Delphi stage, giving the team facilitator the opportunity to question the members concerned. During the group discussion stage, those members with values in the upper echelon limits are also asked to explain their reasoning behind such values – again, this should identify any familiarity bias. Any resulting bias from this kind of judgemental heuristic may also be reduced by the fact that a member's RVs, in whose area of responsibility the risk is likely to occur, are given a higher weighting than the values from other members. Occasionally, however, this may accentuate the problem, a factor which the team facilitator should consider in his or her management of the protocol.

There is also a danger in the PRP protocol at the quasi-Delphi stage that managers will be influenced by the actual description of the risk in the procedural documentation. Over dramatic (or possibly under dramatic) descriptions may lead to over (or under) valuations of risk impact and probability. Tversky and Kahneman refer to this type of judgemental heuristic as 'representativeness', which may lead to biases through 'insensitivity or predictability'. Tversky and Kahneman argue, 'if people predict solely in terms of the favorableness of the description, their predictions will be insensitive to the reliability of the evidence and to the expected accuracy of the prediction'. It is therefore important that the FAP team facilitator is aware of this problem, so as to avoid any valuation bias. However, the discussion stage of the protocol will also help to reduce such a bias, when risks are more accurately defined through the exchange of information.

Conclusion

Using the PRP, project-specific risk is identified and evaluated in a pragmatic and meaningful way. While corporate management will determine the level of risk the organisation is prepared to accept, the identification and evaluation of risk are left to the investment appraisal team.

The advantage of the PRP is that first of all 'risk areas' have to be identified, these areas will correspond with the areas of managerial responsibility so that an individual manager can be identified as 'responsible' for identifying and managing project-specific risks within that area. The PRP also highlights the area in which the highest risk 'impact' is present and also measures the size of variances in the team members' values for risk probability and impact. This gives a fuller risk profile of a proposed project.

It is important that managers keep sight of both the probability of a risk occurring and its impact (and not just the 'expected value' of $R = P \times I$); applying a disutility factor to the impact values is also necessary, as the effect of a high probability/low impact risk will be quite different from that of a low probability/high impact risk. Managers need to have a greater knowledge and understanding of the 'extreme' risk events. It is for these reasons that the PRP model adopts a profile approach – presenting a risk profile for each project. The team facilitator needs to appreciate the possible bias that may be created through selective exposure (i.e. the team) and cognitive availability – 'the mental process by which managers bring certain information to mind'.[12]

Risk identification, analysis, and evaluation can play an important communication role and give a greater insight into a project. Adopting the formal approach of the PRP ensures consistency and uniformity in the assessment of project-specific risk. It also encourages management to consider ways in which this risk can be reduced or eliminated.

A further strength of the PRP is in the actual protocol adopted to arrive at the various 'values' that it uses. The protocol recognises that there are times when a quasi-Delphi approach (where individual team members are free to give their own views and opinions without being influenced by other team members) is necessary. Open debate is then allowed to follow. In this way, possibly, a greater number of key risk elements can be identified. The protocol is also structured to reduce the possibility of groupthink while encouraging decision comprehensiveness.

The PRP protocol creates a disciplinary approach to risk evaluation that should give management a better understanding of the risks involved, for as Hertz[13] states, 'The discipline of thinking through the uncertainties of the problem will in itself help to ensure improvement in making investment choices. For to understand uncertainty and risk is to understand the key business problem – and key business opportunity'.

9

The FAP Model – The Strategic Index (SI)

Within many projects, there are strategic benefits that may defy financial quantification. Nevertheless, as any firm will be naturally concerned with building and sustaining its competitive strategic position and advantage, such benefits should be identified and evaluated and included in the appraisal process. What is proposed is the strategic index (SI) model which aims at doing just that – identifying and evaluating key strategic benefits. The SI highlights the strategic benefits looked for in each capital investment opportunity and then goes on to assess their 'worth' within each project.

The SI consists of a formal and structured analysis of a project's key strategic benefits from both corporate and functional management perspectives. Strategic benefits are those benefits that create competitive advantage or contribute to corporate survival, and which cannot be expressed adequately in financial terms. The SI aims to identify and measure the 'level of importance' of the strategic benefits for each project and provide support to the investment decision-making process.

Briefly, the SI adopts a similar team based as the NPVP and PRP to arrive at project strategic score values (PSSVs) for each strategic benefit identified by management. By applying a corporate ranking (CR) to the PSSVs, a unique SI is then achieved. This ranking is necessary, as not all strategic benefits will be of equal importance to the organisation. The ranking procedure recognises the fact that although a given strategic benefit may be apparent, it may not rank highly in terms of its perceived importance to the business. The CRs are represented by a value between 1 and 10 and may be calculated by using a pairwise approach to check for consistency in ranking. The SI is measured on a positive scale of

0 to 10, with 0 representing no strategic value, and 10 representing the highest strategic level.

Reviewing all projects from a corporate strategic viewpoint gives management the opportunity to evaluate the extent that they fit in with the overall corporate and business strategy of the organisation. If, on investigation, there is no tangible 'strategic fit' with a given project, and providing there is no legal, moral, or regulatory case for its acceptance, then it should be considered for outright rejection. The corporate and detailed business strategy of an organisation must, however, be reviewed on a regular basis and should not be inflexible, but should be adaptable to take advantage of new situations and opportunities while still following some overarching strategic plan. It is therefore only those projects that, on preliminary investigation, are shown to be compatible with the corporate and business strategy of the organisation, which will be considered in greater detail, and their strategic benefits being identified and evaluated.

It is important that if a strategic benefit has been given a financial value, and as a result has been included in the NPVP, it is not also included in the SI – as this would result in the benefit being accounted for twice. The SI includes all those strategic benefits identified in a project for which a financial value is not readily obtainable. It therefore reduces the possibility of financial error resulting from the likelihood of assigning an over- or under-optimistic financial value to a strategic benefit.

As a company builds up its experience with the use of the SI model, it will also build up a profile of 'key' strategic benefits against which all projects are assessed. In this way, provided a 'value' is attributed to each key strategic benefit with respect to each project under consideration (so like is compared with like), ranking all projects by their SI levels will be possible.

The protocol for determining a project's SI

Stage one

The initial stage of the protocol (Figure 9.1) is generally conducted by corporate management – those responsible for the determination of the corporate and business strategy of the organisation. In small- and some medium-sized organisations, this corporate team may also act as the investment appraisal team, while in large organisations, some or all of the corporate members may not be directly involved. Once this stage is completed, it is not undertaken again until either it has become

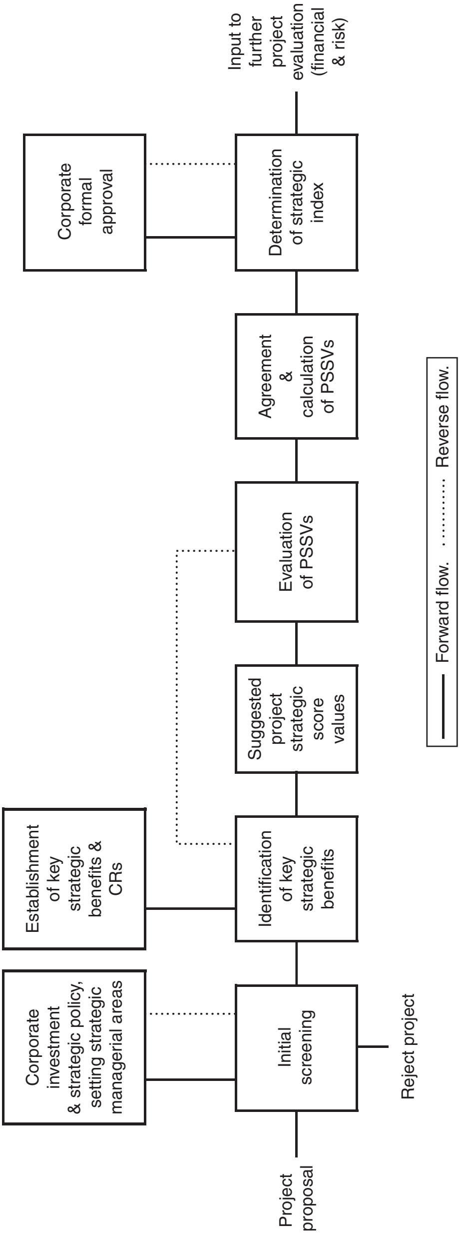

Figure 9.1 The SI sub-model

apparent that because of an initial omission there is a need to revisit the exercise or because there has been a significant shift in corporate or business strategy.

First, the key strategic benefits looked for in all capital projects are identified by corporate management and a CR of '10' is given to the most important benefit(s). All other key strategic benefits are then assessed against the CR of the 'first' key strategic benefit by determining how less important they are to the organisation in relation to that benefit. The benefits are then assessed against each other, in order to determine a consistency of ranking – in other words, to make sure that the *laws of transitivity* have not been violated.

This first stage of the protocol adopts a group discussion approach, where corporate managers meet, exchange their views, and come up with a group CR value for each of the key strategic benefits identified. It is important in this process of consensus building that corporate managers fully interact at this stage in the protocol and arrive at an agreement in a manner similar to that which they adopt for all other key corporate decisions. Corporate management must present a unified front, with all members seen to be in full agreement.

To give an example of establishing the CRs, the corporate management of an organisation have identified five key strategic benefits (A, B, C, D, and E) looked for in each potential project. Benefit 'B' is given a CR of 10 and 'E' (which is seen to be equal to 'B') is also given a ranking of 10 – these are the most important strategic benefits. Strategic benefit 'A' is seen to be just less valuable to the firm than both 'B' and 'E' and is given a ranking of nine, and 'C' is seen as having a significantly lower ranking than both 'B' and 'E' and is given a ranking of six. Strategic benefit 'D' is given a ranking of five, and is seen to be one point less than 'C', four points less than 'A', and five points less than both 'B' or 'E'. In order to achieve a consistency of ranking, 'C' has to be assessed to be of less value than 'A' by a magnitude of three and 'B' and 'E' by a magnitude of four and greater value than 'D' by a magnitude of one. The CRs have been expressed in terms of whole numbers; in practice, in order to take into account small differences in the value of various strategic benefits, it may be appropriate to calculate values to one decimal place. However, greater precision than this is unlikely to be necessary.

An alternative approach to the calculation of the CRs, especially where a large number of key strategic benefits are involved, is to use the pairwise matrix.[1] Although the Eigen-Vector method for calculating the required weights is preferred, using the 'geometric average' of the entries in each row of the matrix is a good enough approximation and also lends itself to the use of a simple calculator.[2] The 'normalised weights' arrived at through this method can then be used to represent the CRs.

It may be beneficial to classify key strategic benefits to managerial areas of responsibility, so that an individual appraisal team member can be specifically 'associated' with that benefit. Such benefits may then be categorised into one of a number of 'key strategic benefit areas'.

It is essential that the investment appraisal team members are made fully aware of the corporate and business strategy of the organisation and that they are given precise details of the key strategic benefits looked for in each project by corporate management. Any changes in the strategic direction of the organisation should be communicated promptly to this team.

Stage two

The second part of the SI protocol is conducted by the investment appraisal team, which is an essential feature of the overall FAP protocol. The investment appraisal team includes key functional managers of the organisation together with an 'independent' team facilitator (group leader). It has already been emphasised that it is vital that the team facilitator is unbiased towards the project and can act impartially. Again, it is emphasised that the team facilitator should not be confused with a 'project champion', a person who is heavily committed towards its acceptance.

To expand further on the concept of the FAP protocol, it is emphasised that while the composition of the capital investment appraisal team is important in respect of the members' varied managerial disciplines, it is also essential to appreciate that their other demographic characteristics (basic social attributes such as age, sex, educational standard, length of service, etc.) may also be important and may account for the fact that some teams will be more efficient than others. Also of importance is the level of managerial diversity in relation to the PEU – the degree to which managers differ in their perception of the uncertainty of their organisation's external business environment. It is therefore the responsibility of the team facilitator to aim at maximising team efficiency based on their knowledge of the demographic characteristics of the team members. This attention to diversity in the appraisal team is important to ensure that idiosyncratic perceptions are minimised in the evaluation process. As with previous stages in the FAP protocol, the objective is to maximise the emergence of 'core rationality' through a team based as opposed to individual judgement.

Each member of the investment appraisal team, on receipt of the SI part of the project proposal document, is asked by the team facilitator to identify the specific strategic benefits appertaining to the project under consideration with particular reference to their own area of responsibility. This should not deter an individual team member from identifying and commenting on other key strategic benefits that he/she feels are relevant to the project. Identifying, at this stage, as many as possible of the key strategic benefits is important. Key strategic benefits are those strategic benefits that corporate management has determined are the ones that should be considered when evaluating all projects. Each member will also give a short narrative on the strategic benefits identified. This part of the protocol (as in the PRP) adopts a quasi-Delphi approach where each team member identifies strategic benefits without reference to any of the other members. A degree of anonymity is required to give managers the freedom to express their own opinions without, at this stage, being directly influenced by other members. At this first stage in the quasi-Delphi process, the aim is to identify and explain the strategic benefits offered by the project, ones that conform to the key strategic benefits looked for in all projects. Several Delphi probes can be made, until the team facilitator is satisfied that as many as possible of the key strategic benefits have been identified and incorporated in the judgement process.

The team facilitator, who may ask for clarification from individual team members where necessary and make 'clarification' comments, collates this information. The SI documents are then returned to the team members for them to enter their 'suggested' PSSVs, based on their own perceptions and opinions, for each of the key strategic benefits. The PSSV represents the existence level, within a given project, of a particular strategic benefit. The higher the perceived level of existence, the greater the score. PSSVs are again scored on a scale of 0 to 10, with 10 representing the highest score. At this stage, the 'identifier' of the strategic benefits is not revealed.

Once each member has entered their PSSVs for each of the key strategic benefits, the SI documents are returned to the team facilitator, who will collate the information. The documents, with the collated information and any further comments made by the team facilitator, are then sent back to the team members. Each team member will now be aware of all the other members suggested PSSVs. At this stage, the second and final stage of the quasi-Delphi process, the aim is to 'score' the key strategic benefits looked for in each project, without any direct contact between team members except through the mediation of the team facilitator.

Following the quasi-Delphi process, the team facilitator calls the first strategic meeting of the investment appraisal team to discuss the key strategic benefits. At this meeting, team members are asked to justify their own 'suggested' score values. While each team member will be 'guided' by the more experienced functional manager regarding strategic benefits that may be specifically relevant to the functional manager's area of responsibility, each member will, however, have a personal view regarding each of these benefits. Once all the members have made their views known, the debate that follows will naturally influence members' earlier views, allowing them to revise their score values if they so wish. At this stage, new strategic benefits may also be included in the evaluation.

While a team member may be influenced by the views expressed by other members, a member should not be coerced into revising their values. The protocol adopted together with the independent control of the team facilitator will reduce the possibility of 'groupthink' developing. This process of debate and re-evaluation will continue until all views have been expressed and the team facilitator is satisfied that 'final' PSSVs have been reached. A record is made of the final PSSVs suggested by each member and a weighted average approach is adopted to arrive at an 'agreed' PSSV for each key strategic benefit.

Stage three

Once the identification and evaluation stage has been completed and PSSVs agreed, the final stage is to calculate the SI for the project. The SI is the weighted average of the CRs and PSSVs. This is then sent, by the team facilitator, to each member of the appraisal team for his/her final approval. It is not appropriate at this stage to allow members the opportunity to 'manipulate' the SI figure but merely to seek acceptance of the protocol and commitment to its outcome.

The CR of a particular key strategic benefit will be the same for all projects; it is only the individual PSSVs that may vary with each project. The PSSV for each key strategic benefit will vary according to the value each manager places upon that benefit in the context of the project being considered. It is these unique strategic values that produce a distinctive SI for each project.

Comments on the SI protocol

As outlined earlier, there are three generally accepted methods of estimating judgemental values from more than one manager:

(i) Through group discussion, where managers meet, exchange views, and come to a group value – a TMT consensus approach.
(ii) By pooling of individual values, where managers supply their values individually, which are then combined in some way to arrive at a single value. A variation of the pooling method is the nominal group technique which does allow a limited amount of discussion.
(iii) The Delphi approach, where individual managers are asked to supply their own values and assumptions which are then reviewed by a group facilitator and returned to the managers for their further consideration until a consensus value is reached – usually using some kind of weighted average approach. Under this method, the managers never meet to discuss their individual views but interact through the group facilitator.

In the SI model, the protocol for determining the CRs uses a TMT consensus approach (group discussion), while the determination of the individual values placed on the key strategic benefits uses a combination of all the above methods.

Conflict within the team is constructively managed as members are permitted, or even encouraged, to revise their original strategic benefit values taking into account views (which have to be supported by succinct debate) of other members involved in the process. Where group dissensus exits, Simons[3] (who first coined the term to describe divergent perceptions and the opposite of consensus) argues that active debate will moderate the process, resulting in dissensus having a positive impact rather than being destructive if debate is not encouraged. Dissensus is, by definition, a form of conflict, and conflict is necessary to stimulate thought and understanding in the decision-making process.[4] It is therefore important that a team approach, which encourages active debate, is an integral part of any strategic benefit analysis.

It may be that those team members whose strategic benefit values are at the extreme ends of the range have access to information that is not generally known to the team as a whole. In such circumstances, when this knowledge is shared with other team members it may well influence some members to revise their 'values'. On the other hand, some members may have extreme opinions that are based on misunderstanding or ignorance. In these circumstances, when such members are required to explain their position for their extremity, clarification and information from other team members may stimulate a 'rethink'. Through this interaction and reaction approach, the whole process of the structured FAP protocol (with respect to both the PRP and SI) results in a more fully informed and therefore qualitative superior decision-making than that possible when managers, no matter how senior, attempt to make such decisions on their own. The process of debate allows the team to capitalise on its constitutional strength by highlighting different perspectives that may otherwise be neglected. The whole protocol may take a number of sessions for managers to develop their final judgement on the strategic values associated with given projects. However, it is left to the team facilitator finally to draw this part of the protocol to a conclusion, when all views have been considered.

The interaction of managers in this protocol allows individual questions to be raised with immediate reactions from the team as a whole, thus fostering a greater in-depth analysis and stimulating thought and understanding of the strategic benefits concerned. The importance of this approach is that a record of each individual manager's final estimate of the project's strategic score values is made and, while this may be influenced by other managers' views, it is still based on each manager's own individual judgement. This is not a consensus value in the true sense of the word, as it recognises the differences in each manager's interpretations of the values attached to given strategic benefits. The perceptions of each manager to the values arrived at might often be different. There is therefore no one 'correct' value. Nevertheless, an agreed consensus – through accepting the differences of opinion in each manager – is reached on the final values put forward.

The part of the FAP protocol concerned with arriving at the SI is designed to extract 'accurate' judgemental values and to formalise, in a structured way, what would otherwise be an unstructured and subjectively complex problem.

Calculation of a project's SI – A worked example

A company is considering the purchase of some new equipment (project reference ME:784) that will fundamentally change the working practice of its production department and allow the company to be more flexible in its approach to customer needs. Through this flexibility, the company will gain a competitive advantage over its rivals by being able to offer a continuous supply of customised products. The installation of this equipment and the revised working practices will also allow the company to reduce its overall noise and dust extraction levels (although these levels are currently well within the legal limits) and reduce weekend working.

The company will also maintain its market leadership through superior quality and enhanced design of some of its products. Another of the advantages to be derived from this investment is the opportunity to develop and market a new product, which will add to, as well as complement, its existing product lines. While an early entry to the market with this new product may give the company a significant benefit, quantifying in financial terms its precise value is difficult, as it is known that a competitor is also progressing with a similar product and the time scale of their entry to the market is uncertain. Nevertheless, this product will produce a return to the company on a long-term basis at a normal profit margin. It is only the additional benefits that may be achieved through early entry to the marketplace, which are in question.

The total cost of the equipment including installation is £1.3m. The estimated net cashflow from the project has been calculated, and adopting a discount rate of 9%, the project shows an NPV of £145,471.

The project shows a positive NPVP that is only marginally acceptable to the company, but the PRP for the project shows a low-risk profile. The managing director believes, however, that there are other benefits, of a more strategic nature, that are not highlighted in the financial appraisal, but would influence him to be more supportive of the project. Having recently undertaken a strategic review, the company is keen to identify those projects that fit in with its revised corporate and business strategy and produce those strategic benefits for which it is now looking.

The board of directors have established a number of 'key strategic benefits', the level of which they require identifying with respect to all major capital projects. For illustrative purposes, five have been selected: (A) manufacturing flexibility, (B) marketing competitive advantage, (C) organisational, (D) environmental, and (E) logistics, and the CRs given earlier have been adopted. The calculations are based on the pairwise matrix approach and 'normalised weights' are used to represent CRs. The various relationships between the key strategic benefits are shown in the pairwise matrix below the diagonal line, while the reciprocals of these evaluations are shown above the diagonal line in the matrix (Table 9.1).

In order to simplify the illustration of the calculations, the geometric average is used. The row averages are then 'normalised' so that they add

Table 9.1 Corporate ranking of key strategic benefits – Pairwise comparisons

Key strategic benefits	**A**	**B**	**C**	**D**	**E**
A	1	9/10	9/6	9/5	9/10
B	10/9	1	10/6	2	1
C	6/9	6/10	1	6/5	6/10
D	5/9	2	5/6	1	2
E	10/9	1	10/6	2	1

Table 9.2 Corporate ranking of key strategic benefits – Computation of normalised weights

Key strategic benefits	**A**	**B**	**C**	**D**	**E**	**Geometric mean**	**Normalised weights**
A	1	0.9	1.5	1.8	0.9	$2.1870^{1/5} = 1.1694$	0.225
B	1.1111	1	1.6667	2	1	$3.7037^{1/5} = 1.2994$	0.25
C	0.6667	0.6	1	1.2	0.6	$0.2880^{1/5} = 0.7796$	0.15
D	0.5556	0.5	0.8333	1	0.5	$0.1157^{1/5} = 0.6496$	0.125
E	1.1111	1	1.6667	2	1	$3.7037^{1/5} = 1.2994$	0.25
						Totals 5.1974	1.0

up to 1. The normalised figures are then used as the 'weights' to reflect the relative importance, as determined by the board of directors, of the key strategic benefits (Table 9.2).

All major projects are considered by an appraisal team, which consists of an independent team facilitator and senior managers from the following departments: production, marketing and sales, environmental (including public relations), personnel, and transport. Other advisors to the team are co-opted as required.

The appraisal team was asked to investigate, through the use of the SI, the strategic implications of the project under review and identify, within the project, the level of those strategic benefits looked for by the board of directors. During the second stage of the SI protocol, it was revealed that there were strategic benefits that had not been taken into account in the financial appraisal. Some, but not all, by way of illustration are mentioned below.

The production manager argued that the project would offer greater manufacturing flexibility. This increased flexibility, other than reducing costs, would reduce the pressure and associated stress on his production control staff and relieve him of some headaches of production planning, resulting in increased efficiency and a better service to customers. This, he believes, would make him more proactive rather than reactive to customer needs. The production manager makes a final suggestion of a PSSV of 5.4 in respect of strategic benefit 'A'.

The marketing and sales manager, although optimistic in his approach to the investment and opportunities that the project offers to his department, is mildly concerned that some of the inevitable product changes may not be readily acceptable to his customers. He is, however, encouraged by the strategic benefits from maintaining superior quality and enhanced product design, with the possibility of an early entry to the market of a new product. Although he was consulted on the most likely sales forecast (the figures of which were included in the financial appraisal), he knows from experience that sales can go either way. On the one hand, intuitively, he believes there is a possibility that sales could be higher than those forecast, but he could not put a figure on this. This therefore offers a 'benefit' regarding possible increases in sales, which has not been taken into account in the financial appraisal. The marketing and sales manager makes a final suggestion of a PSSV in respect of marketing competitive advantages (key strategic benefit 'B') from the project of 7.5.

Once the project has been completed, it will have a continuing impact on a number of departments within the company, which will require them to work more closely together. The sales department will be required to improve their customer order processing, while the manufacturing department will be required to work to a JIT philosophy. Accounting will be required to adopt an activity-based costing (ABC) approach and supply more timely cost information to both the manufacturing and sales departments. Transport and logistics will have to be more flexible, yet work within a somewhat tight budget. Information processing will become more defined, structured, and interdepartmental. While this organisational change in working practices may present some risks, based on the affect this may have on employee relations as a result of the natural threat perceived by many employees because of the change, this risk is judged by management to be short-term and that there are significant benefits, through organisational change, which can be won in the long-term. It is therefore seen that there will be a small risk, as far as labour relations are concerned, but a higher strategic benefit from organisation change. This change will signal a dynamic reformation in corporate culture and place the company in a better position for the future. The personnel manager suggests a PSSV, in respect of these strategic organisational advantages (key strategic benefit 'C'), of 5.1.

While there are some advantages from an environmental standpoint, and while such issues are reasonably important to the company, this project is only seen as producing minor strategic benefits in this area. The reduction in noise and possible dust pollution, although these areas are not creating a problem presently, can only be beneficial in the development of improved employee and public relations. The environmental manager makes a final suggestion of a PSSV of 2.9 to cover such strategic issues (key strategic benefit 'D').

With respect to the logistical benefits, the transport manager suggests a PSSV of 6.6 (key strategic benefit 'E') and is unmoved by the forceful arguments of his colleagues who suggest that the figure should be higher. It was noted that the transport manager had placed lower PSSVs than his colleagues for all the other strategic benefits.

Following the completion of the second stage of the SI protocol, the final suggested PSSVs, for the various team members' areas of managerial responsibility, were agreed, and the PSSV for each key strategic benefit was calculated (Table 9.3). This calculation uses a weighted average approach giving the team member, in whose area the key strategic benefit is particularly relevant, a weighting of '2', while all other team members values have a weighting of 1. This increased weighting is applied to give a greater influence to the values suggested by the team member, in whose area each key strategic benefit is most applicable – it is to reflect his/her assumed higher level of strategic knowledge and expertise in that area.

The CRs are then applied to the PSSVs, from which the SI is calculated as the weighted average of all the rankings and strategic score values (Table 9.4). In the example, it can be seen that, with respect to the project being evaluated, the SI is 6.0, which, on a scale of 0 to 10, shows an above-average score value and highlights the strategic significance of the project.

The managing director now has a more detailed appreciation of the likely benefits from project ME: 784, which not only shows a positive NPVP (with an NPV of £145,471) but has an SI of 6.0. The project therefore has an above-average strategic value. This multicriteria approach, which when linked to an assessment of project-specific risk (using the PRP protocol), will give more dynamic decision support to the whole area of investment appraisals.

Table 9.3 Calculation of the PSSV

Key strategic benefits	Suggested PSSVs for each team members managerial area of responsibility					
	Production	**Marketing and sales**	**Environment**	**Personnel**	**Transport**	**Agreed PSSV**
Manufacturing flexibility	5.4	5.8	5.2	6.1	4.5	5.4
Marketing competitive advantage	7.3	7.5	7.8	7.1	6.3	7.3
Organisational	5.6	5.7	5.0	5.1	4.7	5.2
Environmental	3.1	3.2	2.9	2.8	2.7	2.9
Logistics	7.4	7.8	8.1	7.4	6.6	7.3

Note: The 'agreed' PSSV for each strategic benefit is the weighted average of all the 'suggested' PSSVs for that benefit. The shaded boxes highlight the values suggested by the team member in whose area the strategic benefit is particularly relevant. This member's values are given a weighting of '2' while all other members' values are given a weighting of '1'. In this example, it can be seen that the team member responsible for the transport area of responsibility has consistently undervalued the strategic benefits, but by adopting a team approach the effect of this downgrading has been minimised.

Table 9.4 Determination of the SI

Key strategic benefits	CR (a)	PSSV (b)	(a) × (b)
Manufacturing flexibility	0.225	5.4	1.215
Marketing competitive advantage	0.25	7.3	1.825
Organisational change	0.15	5.2	0.78
Environmental issues	0.125	2.9	0.3625
Logistics	0.25	7.3	1.825
Totals	1		6.0075
	The strategic index = 6.0075		SI 6.0

Note: The CR is the weight placed on a particular strategic benefit by senior corporate management to reflect its corporate importance in relation to other strategic benefits (see Tables 9.1 and 9.2). Each individual benefit is also given a PSSV, representing the benefit level within a given project (see Table 9.3). The SI is the weighted average of all the rankings and strategic score values.

Conclusion

The conventional financial appraisal models are often incapable of taking into account the strategic benefits from capital investments. Such strategic benefits can therefore only be 'valued' adopting a judgmental approach. The procedure to elicit such judgements from a management team needs to take into account many aspects of decision behaviour to arrive at a consensus outcome.

Regarding some, if not all, companies, the strategic opportunity of a 'growth option' may be included as one of the key strategic benefits looked for in all major capital projects. This particular strategic benefit will be assessed in the same way as all the other strategic benefits that form part of the overall SI.

Although other strategic models (primarily concerning investments in AMT projects) have been developed, the SI is a more general strategic model. The SI model also differs in six main respects to some earlier models:

(i) it forces corporate management to 'identify' key strategic benefits against which all projects will be assessed;
(ii) it adopts a structured protocol aimed at maximising the opportunity for a group consensus to emerge;
(iii) it produces a unique PSSV for each key strategic benefit;
(iv) it applies a CR, which takes into account the relative corporate importance of the key strategic benefits, to the PSSVs;
(v) the SI from one project can be compared with that of other projects; and
(vi) it does not attempt to quantify all strategic benefits in financial terms, which is believed to be a failure of some earlier models.

The SI is therefore, what we call, a 'primary-profile model'.

Using the SI, an organisation may construct a profile of the strategic benefits of all accepted projects. The protocol of determining the SI forces management to look more closely at the strategic issues of each investment opportunity and to quantify formally the perceived significance of a project's key strategic benefits. It improves strategic awareness, for, as Hambrick[5] argues, strategic awareness cannot be assumed to exist, even at high levels in an organisation. A much broader dimension to the appraisal of capital projects is achieved by including the SI as part of the FAP model.

Adopting the SI model will encourage organisations to 'fire on all cylinders' and is one way in which all functions can integrate into an 'effective whole' where management is 'strong enough, persuasive enough, and tough enough to push beyond conventional management thinking and force their organizations to grapple with the deeper challenges prevailing in the increasing competitive world of industry'.[6]

The SI model retains the responsibility for corporate strategy at the highest level within an organisation, while the identification and evaluation of key strategic benefits derived from capital investments are delegated to the investment appraisal team. This not only places the various strategic responsibilities where they should be – at both corporate and functional management levels – but also encourages greater managerial involvement in the strategic affairs of the organisation. An important prerequisite of the SI model is the requirement of corporate management to formulate a corporate and business strategy and to identify key strategic benefits looked for in each investment opportunity. It also encourages senior management to be more explicit in the development of corporate and business strategy, so there is a greater understanding of what the organisation's strategy is. This fosters greater awareness of strategic issues and goals and should lead to a more focused top management team – with all members pulling in the same direction.

10
Summary Comments on the FAP Model

As a prelude to our discussion of the application of the FAP model through a case study, we will take the opportunity in this chapter to summarise some of the main features of the FAP model as an aid to management decision-making in the appraisal of capital projects.

The FAP model is made up of the three sub-models, the NPVP, the PRP, and the SI, which are brought together through the FAP protocol (Figure 10.1). The NPVP is concerned with financial appraisal, the PRP with risk assessment, and the SI with the strategic evaluation of the project proposal. The FAP model therefore evaluates a capital project from a financial, risk, and strategic viewpoint. It is a multi-attribute information model based on a profiling concept and is therefore more dynamic in its approach than many existing conventional investment appraisal models.

Under the FAP model, the financial evaluation of each project is achieved through the NPVP which extends the conventional NPV by incorporating the DPB, the DPBI, and the MGR, into a financial profile of each investment opportunity. It addresses the two important financial issues when evaluating capital projects. First, it measures the economic return from each project, thus identifying those projects that are beneficial to the long-term interests of the shareholders/owners through the increase of shareholder value. Secondly, it measures a project's time-risk and liquidity (after taking into account the time-value of money). The NPVP also highlights the abandonment values for the first three years of a project's life and thus produces a complete financial profile for each project.

Using the PRP, project-specific risks are identified and evaluated in a practical way. While corporate management set the level of risk the organisation is prepared to accept, through the CRT, the identification

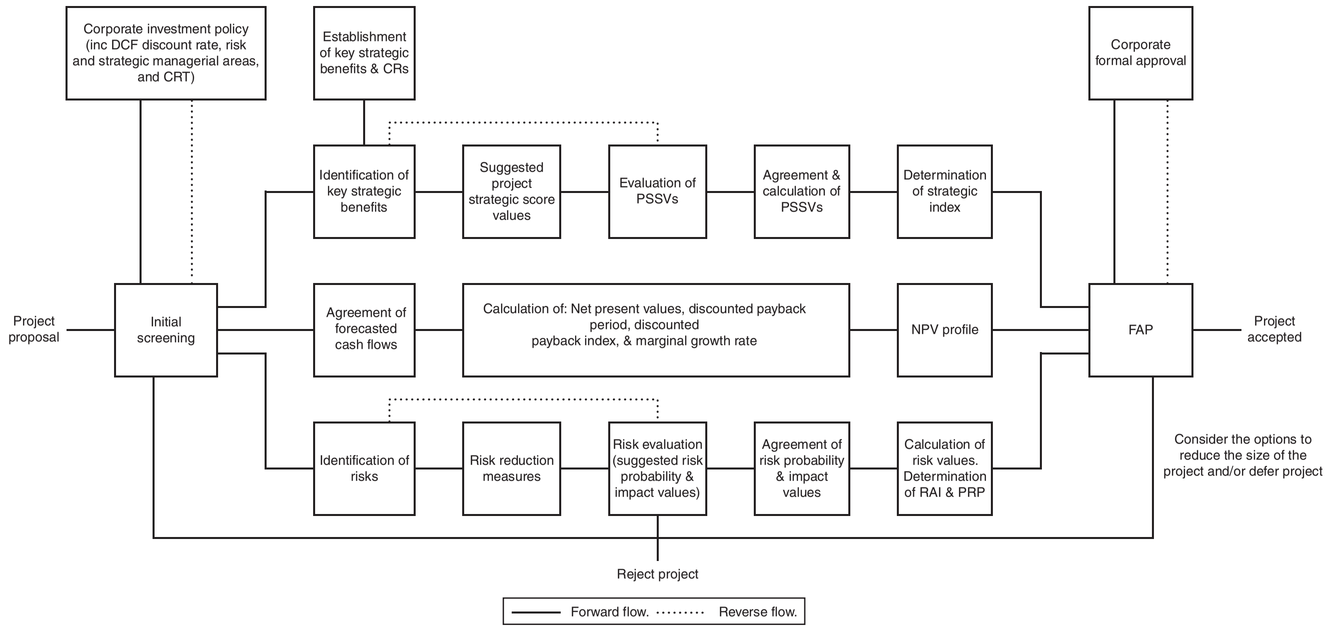

Figure 10.1 The FAP model

and evaluation of each project's specific risks are the responsibilities of the investment appraisal team.

An important feature of the PRP is that 'risk areas' are established which correspond to the areas of managerial responsibility, so individual managers become responsible for identifying and controlling the risks in their own area of accountability. In this way, risk is managed more effectively and the level of risk under the control of each manager can be monitored.

Within the PRP, a separation is made between the estimation of a specific risk occurring and its impact (and not just the 'expected value' of $R = P \times I$). We also propose a disutility factor which is applied to the respective impact values (so that $R = P \times DIV$), recognising that in most situations the effect of a high probability/low impact assessment will be quite different from that of low probability/high impact. Managers also need to have a greater knowledge and understanding of possible 'extreme' risk events. It is for these reasons that the PRP adopts a profiling approach, presenting a risk profile for each project.

The SI maintains the responsibility for corporate and business strategy at the highest level within an organisation, while the identification and evaluation of key strategic benefits looked for in each capital investment are delegated to the investment appraisal team. This not only puts responsibility together with accountability of strategic decision-making but also encourages greater managerial involvement in the strategic affairs of the organisation.

An important prerequisite of the SI is the requirement of corporate management to formulate a corporate and business strategy and to identify key strategic benefits in each capital investment opportunity. It also encourages the senior management to be more explicit in the development of strategy and thus encouraging a greater understanding of the organisation's strategy in a holistic sense. Experience suggests that it is unwise to assume that even senior management are aware of their organisation's corporate or business strategy.[1]

Thus the SI sub-model fosters greater awareness of strategic issues and goals and should lead to a more focused top management team (TMT), with all members pulling in the same direction. The final result is to produce a unique SI for each project.

An important characteristic of the FAP model is the dynamic 'protocol' employed to obtain the information through judgemental values used in the model. It recognises that there are times when a quasi-Delphi approach (where individual team members are free to give their own views and opinions without being influenced by other team members) is necessary. Open debate is then allowed to follow. In this way, an opportunity is created for a greater number of strategic benefits and risk factors to be evaluated. The protocol is also structured to reduce the possibility of groupthink,[2] combat the problem of judgemental heuristics under uncertainty,[3] and encourage decision comprehensiveness through a multicriteria approach.

The three sub-models that make up the FAP model are to a great extent self-contained and can be used to supplement other investment appraisal approaches. The greater synergy, however, is achieved by bringing them together into the FAP model.

Advantages of the FAP model

One of the advantages of the FAP model is that it is conceptually simple in its approach, yet produces a meaningful profile of a proposed capital investment's utility to the firm. It also takes into account not only the financial aspects of a given project but also the risk and strategic factors, which may influence the outcome of the decision. Although the PRP and SI are to a large extent subjectively determined by management, the FAP approach does force management to take a structured and calculated view of such issues.

Some projects may possibly be rejected outright because they are too risky or they do not fit in with the overall corporate strategy of an organisation but, under the FAP model, no project will be rejected solely because of an adverse financial evaluation. The FAP model permits the creation of an overall profile of the financial, risk, and strategic elements of a project and a project will be accepted or rejected after taking into account the results of this profiling process. The various sub-models within the FAP model take into account the important real 'options' available to management, including the options of deferment, growth, reduction and abandonment. The management literature supports the use of a balanced (profile) approach,[4] as adopted by the FAP model.

There will always be some projects that, because of their very nature (e.g. legally mandatory projects in respect of environmental or personnel issues), do not produce an adequate financial return but must be undertaken in some form or other. It is important that such projects are not merely accepted irrespective of the costs or benefits associated with them. The FAP model encourages the search for and evaluation of alternatives, which offer a more satisfactory trade-off between cost and benefit. A detailed appraisal, through the use of the FAP model, should be undertaken for all major projects; otherwise an organisation will not be aware of the full implications of their investment decisions.

Recording, on a continuing basis, the FAPs for each accepted project will make it possible for an organisation to produce an overall capital investment profile which can be monitored against its capital budgeting strategy.

The FAP model, through its protocol, adopts a dynamic and pragmatic approach to the evaluation of capital projects and allows management to use their own judgemental skills in a structured way. One of its main advantages is that it forces management to look more closely at the risk and strategic factors embedded in an investment opportunity. By quantifying these factors, managers are more likely to give them serious consideration, especially if a record is kept of the values they each place upon the factors concerned. The FAP model brings together the three aspects of an investment decision – financial, risk, and strategic – and, as a result, benefits from the synergy of so doing. However, the managerial strength of the FAP model lies not only in the synergy of having these three elements included in one overarching procedure but in the actual protocol adopted to arrive at the various 'values' which are used in the model.

Farragher *et al.*[5] argue that effective allocation of a company's capital resources is a key to corporate success and that most theorists hold that effective allocation can best be achieved with a sophisticated capital investment process. They also argue that a sophisticated process is one that will enhance the probability of making good investments by helping ensure that corporate strategy is followed, that all investment opportunities are considered appropriately and consistently, and that the counterproductive political aspect of informal, ad hoc decision-making is minimised. The FAP model falls within this broad definition and in their terms would qualify as a sophisticated capital investment process, or as we prefer to call it a 'protocol', the use of which should result in the effective allocation of a company's capital resources and ultimately its corporate success.

The evaluation of the three areas of finance, risk, and strategic benefits may not in itself be novel – research addressing some aspects of them is well established in the literature. What is relatively novel, however, is the integration of them into one pragmatic investment appraisal model – the FAP model. The FAP model places great importance on the evaluation protocol as a vital attribute of any efficient capital investment appraisal model.

The FAP model as an aid to management decision-making

The FAP model is an aid to management decision-making and not a substitute for it. One feature that distinguishes the successful companies from the less successful is the ability of their senior management to take appropriate judgemental strategic decisions. It is therefore important that any investment decision tools used by management should be sufficiently flexible and robust to guide management in making the right decisions. However, it must be remembered that it is management that will take the decision and who will be responsible for the consequences of that decision. No decision tool can take that responsibility away. One important characteristic of the FAP model is its ability to allow management the creativity of decision-making, as well as giving them both a framework and the flexibility to effectively deploy their judgmental skills. Investment decisions should not be based on financial criteria alone but should take a much wider perspective that embraces risk and strategic factors.

By adopting the FAP approach, managers will have a broader and more flexible financial, risk, and strategic base to help make such important investment decisions. It also forces management to take a consistent approach to the appraisal of investments in new capital assets, irrespective of whether the project is a traditional cost reduction or machine replacement project, or an investment in new technology, with its greater complexity and strategic implications.

The adoption of a management team approach to investment appraisal, through the FAP protocol, not only enhances the information base, upon which decisions are made, but will also result in greater managerial commitment to a project. Managers who are left out of the decision-making process and are not asked to contribute to a particular decision may become alienated to that decision. This alienation may result in a lack of motivation and project commitment on their part, if they are later asked to become involved in a project after the decision has been made. It is therefore important to seek management participation at an early stage in the project selection process.

By taking a pragmatic and protocol approach, the FAP model divorces itself, in some respects, from the more conceptual and theoretical models while still retaining their economic and analytical rationale. As the model is simple in its nature, yet provides meaningful information, it should be easily understandable by all areas of management and be applied on a routine basis for all major projects.

The FAP model is especially appropriate for medium-sized organisations who at the present time may rely too heavily on management intuition, believing that the existing investment appraisal techniques are, perhaps, unsuitable. This is not to play down management intuition but to reduce the need for what, in reality, may only be guesswork, by producing a more detailed and structured information base to be used in the decision-making process.

Although the FAP model is suitable for most capital investment appraisal situations, there will always be 'special circumstances' which require special consideration. These situations, which are often difficult to predict, will reveal themselves by their very unusual nature, and management must act accordingly. This is neither criticism of the FAP model nor undermining of our claim that it is a 'universally acceptable model', but to highlight that unusual situations often require unusual approaches.

When considering investment in capital projects, it is argued that a firm should produce better results through improved decision-making as a result of adopting more sophisticated capital appraisal techniques. It is also argued that the more sophisticated the capital project being considered, the more sophisticated the appraisal methods used in its evaluation. The literature presents arguments both for and against the use of sophisticated capital budgeting techniques and their link to improved company performance. There is, however, some indication that improved organisational performance is achieved when an economic and strategic approach to business decision-making is adopted.[6] This approach is an integral part of the FAP model.

The literature[7] suggests that some successful firms will go through a period of reduced effort, less structured, and more intuitive decision-making until the point is reached where market pressure forces a more rational and exhaustive approach upon its decision-making procedures. Conversely, a high-performing firm may have sufficient slack to allow it to survive without rationalising its strategic decision-making processes. However, research does not support this inverse relationship between performance and rationale decision-making.[8] Either way, if the FAP were adopted, we would argue that the disciplines it entails would help to reduce any volatility or idiosyncrasy in decision-making that may otherwise exist. The continued monitoring of past investment acceptance criteria will soon highlight any changes in the acceptance level of crucial strategic investments, or the acceptance of higher risk projects.

There is a school of thought that argues that a project's success or failure depends, in some cases, on factors that are outside the control of management, and that these factors are rarely identifiable at the time the investment decision is being made. Although there will inevitably be factors (such as unexpected changes in legislation and abnormal fluctuations in foreign exchange rates due to unforeseen changes in government policy etc.) outside the control of management, this should not deter management from seeking to improve decision-making based on known information and perceived future events at the time the decision is being made. Arguing, as this school of thought does, that because there are such major influences that can affect the outcome from a project, makes any decision model worthless (as all models are incapable of allowing for these factors), is, in some way, a negative argument. It suffers from the fallacy that weak data does not validate a weak model but rather imprecision in the data demands that we use the best possible tools for handling it and thus help dilute our ignorance. We would argue that the greatest source of risk for any organisation is managerial ignorance. Although decisions can only ever be made on the basis of the information available, by using the FAP model, managers can maximize the use of the information at hand, which will lead them to more informed and ultimately, more successful decision-making.

11

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

The initial evaluation of AT projects, such as AMT and IT, is proving to be extremely difficult, as existing financial models, such as the NPV and the IRR, fail to capture many of the strategic benefits.[1] The literature shows that some companies now tend to use a greater number of appraisal techniques than in the past, but there is no consensus on the actual combination.[2] The literature also shows that individual appraisal models on their own are now inappropriate and a more hybrid approach is required, one that includes both economic and strategic dimensions of choice.[3] As a result of the perceived failure of some of the traditional methods of capital investment appraisal, managers sometimes base their decisions on 'acts of faith' or, as some researchers report, use less sophisticated financial models to evaluate what must be regarded as sophisticated IT projects.[4]

We would argue that it is not necessarily the investment appraisal models that are inappropriate, but the way in which these models are used. It must be acknowledged that any investment appraisal model is in effect an information model – it provides information on which a manager (or group of managers) will make an investment decision. The decision is not made by the model or methodology as the rationalist/positivist advocate. Adopting a rationalist/positivist approach, the project with the highest NPV, IRR, or other measure (financial or otherwise) should be accepted. Such a decision is therefore made on a highly structured basis.

In reality, managers in many cases adopt an unstructured approach, where, through a process of data interpretation and understanding, they are able to make key investment decisions – an approach which has been referred to as 'hermeneutic' (hermeneutics – the science or art of understanding).[5] Under the hermeneutic approach, the decision-maker assimilates a range of metrics combining them in his/her own mind in a manner that is incapable of being formally stated. It is this latter approach that has sometimes been negatively referred to as 'an act of faith' or positively referred to as 'strategic insight'.

The positivist approach to the evaluation of IT projects, which makes excessive emphasis on accounting aspects, may no longer be relevant and that a more 'interpretive' approach should be adopted.[6] Introna[7] supports the case of the so-called 'involved manager', one who is involved in-the-world with a history of engagement and relationships in that world and not as an outside dispassionate observer ('rational manager') taking rational decisions on the basis of objective information. He sees the use of this information as a hermeneutic process of interpretation with decisions and actions being the reification of understanding, which know-how existed from our beginning. This view is supported by Feldman,[8] who states, 'Our being-in-the-world is hermeneutic: we are always and already interpreting. The subject or self never stands separately and independently from the objective world.' Whitley[9] states, 'our understanding of a situation develops and becomes more sophisticated, essentially following a hermeneutic process, whereby each new reading of a situation differs as a result of the accumulated understanding gained from the previous readings'.

This hermeneutic/pragmatic approach to decision-making is very complex and difficult to model as it is non-linear; it therefore rests more in the field of philosophy or psychology than economic/financial theory. This does not mean that we should ignore 'intuition'. Neither does it mean that there is no place for rational structured models. We support the notion that combined rational analysis with intuition produces improved managerial performance.[10] Any new capital investment appraisal model should therefore include a rational analysis of the three main investment attributes of finance, project-specific risk, and strategic benefits together with intuitive decision-making. This is supported by Heemstra and Kusters,[11] who argue that an evaluation model for ICT projects 'should at least account for the financial consequences of the proposed investment. Next, relevant non-financial data should be selected and, last but not least, relevant risk factors should be included.' The model should be an information model 'guiding' management in the right direction to make the best investment decision based on their interpretation of the data. Of necessity, the values will be subjective and judgemental and incorporate both financial data and score values. These data and values should not, however, be reduced to a single score value but be presented in such a way that managers can see the whole picture or profile of the investment opportunity, on which an investment decision can be made. Bannister and Remenyi[12] state that, 'it is in this area that instinct and intuition plays the biggest role . . . it is sometimes argued that this is the most important aspect of decision making'.

No model can take away the responsibility of management to make the final investment decision, but the adoption of a suitable model can however guide management in the right direction to help them make a more informed decision. The decision process is judgemental and subjective relying on instinct and intuition. It is only in this way that successful decision-making can be achieved – a combination of rationality and instinct. This, in our view, is what distinguishes the very successful organisations from the successful.

The FAP model

The FAP model gives a profile of the capital investment on which management will assess the 'value' of the project from a financial, strategic, and risk perspective, while the IT score[13] guides management in the selection of the actual supplier(s) to be used.

The basic FAP model is made up of the three sub-models, the NPVP, the PRP, and the SI, which are brought together through the FAP protocol. It is a multi-attribute information model based on a profile concept. In this chapter, we introduce a fourth dimension to the basic FAP model – the IT score. The IT score focuses on the following seven key IT-specific factors: platform neutrality and interoperability, scalability, adaptability, security, reliability, customer support, and ease of use. It is similar, in some respects, to the SI in that it requires corporate management to place a weighting on the various IT factors, reflecting the level of importance of such factors, while allowing the investment appraisal team to 'value' these factors in relation to the supplier(s) being considered.

An important characteristic of the FAP model is the dynamic 'process' employed to obtain the information through judgemental values used in the model. It recognises that there are times when a quasi-Delphi approach is necessary. Open debate is then allowed to follow. In this way, possibly, a greater number of strategic benefits and risk factors can be identified and evaluated. The process is also structured to identify and reduce the impact of groupthink[14] to combat the problem of judgemental heuristics under uncertainty[15] and at the same time encouraging decision comprehensiveness through a multi-criteria approach. The whole FAP protocol is aimed at achieving a practical discourse which, as Habermas[16] states, 'insures that all concerned in principle take part, *freely and equally*, in a cooperative search for truth, where *nothing coerces* anyone except the force of the better argument'. The process aims 'to develop an environment where people are not only able to engage in reflective judgement, but are also willing to re-visit their views and beliefs and to conceive of new possibilities'.[17] One of the advantages of the FAP model is that it is simple in its concept, yet produces a meaningful profile of a proposed capital investment's utility. The model incorporates both rational and hermeneutic paradigms.

In this chapter, the FAP model is illustrated through a detailed action/experimental research approach applying the model to an ICT project within a professional organisation.[18]

The research involved eight meetings with corporate management or the management investment appraisal team, seven telephone calls, and 42 emails. The basic research questions were the following:

(i) How did the organisation evaluate capital projects at the current time?
(ii) Did they perceive their existing procedures to be adequate?
(iii) Can a 'project champion' adversely affect the investment decision?
(iv) Will the possible adverse influence of 'groupthink' be reduced by adopting the FAP model?
(v) Did the management team understand the reasoning behind the FAP model?
(vi) Did the FAP model give a better understanding of the ICT project and its evaluation? Would the organisation use the FAP model again?

Case study

The research was undertaken at The Association of International Accountants (AIA), which is one of six statutorily Recognised Qualifying Bodies (ROBs) in the United Kingdom for company auditors under the Companies Act 1989. The governing body of the Association is its 'Council of Management'. The Council is effectively the Association's 'Board of Directors' and is responsible for determining policy and for management of the business of the Association. The Council is headed by the President and Chairman. The Secretariat, or the Head Office of the Association, is controlled by the Chief Executive, who is responsible for the operation of the organisation.

Challenges and concerns facing the Association

The Association needs to build on its current success by satisfying the high expectations of both existing and prospective students and members and providing a high-level service within the accountancy profession. To provide continued and sustained growth, the Association also needs to maximise revenues from current and new membership. Although the current services provided by the Association are well received by its membership, there are growing expectations from its members that exceed the information communications technology systems capability.

The ICT project

In order to address these concerns, it was proposed that the Association improves its ICT systems by purchasing new computer hardware and software together with new database facilities. The Association decided that two suppliers would be required, (i) hardware and software, and (ii) database. The software would be a combination of 'package' and 'customised', while the database would be 'customised'.

Evaluating the project using the FAP model

The project was evaluated by a capital investment appraisal team that consisted of an external independent team facilitator and five senior managers: Technical, Marketing and Public Relations, Administration, Accounting and Finance, and Examinations. The team was given the responsibility for carrying out the FAP analysis for this project.

The Chief Executive of the Association together with the Director of Administration and other senior executives agreed five key strategic benefits, against which all future capital projects would be assessed.

(A) *Recognition and status* – statutory recognition and standing within the profession.
(B) *Growth* – membership recruitment.
(C) *Service to members* – satisfying members' needs.
(D) *Promotion* – awareness.
(E) *Organisational efficiency* – portraying an efficient organisation.

While all the strategic benefits were very important to the Association, strategic benefit (B) was deemed by corporate management to be of highest importance and was given the maximum CR of 10. Benefits (A), (C), and (D) were the next in line of importance and were given a CR of 9, while benefit (E) was given a CR of 8. The significance of the CR will be discussed in detail later in the chapter.

With respect to the assessment of the project's specific risk, the Association established five risk management areas of responsibility (which were represented by the five members of the appraisal team) and determined a CRT rating of 9.5. This is discussed in more detail later in the chapter.

As the CRT represents the cut-off point for risk acceptance with respect to individual management areas of risk responsibility, it was decided to ascertain the level of individual risk that each member of the appraisal team and a number of directors/council members were prepared to accept. From this data, a CRT was determined from the arithmetical mean of all the values obtained.[19]

The Association also accepted the notion of applying a weighting to the risk impact values, to take into account the greater 'perceived importance' of higher impact values. A weighting formula, based on previous research, to be applied to the calculation of the appropriate DIVs was therefore accepted.[20]

We argue that there will come a point, when the risk probability is so high, that a particular risk should be regarded as 'certain to occur', and appropriate action taken. In some cases, where the risk has a predetermined financial consequence, it may be treated as a 'cost' and included in the cashflows of the project.

The determination of an appropriate discount rate to be used in DCF calculations is the subject of ongoing debate.[21] On the basis that the Association is a non-profit making organisation and has a large surplus of funds, it was agreed that the discount rate to be used in the NPVP calculations should be based on the marginal interest rate received, which was calculated at 4%.

The total capital cost (based on the two recommended suppliers) of the project was £181,479, (discounted value £179,400), while the estimated scrap value of the IT equipment, and so on, at the end of its useful life of ten years was zero.

The FAP protocol

As stated earlier in the chapter, an important characteristic of the FAP model is the dynamic 'protocol' employed to obtain information through judgemental values. It recognises that there are times when a quasi-Delphi approach is necessary. Quasi-anonymity, where team members are known to each other, but their statements, arguments and comments are still anonymous thus allowing objectivity and emotive neutrality[22] to some extent, was achieved during the quasi-Delphi stages of both the PRP and SI process, by allocating confidential managerial area numbers to each team member, [Examinations (Management Area 1), Technical (Management Area 2), Administration (Management Area 3), Marketing and Public Relations (Management Area 4), and Accounting and Finance (Management Area 5)]. In the FAP model, open debate is then allowed to follow. This two-tier process (quasi-Delphi approach followed by open debate) creates an opportunity for risk factors and strategic benefits to be evaluated in a more meaningful way. The protocol is also structured to reduce the possibility of groupthink and encourage decision comprehensiveness through a multi-criteria approach.

The initial screening of the project was based on a 'strategic needs to do basis' and the capital and running costs of the various hardware/software and database alternatives. Discounted cashflow figures for the project were not considered during this initial screening process. The initial screening resulted in three suppliers being considered for the hardware/software and three suppliers for the database.

The director of administration arrived at the cashflows for the project. The positive cashflows were based on cost savings and expected additional revenue. The abandonment values were agreed between the director of administration and the technical manager. As there were no significant differences between the capital costs and annual running costs of each supplier alternative, it was agreed that an NPVP would only be prepared for the recommended (based on the outcome of the IT Score analysis) suppliers.

The IT score

The IT score analysis was prepared by the director of administration and the technical manager, based on seven key IT-specific factors.[23] The technical manager determined the factor weightings for these factors, while the agreed scores for each of the various alternatives were a joint decision. The respective IT scores for the three prospective hardware/software suppliers were, Supplier HS1 (50.75), Supplier HS2 (46.75), and Supplier HS3 (42.95), while the IT scores for the three prospective database suppliers were respectively, Supplier D1 (56.95), Supplier D2 (46.2), and Supplier D3 (39.95). The optimum selection

Table 11.1 The IT score (based on optimum selection: Supplier HS1 and Supplier D1)

Key IT-specific factors	**Weighting (a)**	**Average agreed scores 0–10 (b)**	**(a) × (b)**
1. Platform neutrality and interoperability	0.7	5.5	3.85
2. Scalability	0.95	9.5	9.03
3. Adaptability	0.85	8.5	7.23
4. Security	1.0	9	9.00
5. Reliability	1.0	9	9.00
6. Customer support	0.9	8.5	7.65
7. Ease of use	0.9	9	8.10
		The IT score [(53.86/63) × 100] = 53.86 (85.5%)	

Note: The weighting in column (a) reflects the level of importance of each IT-specific factor as determined by the senior IT specialist(s) within the Association. The agreed score values in column (b) were determined by an IT team and are specific to the project under review. The IT Score represents the total of the weighted score values with a maximum possibility of 63.

was then identified as Supplier HS1 (hardware/software) and Supplier D1 (database), showing an average IT score of 53.86 or 85.5% (Table 11.1). The NPVP calculations were based on this suggestion.

The Net Present Value Profile

The NPVP extends the NPV by incorporating the DPB, the DPBI, and the MGR, into a financial profile of an investment opportunity. With respect to this project, it can be seen that, with a discounted capital cost of £179,400 and total discounted net cash inflows of £388,003, it has a positive NPV of £208,603 Table 11.2). The DPB for the project = 4.843 years (four years and ten months). The DPBI is 2.1628. The final stage in the progression of the NPVP is the calculation of the MGR where MGR = $[(\text{DPBI})^{1/n} - 1] \times 100$. The MGR is the marginal return on a project after discounting the cash inflows at the cost of capital. For this project, the MGR is 8.02% $\{[(\text{DPBI})^{1/n} - 1] \times 100 = [(2.1628)^{1/10} - 1] \times 100\}$ and is a measure of the project's rate of *net* return. The NPVP also considers the abandonment option. Highlighting AVs during the project evaluation stage will further assist with the measurement of liquidity and also gives a wider perspective to the consideration of project-specific risk. The Association has determined to highlight each project's AVs for the first three years of its life, and that if the average of the discounted AVs

Table 11.2 NPVP – Calculation of the NPVP

Capital cost of project £181,479 (historic cost) £179,400 (discounted cost)						
Year	**Project net cashflow**				**Abandonment option**	
	Net cashflow £	**Discount factor 4%**	**PV of net cashflows £**	**Cumulative net PV £**	**Abandonment values £**	**Discounted AVs £**
0	126,783	1.0000	–126,783	–126,783		
1	14,122	0.9615	13,057	–113,726	8,231	7,914
2	28,202	0.9246	26,076	–87,650	2,744	2,537
3	32,210	0.8890	28,635	–59,015	0	0
4	36,346	0.8548	31,068	–27,947		
5	40,346	0.8219	33,160	5,213		
6	47,022	0.7903	37,161	42,374		
7	51,343	0.7599	39,016	81,390		
8	55,796	0.7307	40,770	122,160		
9	60,395	0.7026	42,434	164,594		
10	65,140	0.6756	44,009	208,603		
Totals	304,139		208,603			

Abandonment option:

The company has determined to highlight each project's AVs for the first three years of its life, and that if the average of the discounted AVs over this period is greater than 30% of the project's original capital cost, it will classify the AVs as '**high**', between 30% and 10% as '**medium**', and below 10% as **low**.

Notes: The capital cost of the project is £181,479 (£126,783 payable in year 0, and £54,696 payable in year 1. Discounted value of capital cost is £179,400. The positive cash flows for year 1 are £68,818. (£68,818–£54,696 = £14,122).
Calculations:
NPV: **£208,603**.
DPB = 4 + (27,947/33,160) = **4 years and 10 months**.
DPBI = (£388,003/£179,400) = **2.1628**.
MGR = $[(\text{DPBI})^{1/n} - 1] \times 100 = [(2.1628)^{1/10} - 1] \times 100 =$ **8.02%**.
AV = $[(10451/3)/179,400] \times 100 = 1.94\%$. Classification = **low**.

over this period is greater than 30% of the project's original capital cost, it will classify the AVs as 'high', between 30% and 10% 'medium', and below 10% low. With respect to the current project, the AVs have been classified as '*low*' $\{[(10451/3)/179,400] \times 100 = 1.94\%\}$.

At an early stage in the FAP process the investment appraisal team were informed of the positive results of NPVP.

The Project Risk Profile

The PRP seeks to place a 'value' on each type of project-specific risk to highlight the level of its 'importance' in determining the risk profile of the project overall. The assessment of the level of importance focuses on two issues: (i) the risk exposure for any particular managerial area of responsibility, and (ii) the level of risk impact irrespective of the probability of occurrence. It is also helpful to know what the variation in the particular risk probability and impact values given by managers are. This will highlight the differences in the perception and RVs of the managers involved.

Under the PRP, each team member has the duty of identifying risk elements for his/her own area of responsibility. Risk elements are *perceived adverse events* that may occur and not just *ill-defined areas of difficulty*. Once the perceived key risk elements have been identified, the next stage is to take steps to mitigate their impact. At this stage in the process, the *option* to reduce the size of the project or the *option* to delay the project may be considered where some element of extreme risk is identified. When this has been achieved, the formal quantification stage of the process can be undertaken which involves *suggestion*, *evaluation* and *agreement* on the determination of departmental (managerial areas of responsibility) RVs, from which an RAI and risk profile is determined. This is a continuous cycle of activity that is only completed when a consensus on the RVs is reached.

The PRP process involved four quasi-Delphi rounds and two group meetings. The team facilitator requested each team member to identify and provide detailed information (nature of risk, perceived level of impact, and probability of occurrence) on the key project-specific risks relating to the team member's own area of responsibility. As three of the team members identified two similar risks – (i) losing or corrupting data during conversion from old to new system, and (ii) failure of system to function as planned, see Table 11.3 – the team facilitator decided that a meeting of all the team members was needed to clarify the situation. It was also important to identify who was responsible for controlling individual risk elements.

From the original five risks identified, eight risk elements were established and allocated to four managerial areas of responsibility. It was noted than none of the risk elements had been allocated to management area 4 (Marketing and Public Relations). The four team members, who had been identified as having some 'control' over the risk elements, were asked by the team facilitator to suggest risk probability and impact values, after taking into consideration measures to reduce these risks, for those risks allocated to their own areas of responsibility (second quasi-Delphi round, Table 11.4). The importance of arriving at their own individual values, without consulting any of the other team members, was emphatically emphasised.

At this stage, the only 'values' communicated were those of the individual team member – no member was aware of any other member's

Table 11.3 PRP – Suggested risk probability and impact values – First Delphi round (identification of project-specific risks)

Risk (1) Losing or corrupting data during data conversion from old to new system

	Management area 1	Management area 2	Management area 3	Management area 4	Management area 5
Probability	5%		2%	2%	
Impact	60%		60%	90%	

Comments: There is an opinion that the biggest risk, other than failure of the system, would be lost data during the data conversion stage. Specifically, if contact details and students examination history were lost or incorrect, this would have a serious impact on the examinations section. There are set rules in the way the examinations are set, for example, you must pass all papers in module C before you can take any of module D. If the data did not convert properly, it may not be possible to enter students for the 'correct' examinations, and so on. This would have financial implications, in that all records would have to be checked manually. The switch over to the new IT system will require testing to make sure, for example, addresses and formats are correct after transferring – if this is not successful, it will directly impact on the level of service currently provided to members. From a marketing and PR perspective, the largest risk factor would be the possibility of not being able to provide services to members and students, and so on – for example, the E-News or the Journal. – either through loss of information or being unable to extract the information required. For the E-News, losing E-mail addresses or being unable to establish from the database those who had subscribed to this service.

Risk (2) Failure of system to function as planned

	Management area 1	Management area 2	Management area 3	Management area 4	Management area 5
Probability	15%			2%	10%
Impact	80%			50%	90%

Comments: Failure or delay (see also risk 5) in the IT project would also have a negative impact on the income received, and as the Association uses a cash accounting policy, a delay in the issue of subscription notices will result in a significant loss of reported income. There would be extra costs for re-posting data to old system in case of failure of the project. There may also be a serious disruption to the examinations system. This particular risk element is seen by some as the main area of concern. (See also comments for risk elements 1 and 5.)

Risk (3) Personnel – Possible conflict over user acceptance of new IT skill requirements

	Management area 1	Management area 2	Management area 3	Management area 4	Management area 5
Probability		5%			
Impact		5%			

Comments: While new technologies present a multitude of benefits, they can take more effort to learn. If users were unwilling to accept the need to learn new skills, then there would be a negative effect on the project. User acceptance risks cover hardware, software, and the database.

Risk (4) Database – Possible misunderstanding of bespoke programming requirements between the Association and its suppliers

	Management area 1	Management area 2	Management area 3	Management area 4	Management area 5
Probability		2%			
Impact		7.5%			

Comments: There may be a risk associated with the need to have the new IT system tailored to the Association's way of working. Agreement and understanding with the suppliers on this issue is crucial to prevent increased costs being incurred for additional bespoke programming to the system. Should there be a significant amount of 'tailoring' to the system, this would not only increase the cost of the project but would inevitably raise the question as to whether the chosen solution was in fact the best one.

Risk element (5) Delay of new system coming on line

Probability	20%
Impact	80%

Comments: Delay of the new system coming on line would have a serious impact on both the accounting and professional examination functions. (See also comments on risk 2.)

Note: The values shown are for those team members who identified and 'valued' a particular risk. It can be seen that for risk elements 1 and 2, three team members identified these two risks.

entered 'values'. The team facilitator collated all the information and returned the updated PRP details back to the team members (third quasi-Delphi round). The updated information also included 'comments' made by the team facilitator on the various risk elements. The comments were made to clarify any ambiguous issues. Team members were asked to enter their own risk probability and impact values for the key risk elements 'controlled' by other team members. This information was again collated and used as a basis for the fourth quasi-Delphi round.

At this stage, all team members were knowledgeable of the other team members' opinions and 'values'. This completed the quasi-Delphi stage, following which the second team meeting, to discuss the risk elements, was held.

During this second meeting, team members were invited to comment on the various risk elements and in particular those members whose scores were at the upper or lower ends of the spectrum were asked to justify their position.

An interesting comment, which typified, in some respects, the whole team made by one of the team members at this meeting clearly put a valid perspective on the probability of a particular risk occurring, especially in the examinations area:

> Given that we are very aware of the impact of examinations on our business, I would have imagined that come hell or high water those exams would have gone ahead.
>
> (Marketing and Public Relations)

Table 11.4 PRP – Suggested risk probability and impact values (information received from second Delphi round). Example of document

Risk element (1) *Losing or corrupting data during data conversion from old to new system.*
Comments: The level of impact would be based on additional programming/database resource skills being required to correct data. From the old database, it would be an easy transition to convert the information into XL files, which can then be transferred from approximately five spreadsheets to maybe 50 data tables.

Probability	5%
Impact	10%

Risk element (2) *Failure of system to function as planned.*
Comments: Here we are looking at the system not working as expected after any misunderstandings between the Association and its suppliers have been ironed out and the system is up and running.

Probability	1%
Impact	10%

Risk element (3) *Personnel – Possible conflict over user acceptance of new IT skill requirements.*
Comments: This would not only cover IT and administrative personnel (i.e. software users) but may involve end users such as senior management

Probability	2.5%
Impact	15%

Risk element (4) *Possible misunderstanding of bespoke programming requirements between the Association and its suppliers with respect to all other issues except Accounting and Examinations data.*
Comments: There may be minor problems with any new computer system, but these are usually rectifiable. It is important to explain what is required and receive a signed document from the supplier on the agreed system to reduce any risks from this element.

Probability	2%
Impact	10%

Risk element (5) *Possible misunderstanding of bespoke programming requirements between the Association and its suppliers with respect to Accounting data.*
Comments: There may be minor problems with any new computer system, but these are usually rectifiable. It is important to explain what is required and receive a signed document from the supplier on the agreed system to reduce any risks from this element.

Probability	5%
Impact	40%

Risk element (6) *Delay of the system coming on line – Accounting.*
Comments: This would have a negative affect on cashflow receipts and would result in loss of income from interest received. This may, however, not be a significant risk. Timing of conversion from old to new system is very important together with adequate backup.

Probability	10%
Impact	30%

Risk element (7) *Delay of the system coming on line – Examinations.*
Comments: Delay may result, in the worst-case scenario, in a diet of examinations having to be cancelled with both a loss of income and additional cost to the Association being incurred. An alternative scenario may be if the examinations were delayed by, say, one month, then examination results would also be delayed and students would have less time to prepare for the next stage. This may affect income and student confidence in the Association. Timing of conversion from old to new system is very important together with adequate backup.

Probability	10%
Impact	45%

Risk element (8) *Possible misunderstanding of bespoke programming requirements between the Association and its suppliers with respect to Examinations data.*
Comments: There may be minor problems with any new computer system, but these are usually rectifiable. It is important to explain what is required and receive a signed document from the supplier on the agreed system to reduce any risks from this element.

Probability	5%
Impact	25%

Note: The figures in the third (shaded grey) column are those suggested by the manager responsible for controlling the particular risk – they are for your guidance only. You should include in the second column your own perception of the probability/impact of each risk, without referring to other team members. Ignore the boxes in the second column that are shaded black (this referred to the document that was actually sent out to the team members) as they refer to your own area of risk responsibility and you will be given the opportunity to change these values if you wish later.

After a lively debate (controlled by the team facilitator), involving persuasive argument, conflict, and the introduction of additional information, final risk probability and impact values were arrived at (Table 11.5).

These final values were used to determine the PRP (Tables 11.6–11.8), which showed that the highest risk was in the Accounting Department at –2.51 (on a scale of 0 to –10). The extreme risk impact was in the Examinations Department with respect to risk element 7 at 29.17 (on a scale of 1 to 100) with a degree of variance in the appraisal team members' individual values of 18.21%. The profile also identifies that the highest degree of variance in the values put forward by the appraisal team members was again with respect to risk element 7 in the Examinations Department at 69.66% – this indicates a degree of uncertainty with respect to the probability of this particular risk occurring.

The strategic index

The determination of the strategic importance of the project to the Association was based on an appraisal, through the SI, of the five key

Table 11.5 PRP – Suggested risk probability and impact values – Final after group meeting

	Management area 1	Management area 2	Management area 3	Management area 4	Management area 5
Risk element (1) Losing or corrupting data during data conversion from old to new system					
Probability	5%	2%	3%	3%	5%
Impact	10%	10%	10%	10%	10%
Risk element (2) Failure of system to function as planned					
Probability	3%	2.5%	1%	3%	5%
Impact	10%	10%	10%	10%	15%
Risk element (3) Personnel – Possible conflict over user acceptance of new IT skill requirements					
Probability	5%	10%	2.5%	5%	5%
Impact	15%	15%	15%	10%	20%
Risk element (4) Database – Possible misunderstanding of bespoke programming requirements between the Association and its suppliers with respect to all other issues except Accounting and Examinations data					
Probability	5%	2%	2%	5%	5%
Impact	10%	15%	10%	10%	15%
Risk element (5) Database – Possible misunderstanding of bespoke programming requirements between the Association and its suppliers with respect to Accounting data					
Probability	5%	2%	5%	2%	5%
Impact	30%	20%	10%	25%	30%
Risk element (6) Delay of the system coming on line – Accounting					
Probability	10%	2%	5%	6%	10%
Impact	15%	10%	15%	10%	30%
Risk element (7) Delay of the system coming on line – Examinations					
Probability	3%	2%	3%	3%	10%
Impact	35%	30%	25%	20%	30%
Risk element (8) Database – Possible misunderstanding of bespoke programming requirements between the Association and its suppliers with respect to Examination data					
Probability	5%	5%	3%	2%	5%
Impact	10%	10%	10%	10%	20%

Note: The shaded boxes highlight the values suggested by the manager responsible for the particular risk area.

strategic benefits identified by corporate management and given CRs (Table 11.9). The SI process involved two quasi-Delphi rounds and a final group meeting.

In the first quasi-Delphi round, each team member was asked by the team facilitator (by way of e-mail) to arrive at a score (on a scale

Table 11.6 PRP – Calculation of risk probability and impact values for key risk elements

	Management areas of responsibility – suggested values					Agreed values	Variance
	Management area 1	Management area 2	Management area 3	Management area 4	Management area 5		
Risk element (1) Losing or corrupting data during data conversion from old to new system (Technical)							
Probability	0.05	0.02	0.03	0.03	0.05	**0.033**	33.3
Impact	10	10	10	10	10	10.00	0
*Disutility factor**	1.015	1.015	1.015	1.015	1.015		
*DIV**	10.15	10.15	10.15	10.15	10.15	**10.15**	
Risk element (2) Failure of system to function as planned (Administration)							
Probability	0.03	0.025	0.01	0.03	0.05	**0.026**	44.16
Impact	10	10	10	10	15	10.83	18.18
Disutility factor	1.015	1.015	1.015	1.015	1.023		
DIV	10.15	10.15	10.15	10.15	15.34	**11.01**	
Risk element (3) Personnel – Possible conflict over user acceptance of new IT skill requirements (Administration)							
Probability	0.05	0.1	0.025	0.05	0.05	**0.05**	44.54
Impact	15	15	15	10	20	15	21.08
Disutility factor	1.023	1.023	1.023	1.015	1.031		
DIV	15.34	15.34	15.34	10.15	20.62	**15.36**	
Risk element (4) Database – Possible misunderstanding of bespoke programming requirements between the Association and its suppliers with respect to all other issues except Accounting and Examinations data (Administration)							
Probability	0.05	0.02	0.02	0.05	0.05	**0.035**	38.68
Impact	10	15	10	10	15	11.67	20.41
Disutility factor	1.015	1.023	1.015	1.015	1.023		
DIV	10.15	15.34	10.15	10.15	15.34	**11.88**	
Risk element (5) Database – Possible misunderstanding of bespoke programming requirements between the Association and its suppliers with respect to Accounting data (Accounting)							
Probability	0.05	0.02	0.05	0.02	0.05	**0.04**	38.68

Table 11.6 (Continued)

	Management areas of responsibility – suggested values					Agreed values	Variance
	Management area 1	**Management area 2**	**Management area 3**	**Management area 4**	**Management area 5**		
Impact	30	20	10	25	30	24.17	32.54
Disutility factor	1.048	1.031	1.015	1.039	1.048		
DIV	31.43	20.62	10.15	25.99	31.43	**25.18**	
Risk element (6) Delay of the system coming on line – Accounting (Accounting)							
Probability	0.1	0.02	0.05	0.06	0.1	**0.072**	46.55
Impact	15	10	15	10	30	18.33	45.93
Disutility factor	1.023	1.015	1.023	1.015	1.048		
DIV	15.34	10.15	15.34	10.15	31.43	**18.97**	
Risk element (7) Delay of the system coming on line – Examinations (Examinations)							
Probability	0.03	0.02	0.03	0.03	0.1	**0.04**	69.66
Impact	35	30	25	20	30	29.17	18.21
Disutility factor	1.056	1.048	1.039	1.031	1.048		
DIV	36.97	31.43	25.99	20.62	31.43	**30.57**	
Risk element (8) Database – Possible misunderstanding of bespoke programming requirements between the Association and its suppliers with respect to Examination data (Examinations)							
Probability	0.05	0.05	0.03	0.02	0.05	**0.042**	31.62
Impact	10	10	10	10	20	11.67	33.33
Disutility factor	1.015	1.015	1.015	1.015	1.031		
DIV	10.15	10.15	10.15	10.15	20.62	**11.89**	

Note: *The DIV is arrived at after applying a disutility factor to the suggested impact value. The *variance* is the *coefficient of variation* in the suggested values. The shaded boxes highlight the values suggested by the manager responsible for the particular risk area and whose values have been given a weighting of 2.

Table 11.7 PRP – Calculation of departmental RVs

Details of key risk elements	Probability of risk occurrence [0–1]	DIV of risk on project [0–100]	'Importance' rating: RV
Managerial area 1. Examinations			
Risk element (7)	0.04	30.57	1.22
Risk element (8)	0.042	11.89	0.50
Total 'importance' rating.			1.72
Agreed managerial area 1 RV [$1.72/9.5 \times -10$]			**–1.81**
Managerial area 2: Technical			
Risk element (1)	.033	10.15	0.34
Total 'importance' rating.			0.34
Agreed managerial area 2 RV [$.34/9.5 \times -10$]			**–0.36**
Managerial area 3. Administration			
Risk element (2)	0.026	11.01	0.28
Risk element (3)	0.05	15.36	0.77
Risk element (4)	0.035	11.88	0.42
Total 'importance' rating.			1.47
Agreed managerial area 3 RV [$1.47/9.5 \times -10$]			**–1.55**
Managerial area 4: Marketing and public relations			
No specific risks allocated to this area			n/a
Total 'importance' rating.			n/a
Agreed managerial area 4 RV			**0**
Managerial area 5: Accounting			
Risk element (5)	0.04	25.18	1.01
Risk element (6)	0.072	18.97	1.37
Total 'importance' rating.			2.38
Agreed managerial area 5 RV [$2.38/9.5 \times -10$]			**–2.51**

Note: Within the PRP, it is only the 'acceptable' level of risk that is of interest. It is therefore necessary to introduce a CRT into the calculations, so that the scale of 0 to −10 refers only to the 'degrees of acceptable risk', with −10 representing the greatest risk the company is prepared to accept from any one risk area. The CRT represents the cut-off point for risk acceptance. The CRT in this instance is 9.5.

of 0 to 10) for each of the key strategic benefits and they were also given the opportunity to make comments. The importance of arriving at their own individual score values, without consulting any of the other team members, was again emphatically emphasised. The

Table 11.8 PRP – Determination of the PRP

Risk areas (Departments/areas of responsibility)	**Risk value/profile**
Management Area 1. Examinations	−1.81
Management Area 2. Technical	−0.36
Management Area 3. Administration	−1.55
Management Area 4. Marketing and public relations	0
Management Area 5. Accounting	−2.51
Project Risk Area Index [Accounting]	**RAI −2.51**
The project RAI is based on the highest risk value shown by the risk profile, which for this project is in the accounting risk area (RAI = −2. 51).	
Extreme 'risk impact' area and value:	**Examinations: 29.17 (Variance 18.21%) Risk element 7.**
Highest variance	**Prob: Risk element 7. Examinations. 69.66%**

Note: The administration director (management area 3 – administration) is the project manager and may also be regarded as the 'project champion'. It must be noted that the highest variance [Probability: Risk element 7. Examinations. (69.66%)] reflects the fact that one team member's value was well in excess of any of the other team members.

Table 11.9 SI – Corporate ranking of key strategic benefits/areas on a scale of 1 to 10

Recognition and status (statutory recognition and standing within the profession)	9
Growth (membership recruitment)	10
Service to members (satisfying members needs)	9
Promotion (awareness)	9
Organisational efficiency (portraying an efficient organisation)	8

Note: The rankings were agreed by the chief executive, following discussions with directors/senior executives.

individual scores represented each team member's assessment of the level of benefit offered by the project. The scores (Table 11.10) together with any additional comments made by team members were collated by the team facilitator and become the information base for the second quasi-Delphi round. It was during this stage that all team members became aware of all the other team members scores. During this second stage only one team member made any changes to his/her

Table 11.10 SI – Suggested PSSVs – First Delphi round

Key strategic benefits	**Suggested PSSVs by each team member**				
	Management area 1	**Management area 2**	**Management area 3**	**Management area 4**	**Management area 5**
[A] Recognition and status	0	0	8	7	2
[B] Growth	6	5	9	7	4
[C] Service to members	8	8.5	9.5	8	8
[D] Promotion	0	7	7	6.5	7
[E] Organisational efficiency	7	9	8.5	8.5	8

Comments:
[A] Recognition and Status: While the IT project may at first sight appear to offer no strategic benefit as regard the Association's recognition and status, there is a view that with the advantage of the new IT system, information to support 'recognition' renewal and applications will be more readily available.
[B] Growth: The new system will assist growth, for example, through online membership applications, examination enrolment, and the option of direct payment in local currency.
[C] Service to members: One of the main objectives of the new project is to improve the service to members in all areas and to be more responsive to members needs.
[D] Promotion: Improving WEB facilities may act as a promotional aid as far as both existing and prospective members and students are concerned. It may also increase awareness of the Association among the business and accounting community.
[E] Organisational efficiency: Although the information may be available at present, the new system will enable the Association to extract it in a more efficient, specific, and flexible manner.

scores (Table 11.11). This completed the quasi-Delphi stage, following which the first team meeting, to discuss the key strategic benefits, was held.

During this meeting, team members were invited to comment on the various key strategic benefits and in particular those members whose scores were at the upper or lower ends of the spectrum were asked to justify their position. This meeting allowed those members with widely differing views to express their opinions and justify their position. Just to give an example, the following two comments show the initial conflicting views over strategic element [A] *Recognition and status*:

> From my point of view, a large part of the recognition process is the ability to be able to produce statistics in a format that is able to help us put our case to governing bodies and country bodies worldwide.
> (Administration)

> My vision of gaining recognition and status is far more a political issue rather than the information provided, that's my reason for giving a low score.
>
> (Examinations)

Table 11.11 SI – Suggested PSSVs – Second Delphi round

Key strategic benefits	**Suggested PSSVs by each team member**				
	Management area 1	**Management area 2**	**Management area 3**	**Management area 4**	**Management area 5**
[A] Recognition and status	0	3	8	7	2
[B] Growth	6	5	9	7	4
[C] Service to members	8	8.5	9.5	8	8
[D] Promotion	0	7	7	6.5	7
[E] Organisational efficiency	7	9	8.5	8.5	8

Comments:
[A] Recognition and Status: While the IT project may at first sight appear to offer no strategic benefit as regard the Association's recognition and status, there is a view that with the advantage of the new IT system, information to support 'recognition' renewal and applications will be more readily available. As a result, the project could offer some degree of strategic benefit in this area, but possibly only in a supportive role.
Recognition may be more a matter of politics than anything else. In one instance, for example, where no foreign bodies have been recognised by the local government in that country for 25 years, we have made a number of applications for recognition, would a better software/hardware system have made an impact in this situation? This suggests that the strategic importance of the existing project may not be as high as some may think.
Status reflects the value of the qualification in the market place, and improving status is a long and tortuous path along which many significant facts play an important role – the current project is a good supportive tool in this respect.
While the project itself will not aid recognition, the information that the new system provides will help the recognition process. The old system required this information to be collated manually but with the new system this information will be correlated at the push of a button, speeding up the process.
[B] Growth: The new system will assist growth, for example, through online membership applications, examination enrolment, and the option of direct payment in local currency. As a result, the project should offer some strategic benefit.
[C] Service to members: One of the main objectives of the new project is to improve the service to members in all areas and to be more responsive to members needs. As a result, the project should offer a high degree of strategic benefit in this area.
[D] Promotion: Improving WEB facilities may act as a promotional aid as far as both existing and prospective members and students are concerned. It may also increase awareness of the Association among the business and accounting community. As a result, the project could again offer some degree of strategic benefit in this area in a supportive role.
[E] Organisational efficiency: Although the information may be available at present, the new system will enable the Association to extract it in a more efficient, specific, and flexible manner. As a result, the project should offer some degree of strategic benefit in this area.

Table 11.12 SI – Calculation of the PSSVs – Final after group meeting

Key strategic benefits	Suggested PSSVs for each team members managerial area of responsibility					
	Management area 1	**Management area 2**	**Management area 3**	**Management area 4**	**Management area 5**	**Agreed PSSV**
[A] Recognition and Status	3	3	6	5	2	**3.8**
[B] Growth	6	5	9	5	4	**5.8**
[C] Service to Members	8	8.5	9.5	8	8	**8.4**
[D] Promotion	5	7	7	6.5	7	**6.5**
[E] Organisational efficiency	7	9	8.5	8.5	8	**8.2**

Note: The 'agreed' PSSV for each strategic benefit is the weighted average of all the 'suggested' PSSVs for that benefit.

Table 11.13 SI – Determination of the SI

Key strategic benefits	CR (a)	PSSV (b)	(a) × (b)
[A] Recognition and status	0.20	3.8	**0.76**
[B] Growth	0.22	5.8	**1.28**
[C] Service to members	0.20	8.4	**1.68**
[D] Promotion	0.20	6.5	**1.30**
[E] Organisational efficiency	0.18	8.2	**1.48**
Totals	1.0		**6.50**
		The strategic index	**SI 6.5**

Note: The CR is the weight placed on a particular strategic benefit by senior corporate management to reflect its corporate importance in relation to other strategic benefits. Each individual benefit is also given a PSSV by the appraisal team, representing the benefit level within a given project. The SI is the weighted average of all the rankings and strategic score values.

After a lively debate, final score values for all the strategic benefits were arrived at (Table 11.12).

These final scores, together with the previously determined 'corporate rankings' of the key strategic benefits, were used to arrive at an SI of 6.5 (Table 11.13).

The management team's recommendation – the investment decision

So what does the FAP model show? (Table 11.14). It gives us a profile of four main investment criteria – (1) financial, (2) project-specific risk, (3) strategic importance, and, for this particular type of project, (4) IT-specific factors.

Table 11.14 The FAP

Project: IT – Information communication technology including computer hardware and software	
Basic data	
Capital cost of the project (Discounted £179,400)	£181,479
Cost of capital	4%
Estimated life of project	10
Financial: NPV profile	
NPV	£208,603
DPB	four years and ten Months
DPBI	2.1628
MGR	8.02%
AVs – Classification	Low
Project-specific risk: Project risk profile	
Risk area index [accounting]	–2.51
Extreme 'risk impact': Examinations area 1. Risk element 7	29.17 (Variance 18.21%)
Variance. Probability: Risk element 7. Examinations area 1.	69.66%
Strategic index	6.5
IT score	
Supplier HS1 and supplier D1	53.86 (85.5%)

The financial benefits from the project show a positive NPV of £208,603 with a reasonable PB period for this type of project of just less than five years. The project repays (in discounted terms) just over twice its original cost and has a high MGR of 8.02%, but has a low classification for the abandonment value, which is not uncommon for IT projects. The PRP shows that the highest risk is in the Accounts Department at -2.51, which on a scale of 0 to -10 is relatively low. The extreme risk impact is shown as being in the Examinations Department with respect to risk element 7 at 29.17 (on a scale of 1 to 100) with a degree of variance in the appraisal team members' individual values of 18.21%. The profile also identifies that the highest degree of variance in the values put forward by the appraisal team members was again with respect to risk element 7 in the Examinations Department at 69.66%; this indicates a degree of uncertainty with respect to the probability of this particular risk occurring (as noted in Table 11.6, this variance reflects the fact that one team member's value was well in excess of any of the other team members). The overall project-specific risk, as show by this profile, may be regarded as low. The strategic importance of the project is highlighted by the above-average SI of 6.5 (on a scale of 0 to 10). An overall IT Score of 53.86 gives a high rating of 85.5% – Supplier HS1 (hardware/software), and Supplier D1 (database) – which shows that of the seven important IT-specific factors assessed, a relatively high overall score factor is offered by this project.

A final meeting was held with all the team members taking part. At this meeting (which was structured around a discussion of the evaluation exercise and the information in Table 11.14), the Administration Director summarised the results of the FAP model and stated,

> As you know we really needed to do this project and I am pleased that the model has shown a high strategic value. It is also reassuring to find that the project is financially viable. We have also been made aware of the risk implications of the project and how we can control those risks . . . . I had not appreciated the various 'options' available, such as the abandonment option . . . this certainly puts other perspectives on the project and makes me look at risk in a different way.

After the discussion, it was unanimously agreed that the project should be recommended to the Council for formal acceptance. The Administration Director stated,

> With the information provided by the FAP model and our recommendation it should just be a rubber stamping job.

We argue that this implied that he was very confident in the whole FAP outcome. The project was finally accepted by corporate management.

Discussion

The organisation did not have a formal investment appraisal procedure in place, each project seems to have been 'assessed' on its own merit using a 'must be done' approach linked with 'least cost analysis'. In some cases, where a number of possible suppliers have been involved, projects have been assessed using some kind of score or points system, which did not include any weightings applied to the various factors being considered. It was therefore impossible to compare one factor with another and by adding together the various 'scores' or 'points', a true comparison could not really be obtained.[24] The organisation did not use any of the DCF models or specifically take into account project-specific risk. Strategic assessment was based on 'yes, we need to do this project for the future' without any formal strategic appraisal. In fact, formal strategic objectives of the organisation were little evident in the operations management, confirming the findings in the earlier literature.[25] While operational management accepted the shortcomings of such an informal approach, they were of the opinion that it had worked in the past, but corporate management were more critical of the lack of a formal approach to the appraisal of capital assets – with some council members believing that as an accounting body, it should practice what it preaches. The Association is a non-profit-making organisation, and this may account, to some extent, for the lack of use of the financial 'return' models such as PB, ARR, NPV, and IRR and the reliance on a least cost analysis approach.[26] There was no evidence to suggest that the organisation had made any disastrous capital investment decisions in the past, neither was there any evidence to suggest that they had made the most appropriate investment decisions in every case.

While it is accepted that the FAP process incorporates aspects that are subjective and judgemental, it is only by taking this wider approach that we can obtain a broader profile of an investment opportunity. Decision-making is, in itself, subjective, relying on a manager's life experiences, cognitive feelings, perceptions, and subjective assessments.[27] Intuitive (hermeneutic) judgement appears to have a significant influence when making strategic investment decisions. If we can express opinions and views in actual judgmental values (numbers), we can readily compare one value against another. Although any process in doing this will be more of an art than a science, it does help in bridging the gap between limited objective knowledge and the pressing needs of managers for better information.

An essential part of the FAP process is the establishment of a capital investment appraisal team, which includes senior functional managers of the organisation together with an independent team facilitator. It is vital that the team facilitator is unbiased towards each project and will act impartially. The team facilitator must not be confused with a project champion who is a person heavily committed to a project and totally biased towards its acceptance, and, in some instances, his/her influence can result in very damaging consequences.[28]

At an early stage in the evaluation of the project, it was identified that the project champion was the Director of Administration. If, as the literature suggests, the project champion is biased towards project acceptance, we should find that his positive 'strategic values' are high while his negative 'risk values' are low. This was confirmed, as, in this case, his average overall strategic value is the highest of all the team members at 8, while his average overall RV (P x I) is the lowest at 0.4. However, the influence of such a bias is reduced by adopting the FAP process (which aims to incorporate a practical discourse that 'insures that all concerned in principle take part, *freely and equally*, in a cooperative search for truth, where *nothing coerces* anyone except the force of the better argument'[29]) through (i) using a quasi-Delphi approach where, through quasi-anonymity, score values (in respect of a project's specific key risk elements and strategic benefits) determined by each team member are not influenced by other members' individual status or dominance, (ii) where changes in values, if made, and exceptionally high and low values, have to be justified, (iii) as each member of the team, other than the team member in whose area of control a key risk element arises, is given equal weighting to his/her suggested risk or strategic score values, and (iv) an average overall score value is determined. In fact, it is interesting to note that during the SI process stage, the Director of Administration actually reduced his positive PSSV for strategic benefit 'A' from 8 to 6 following constructive debate and having to justify his position.

A familiar problem associated with decision-making using a team approach is that of 'groupthink'. It is therefore important that this is recognised and that steps are taken to reduce its influence within the decision-making process. The quasi-Delphi process adopted by the FAP model seeks to reduce the effect of groupthink. The effectiveness of this approach, as shown in the evaluation of this project, was evidenced by team members who, while having different opinions to some of the other team members, did not just 'fall into line', but either maintained their position or changed their 'values' only as a result of additional information or convincing argument. The following statements (the first three made during the quasi-Delphi stage of the PRP, and the second two made during the quasi-Delphi stage of the SI) give support to this view:

> I would like to keep my values at present, maybe during the next meeting with further discussions with you (team facilitator) and the rest of the panel, something can be slightly amended.
>
> (Accounting)

> I've looked at these (Risk element 3 – Possible conflict over user acceptance of new IT skill requirements) again. I would like to keep the probability at 10% because I still see this as relatively low, but more likely than other risks materialising. I would like to revise the figure given for impact though, 30% would be a huge amount even in a worst case scenario – my new value would be 15%....
>
> (Technical)

> I have reviewed the figures and although I appear to be low on one or two occasions compared to other members of the project team, I think I will stick with my original thoughts.
>
> (Administration)

> I have read the additional information and the rest of the group's values. Despite this, I do not want to change my values.
>
> (Examinations)

> I agree with the comments regarding the use of the new systems to support recognition.... I would like to revise Recognition and Status to 3.
>
> (Technical)

While conflict between the various managerial functions will exist in many organisations, it is important that it is maintained at a constructive 'level of tension', in order to ensure group effectiveness and efficiency, with managers still strongly expressing their own points of view. Conflict should therefore be maintained at a controllable level.

Where group dissensus exits, Simons,[30] who first coined the term to describe divergent perceptions and the opposite of consensus, argues that active debate will moderate the process, resulting in dissensus having a positive impact rather than being destructive if debate is not encouraged. It is therefore important that a team approach, which encourages active debate, is an integral part of the FAP process. The FAP process adopts a 'hermeneutic' approach to conflict that 'does not display the pessimism of an orthodox pluralism that is resigned to conflict at worst and grubby compromise at best'.[31]

Controlled (by the team facilitator) conflict was evident during both the PRP and SI discussion stages (which followed the quasi-Delphi stages) of the FAP process, when variations in project-specific risk and strategic values resulted in lively discussions. These discussions, which centred on new information and persuasive argument, however, resulted in only small changes in some team member's values, with individual team member's opinions still being respected. In fact, only three out of the five members of the team made any amendments during the discussion stage to their strategic 'values', with one member increasing two values, another member reducing two values, and a third member reducing only one value. Again, there were only few changes made to any of the RVs during the discussion stage of the PRP. We argue that controlled conflict is a further way of reducing groupthink, as evidenced during the discussion stages of the FAP process, with members again not just 'falling into line'.

It would therefore appear that the FAP process is an efficient way of arriving at subjective, judgmental values resulting in a more meaningful project evaluation and that it also addresses the issues of the adverse influence that a 'project champion' may have at the project selection stage and the influence of 'groupthink'.

Support and enthusiasm for the FAP model from the management team may be best summarised by the following comment made by the director of administration:

> Having spoken to all the team members, it has been an enjoyable experience – one that people were unsure of in the beginning, because of the unknown, that grew into a kind of reassurance in some ways of the decisions and assumptions made along the selection process. Would I use the FAP model again? 'Yes, definitely, as it opens up many more questions that need to be answered'.

Support for the FAP model from the corporate management of the organisation may be summarised by the following comments made by council members with respect to the final report:

> It gave a better understanding of the project, much clearer, not only from the viewpoint of the objectives, but how those objectives were to be achieved.
>
> It was quite clear in highlighting the financial benefits to be derived from the project.
>
> It clearly linked the project with the Association's strategic objectives.
>
> I thought the risk issues were very well defined and thought through – well done to all concerned.
>
> If you ever wanted a follow-up research project, a post audit could be carried out in a couple of years. I have never seen this done in my working life.

This last comment is interesting, as it suggests that the FAP model may facilitate the conducting of a post audit on the project and that a post audit of projects (especially with regard to positive cashflows rather than capital costs) may not be that common in practice – which confirms much earlier findings.[32] We believe that as the FAP model 'records' the various factors that have contributed to the actual investment decision, it gives a good foundation to any post-investment audit. Post audits may be seen as a learning exercise in producing more accurate appraisals in the future and therefore have value. They also make managers more accountable, but they may create conflict where blame for failure is sought.[33] Post audits should therefore be used in a positive and not a negative way.

A note of concern was, however, expressed by one of the council members concerning the level of mathematical knowledge required in completing the model:

> I struggled on some (most!) of the mathematical formulae.

With the level of sophistication of the new generation of calculators and spreadsheets, we do not consider this of major concern. We would also argue that, in practice, the FAP model should be made available as a software package, which would further address this issue.

The comments made by some of the team members during the final meeting when the actual recommendation was made by the appraisal team, however, suggests that the appraisal may have been no more than a 'ritual' aimed at supporting the intuitive view that the project should be accepted anyhow.

> As you know we really needed to do this project and I am pleased that the model has shown a high strategic value. It is also reassuring to find that the project is financially viable.
>
> (Administration)

> I feel confident that the right suppliers had been selected and that the evaluation has proved to be so supportive of the project.
>
> (Technical)

> I think that I am more informed about the project and although I felt intuitively that the project was a must, it was reassuring to find that the project was actually financially viable.
>
> (Accounting)

Against this argument is the fact that the FAP model is 'transparent' and any attempt at manipulation would be noticeable to the independent team facilitator. It would however have been interesting if the FAP model had not been so conclusive in its support of the project. At what level would the team have rejected the project?

The main object of this chapter has been to report on a research study within a professional organisation involving the appraisal of an ICT project using the FAP model. In its attempt to explore in detail the actual workings of the FAP model, the chapter is, to some extent, normative and descriptive. There is clear evidence to suggest that the model has value in practical application. The model incorporates both rational and hermeneutic paradigms.

We argue that the model addresses many of the issues it set out to address and is perceived by both senior and corporate management as an effective tool in the evaluation of capital assets. It addresses the three main investment issues of finance, project-specific risk, and strategic benefits together with the specific IT issues in a practical and meaningful way. It also addresses, to some extent, the issue of groupthink and the possible adverse influence of a project champion. The model is 'transparent' in that it gives a detailed account of how the information, upon which an investment decision is reached, is obtained. The model should therefore aid any post-investment audit.

Appendix 1: The Accounting Rate of Return[1]

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.

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

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 predetermined 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

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

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

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

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

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

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

$$\textit{Net Income}\ \text{for year 2} = £25,000\ \text{less}\ £12,344\ \text{(second-year depreciation)}$$

$$= £12,656$$

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

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

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

ROCE for year 2

$$\textit{Net Income} \text{ for year } 2 = \text{£}12,656 \text{ (same as ROI)}$$

$$\textit{Investment} \text{ figure} = \text{£}30,861 + \text{£}4,565 \text{ (working capital increase)}$$

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

$$\text{ROCE for year } 2 = 35.73\%$$

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, [(compounded cash inflows/cost of project)$^{1/n}$ – 1] × 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

$$\text{NPV} \Rightarrow \text{DPB} \Rightarrow \text{DPBI} \Rightarrow \text{MGR} \Rightarrow \text{MIRR}$$

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 = $[(\text{DPBI})^{1/n} - 1] \times 100 = [(2.1572)^{1/10} - 1] \times 100 = 7.99\%$.
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 $\text{MGR} = [(\text{DPBI})^{1/n} - 1] \times 100$. 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% {[(compounded cash inflows/cost of project)$^{1/n}$ − 1] × 100 = [(£815, 175/£175, 000)$^{1/10}$ − 1] × 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% {[(DPBI)$^{1/n}$ − 1] × 100 = [(2. 1572)$^{1/10}$ − 1] × 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 + MIRR) = (1 + MGR) × (1 + cost of capital). The MIRR for the above example is 16.63% [(1 + 0. 0799) × (1 + 0. 08) = (1. 0799 × 1. 08) = 1. 1663. MIRR = (1. 1663 − 1) × 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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6 The FAP Model – Basic Data

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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).
7. Booth, R., 1999, Avoiding pitfalls in investment appraisal. *Management Accounting*, 77 (10), 22–23.
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 + MIRR) = (1 + MGR) × (1 + 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 × 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*, Vancover, 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.
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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).
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11 Applying the FAP Model to an ICT Project within a Professional Association

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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.
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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.
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9. Whitley, E. A., 1999. Understanding participation in entrepreneurial organizations: Some hermeneutic readings. *Journal of Information Technology*, 14 (2), 194.

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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 $c = (b - 1)/[1n(a/b)]$; $y = e^{[(x-1)/c]}$. If $a = 60$ and $b = 55$, then $a/b = 1.0909$; $c = (55 - 1)/(1n\,1.0909) = 620.6679$. So that if $x = 55$, then $y = e^{[(55-1)/620.6679]} = 1.0909$. If, for example, $x = 40$, then $y = e^{[(40-1)/620.6679]} = 1.0649$.

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22. Rauch, W., 1979, The decision Delphi. *Technology Forecasting and Social Change*, 15 (3), 159–169.
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25. Hambrick, D. C., 1981, Strategic awareness within top management teams. *Strategic Management Journal*, 2 (3), 263–279.
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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.
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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).
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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.

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