

"The Green Book"

APPRAISAL AND EVALUATION IN CENTRAL GOVERNMENT



HM Treasury

Treasury Guidance

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Preface

This guide is to help government departments and agencies appraise and evaluate their activities effectively. It is intended to ensure consistency across government in appraisal and evaluation practice. It updates the 1991 edition.¹

Appraisal is essential to good decision making. Good appraisal calls for flexibility and imagination. It is not a ritual in which rigid rules are applied to the letter.

Appraisal will need to take account of the policy context in which decisions are made. These decisions often need to reflect not only formal analysis, but wider strategic or managerial considerations. Good appraisal, which follows the guidance in this book, will bring these out and provide a framework for well informed judgement, and lead to better decision making.

This edition of the "Green Book" stresses the importance of evaluation, as well as appraisal, i.e. the systematic examination of decisions already taken in order to learn from them and to improve future decisions. There is a natural tendency, once a decision is taken, to move on to the next and let bygones be bygones. To do this, however, is to sacrifice an invaluable source of learning which can improve future decision making. I hope the material in this guide will encourage the more systematic practice of evaluation within government.

This book represents HM Treasury Guidance but it has been revised in close collaboration with economists across government, and in consultation with Government Social Researchers. I am extremely grateful for their help and encouragement. Individual departments will need to have their own detailed guidance, which is relevant to their own circumstances and which is consistent with this book.

I hope that this updated version of the Green Book will prove as useful and informative as the previous editions have been.

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Deputy Director
Chief Micro-Economist

¹ Economic Appraisal in Central Government: A Technical Guide for Government Departments, HM Treasury (HMSO 1991).

Foreword

The principles of central government appraisal and evaluation, as set out in this guide, apply to any activity - whether a project, programme, or policy - which entails spending or saving money or otherwise changing the ways in which resources are used.

Guidance is provided on basic principles and on many broader technical issues for which there is a common interpretation of good practice.

Chapter 1 is a general introduction. Chapters 2 and 3 provide a background to appraisal and evaluation for those who may be new to, or who have only limited knowledge or experience in the field. Chapter 4 provides advice on technical matters and is aimed more at those who undertake appraisal and evaluation.

The whole document is not intended for reading from cover to cover in one sitting. The chapters, annexes and appendices provide progressively more detail which the reader can choose for his or her particular needs.

This edition supersedes the edition issued in 1991 and has been extensively revised. It provides more material on evaluation. It gives greater emphasis to the appraisal and evaluation of environmental impacts. It takes account of developments in the treatment of these impacts and other costs and benefits which are not easy to value. It takes account of developments in the use of private finance and, related to this, provides a more thorough coverage of the treatment of risk and uncertainty. The section on industrial and regional programmes has been extended to cover a broader range of programmes aimed at raising economic activity.

The guide confirms the use of a 6 per cent real public sector discount rate in most circumstances. The technical annex contains a more extensive discussion of the derivation of the discount rate in terms of the cost of capital and time preference.

This guide is not a substitute for the technical guidance developed by departments. For many areas specific departmental guidance is also required, consistent with this book, and geared directly to departmental needs. Many departmental guidance documents are included in the bibliography.

Previous editions have been used in some parts of local government and by others outside central government. Such use is welcome, although the guidance has been prepared with the needs of central government in mind.

Training in appraisal and evaluation is important and this guide provides a positive contribution to this.

Suggestions for improvement of the content or presentation are welcome. These should be addressed to the Central Microeconomics Team, HM Treasury.

Chapter 1: The Meaning and Context of Appraisal and Evaluation

Appraisal and decision making

1.1 Good appraisal entails being clear about objectives, thinking about alternative ways of meeting them, estimating and presenting the costs and benefits of each potentially worthwhile option, and taking full account of associated risks and uncertainties. Good evaluation, after the event, entails many of the same demands together with a desire and willingness to look for better ways of doing things. Used properly, appraisal and evaluation lead to better decisions by policy makers and managers. They encourage both groups to question and justify what they do. They provide a framework for rational thought about the use of limited resources.

1.2 Appraisal is used in this book to describe the *analysis of the costs and benefits* which should underlie the final policy or executive decision. This analysis may range very widely, to include for example, information on subjective environmental impacts, or consistency with declared policy, or the implications of budget constraints. It should always include an examination of the risks and uncertainties.

1.3 Although a great deal of information can be brought within and presented in terms of a formal framework, this can never do more than *inform* the final decision. Analysis can show how alternative choices compare in many ways, but there will always be further strategic, or pragmatic issues to which those responsible for final decisions must also give weight. The guidance in this book can therefore never give, without this qualification, "the right answer". However, appraisal is an essential input to good decision making.

1.4 It is assumed throughout this book that appraisal within government, in those fields to which its analytical approach can be applied, is concerned with comparing the effects of alternative actions on the national interest. Sometimes the term "economic appraisal" is used as a shorthand, to distinguish this broad meaning from more restrictive forms of appraisal which address just one or two factors only, such as cash flow, or particular forms of impact.¹

¹ The term "economic appraisal" itself is sometimes used in a restrictive sense, to describe the appraisal of, for example, just the impacts on conventionally measured GDP, or just those costs and benefits which can be valued in money terms, but these narrower meanings are not used in this book.

Appraisal and evaluation 1.5 Appraisal is *ex-ante* analysis and in this sense can be seen as the comparison of a potentially wide range of options, all of which are hypothetical. Evaluation is *ex-post* analysis which compares a likely narrower range of options, one of which will be real. However, as part of the management process, planning of the evaluation should be considered at the time of appraisal; most of the guidance in this book applies equally to appraisal and to evaluation.²

What activities should be appraised? 1.6 Examples of activities for which new proposals need to be appraised are:

- **policy development** - such as decisions on the level and type of service to provide.
- new or replacement **capital projects** - such as whether or not to undertake a project; whether to undertake it now, or later, and on what scale and in what location; and to determine the degree of private sector involvement;
- the use or disposal of **existing assets** - such as whether to sell land, or replace facilities by cheaper ones, or relocate facilities or operations elsewhere; or to contract out, or market test, operations;
- **specification of standards** - such as the choice of standards for health and safety, or for environmental quality or sustainability; or for the insulation, fire protection, lighting, or design of buildings; or to balance compliance costs with the benefits of regulation.

What kind of appraisal is needed? 1.7 Sometimes, as typically in the choice between two established suppliers for a small and simple contract, the information needs, about cost and quality for example, may be obvious. The collection of information, and its analysis and presentation to best inform the final decision, can in such cases be straightforward.

1.8 Often however, the information and analytical needs are more complicated. Different people within the decision making body may be especially concerned with specific kinds of information - about for example the budgetary cost in particular years, or impacts on particular groups of users or on others who would be affected. Less often, but still not infrequently, the information itself is not straightforward, but needs particular kinds of analysis, such as those described in Annexes B and C of this guide.

1.9 Appraisal should *a/ways* include an assessment of value for money in terms of the national interest.³ This may sometimes be wholly in financial terms - as for example in comparing the costs of different ways of providing exactly the same output. More often

² Evaluation is still normally used in central government to describe the retrospective analysis of a project, programme or policy. Outside central government it is often also used in this sense, but is also widely used to describe analysis before the event.

³ Obviously most appraisals have to take much as given. For example the appraisal of one feature of a major new facility, or new policy, would usually take the decision to procure the facility or proceed with the policy as given.

it will entail some factors which can be quantified but not valued, or which cannot even be quantified, and about which explicit judgements have to be made.

1.10 Appraisals should also include an analysis of the budgetary implications of a proposal over time. This may need to include an analysis for the public sector as a whole as well as for the spending department or agency. The information provided by this, or by the examination of other institutional constraints, may in the event determine the final decision. However a budgetary or financial appraisal, or any other appraisal of some specific aspect of the proposal, should never be seen as an alternative to an "economic appraisal". They are complementary.

1.11 Several kinds of appraisal are briefly described in Chapter 2.

Appraisal and evaluation and the management process

1.12 Appraisal must not be seen merely as an obstacle through which a proposal must pass in the final stages before implementation. It should begin, at least on a preliminary basis, early in the gestation of a proposal, and undergo review, and sometimes reworking at each important stage, especially when new information becomes available. Only in this way can it properly contribute to the form of the proposal and the choice of options that should be examined.

1.13 Appraisal should be part of a wider business case or management plan, which should include not only the economic analysis, but also other important information such as financing implications, arrangements for project management and plans for the subsequent monitoring and evaluation of outturns. Every appraisal of any substance should indicate how the proposals concerned will be evaluated after completion and how the results of evaluation will be disseminated.⁴

1.14 Responsibilities and procedures for initiating, carrying out and vetting appraisals need to be clear within each organisation. Where responsibility for appraisal is delegated to sponsored bodies or outside central government (for example to local government) responsibility for vetting of the appraisal will usually lie within the departmental, or agency, executive or policy division.

1.15 Any substantial appraisal and evaluation will always benefit from a multi-disciplinary approach calling upon the expertise of a range of specialists. Apart from in-house effort, they will sometimes require expenditure on external research.

1.16 The same expenditure should often be appraised and evaluated at successive levels. This might be first as part of a corporate plan or business strategy, then as a

⁴The principles of appraisal and evaluation apply to central government projects, programmes and policies. In this guide the term project is generally used as a shorthand for all three.

major investment decision, again in the appraisal of options for a major component, and finally as a small equipment purchase. Each level of decision needs its own appraisal procedures, but the fundamental principles are the same. The management of appraisal and evaluation are discussed further in Annex A.

How much effort should go into appraisal and evaluation?

1.17 Appraisal and evaluation are not costless. The effort that should go into them and the detail to be considered is a matter of judgement. When the right questions are asked the appropriate effort is often easy to see.

1.18 Small expenditures generally justify less detailed appraisal than large expenditures, but small items can add up to substantial totals and small expenditures can have big effects, and the principles of appraisal still apply. These same principles apply also to evaluation.

Chapter 2: Elements of Appraisal

The process of appraisal

2.1 Appraisal is not a standard drill; it is a sensibly ordered, but flexible, general approach to the analysis of expenditure and other policy proposals. Nevertheless an appraisal should normally follow this sequence.

- (i) Define the objectives.
- (ii) Consider the options.
- (iii) Identify, quantify and where possible value the costs, benefits and risks and uncertainties associated with each option.
- (iv) Analyse the information.
- (v) Present the results.

2.2 The analysis will sometimes point to a clear-cut recommendation, but often this will not be possible. There may be risks and uncertainties attached to costs, benefits, or both. There may be significant elements which cannot be valued in money terms and some may not be easily quantified at all. Questions such as equity, planning feasibility, prior commitments, and implications for other parts of the economy should all be covered, to the extent that they matter in the particular case, but they may leave open wide areas for subsequent managerial or political judgement. For each option, the impact of such factors should be set out systematically and an assessment made of where the balance of advantage lies.

2.3 An appraisal normally leads on to a decision either not to proceed at all or to proceed with one of the other options that has been appraised. Management procedures thereafter are concerned with detailed planning and control, and the monitoring of expenditures as they are incurred against plans. However, as detailed planning proceeds, the information used in the appraisal will be refined and new issues may arise. It is important to examine whether the basis on which an initial decision was taken remains sound.

(i) Define the Objectives

2.4 The objectives of a proposal should follow clearly from an underlying policy or strategy. Proposals should be related to departmental, or agency, ultimate objectives, as set out in, for example, departmental reports, or statements of government policy.

2.5 Each appraisal should start from a clear understanding of what the project or expenditure is intended to achieve. Emphasis should be placed on outputs and how the outputs enable objectives to be achieved, especially ultimate objectives. Objectives should be defined in such a way that it can be established after the event whether, or to what extent, they have been met. In particular, objectives for the service to be provided should be distinguished from those for the means of provision. Without clear objectives, options will be ill-defined or over-looked, incorrect weights applied to costs and benefits, and risks and uncertainties not examined thoroughly.

2.6 Objectives must not be so narrowly defined as to rule out important options: on the other hand objectives which are too broad create unnecessary work *and* lose credibility. The appropriate objectives depend on the level of the appraisal. General objectives are often appropriate in the initial appraisal of complete systems; narrower objectives apply to the appraisal of particular components. Appraisal may itself help to clarify, justify, question, or change the objectives.

2.7 The setting of objectives is described more fully in the accompanying Box.

Setting Objectives

It is important to define objectives and outputs for a project as precisely as possible. One useful way of classifying objectives is in terms of ultimate, intermediate and immediate.¹

- **Ultimate** objectives are usually framed in terms of strategic or 'high-level' variables, such as economic growth. Department or agency plans and annual reports, or other statements of government policy, such as White Papers, can be used as a source. Generally, the project under consideration will be expected to influence, rather than determine, these variables.
- **Intermediate** objectives are a step down from ultimate objectives. They will need to be met if the ultimate objectives are to be achieved. Generally, intermediate objectives should be measurable, although the net contribution of the measure under consideration may need to be carefully analysed. Intermediate objectives will not always be within the control of those responsible for delivery.
- **Immediate** objectives are usually directly concerned with the outputs of a project. They will normally be measurable, and to a great extent, within the control of those responsible for delivery. The immediate objectives will need to be met if the intermediate objectives are to be achieved.

For example, in the case of a geographically-targeted training programme, the ultimate objective might be to increase the long-term rate of economic growth. Intermediate objectives might be to reduce reported skill shortages, and to reduce disparities in local unemployment rates. Immediate objectives might be framed in terms of the actual take-up of available places.

A common danger is that of management incentives to focus too narrowly on intermediate and immediate objectives at the expense of ultimate objectives.

Objectives need to be carefully defined. One of the purposes of evaluation will be to check if the objectives set were in fact achieved. Some departments find it a useful mnemonic that objectives should be SMART:

- Specific
- Measurable
- Agreed
- Realistic
- Time-dependent

In practice, fully SMART objective setting may not always be practicable, especially for strategic objectives. However, objectives should be as SMART as possible.

¹ Another way of looking at objectives is the "Logical Framework Approach" (see Box in Appendix to Annex A).

(ii) Consider the options

2.8 The main options, or alternative ways of meeting the objectives, should be listed. Normally one option will be to "do nothing" or "do minimum" (for example, maintain a current service level or meet a statutory requirement or standard), which should be included as a base case. For a major investment, a wide range of options should be considered before choosing some for further appraisal. Factors to consider will depend upon the application, but could include timing, scale and location, the degree of private sector involvement, alternative uses for assets released, the use of new or established technology, and environmental quality.

2.9 Public expenditure constraints should not restrict the initial choice of options for consideration. Controls or targets set in the interests of greater efficiency and accountability are not intended to limit the range of possible solutions. If expenditure controls and targets lead to the rejection of the option which appears to be most cost effective this should be brought out clearly in the appraisal.

2.10 The process of appraisal may suggest changes to the original options or a new option. The identification of options is discussed more fully in paragraphs 4.2-4.11.

(iii) Identify, quantify and where possible value the costs, benefits and risks and uncertainties of each option

2.11 The government is concerned with national interests and concerns, including the interests of taxpayers and users of public services, and those affected in other ways by public sector activity. Appraisal should take a broad view of costs and benefits, including indirect and longer term effects, such as, for example, the benefits that may accrue from increased competition in the provision of public services.

2.12 Costs and benefits covered by an appraisal will typically include:

- Expenditures on the provision of any capital assets and operation of the service;
- Any residual value of capital assets at the end of the appraisal period;
- Other costs and benefits which can be valued in money terms, in the form of revenues, cost savings or non-marketed impacts;
- Quantified measures, or at least descriptions, of those costs, benefits or impacts which cannot be valued in money terms.

Relevant information should be identified and new data collected if necessary.

2.13 Expenditure or other policy proposals often lead to both gainers and losers and information on how the costs and benefits are distributed among different organisations, sectors of the economy, or individuals can be very important.

2.14 When assets or other resources are valued in appraisal or evaluation the basis for valuation should be their "opportunity costs". This is the value of the resource in its most valuable alternative use (i.e. other than in its proposed use in the project being appraised).

For example, the appraising body may already own an asset which, if not employed in the proposal, could be used for other purposes, or sold. Use or retention of this asset therefore has an opportunity cost. This is usually given, near enough, by market values, but there are some important exceptions.¹

2.15 The money value of costs and benefits should normally be expressed in "real terms" - that is at the general price level applying when the appraisal is carried out. It is the real value which matters. Apart from relative price changes, general inflation simply raises all cash values by the same percentage and thus it is convenient to express all costs and benefits at the same general price level.² However, relative price movements should be taken into account where the price of a particular good or service is expected to increase or decrease significantly more or less than the general rate of inflation. This is discussed further in paragraph 4.23.

2.16 It is important that costs and benefits should include assessments of the associated risks and uncertainties as explained in paragraph 2.35 below.

2.17 Any important costs and benefits which cannot be valued in money terms should be recorded and wherever possible quantified. Some impacts of this kind are discussed in Annex C.

2.18 Appraisals often require projections or forecasts of the demand for, or output of a service, taking account of such factors as trends in population, take-up of a service amongst client groups, trends in unit costs in real terms, or the value of output. Forecasts made for a particular project should always be consistent with national trends, and should be confirmed with the body responsible for producing the relevant projections. Detailed advice on forecasting is beyond the scope of this document and should be obtained from finance divisions, economists, or statisticians. The identification and valuation of costs and benefits is discussed in more detail in paragraphs 4.12-4.42.

(iv) Analyse the information

2.19 There are many different ways in which the information available about a proposal may need to be analysed, both for different users and to help structure the data where this is complex.

2.20 Any appraisal should include a comparison of those costs and benefits which can be valued in money terms. Often, in central government, this applies only to resource inputs, such as capital assets and operating costs, which have a market value. Comparison of alternative cost streams, to produce a broadly similar set of public service outputs, is

¹ Market values may not be available for some important impacts, such as many environmental costs and benefits. Market values themselves are less reliable for projects being appraised, for example aid projects, in less developed countries or other economies where price distortions and market failures are more pervasive.

² The appraisal of expenditure proposals should be undertaken in real terms even if the spending body has its future budgets set in cash. Cash budgets are set by the government taking into account expectations about future general price changes. In appraisal the GDP deflator is usually appropriate as the general price index for converting projected nominal cash flows to real terms. Where there is doubt over the use of an appropriate deflator advice should be sought from finance divisions or economists, or from HM Treasury.

described as **cost effectiveness analysis**.

2.21 Sometimes it is possible to value non-marketed impacts, for example in cases involving transport accident risks, or impacts on people's time and sometimes environmental impacts. Analysis of this kind, where it makes substantial use of valuations of non-marketed costs or (especially) benefits, is described as **cost benefit analysis**.³

2.22 In either case the analysis entails the comparison of alternative cost streams and possibly benefit streams over time, together with judgements about the comparative risks of the alternative proposals and about differences between the options which cannot be valued.

2.23 Many other partial analyses are applied in particular policy areas, or when particular kinds of impact are specially important. For example **compliance cost assessment** is used to assess the costs to industry of regulations and standards, and a special **environmental appraisal** may be used to contribute to the general appraisal.

2.24 In the appraisal of health programmes, **cost utility analysis** is used where the outputs, in terms of people's well-being, can be quantified but not valued.

2.25 In some cases, where there are several kinds of impact affecting several different groups of people or business, as is often the case with land use planning decisions for example, a **matrix, or impact statement, approach** may be developed, to illustrate how the impacts are distributed.

2.26 Often an appraisal will need to include some separate **financial appraisal**. This may include an examination of the public expenditure costs and savings of each option - sometimes described as an **exchequer cost analysis**. The spending body will also require an analysis of all the cash flow implications of each option for its own budget.

2.27 For trading activities there should obviously be a **commercial appraisal**, where benefits are measured by receipts from sales.

2.28 Any substantial appraisal needs to include an overview of the important issues, an assessment and where possible quantification of costs and benefits which cannot be valued and, crucially, an examination of the risks and uncertainties, drawing as far as possible on past experience.

2.29 Most appraisals have to compare costs and benefits which occur at different times. Benefits generally accrue later than costs.

³ The term cost benefit analysis is used in several different senses. Sometimes it is used to describe the whole appraisal process, and sometimes to describe the analysis only of those quantities which can be valued.

2.30 Normally people prefer to receive cash sooner rather than later and to pay bills later rather than sooner. This remains true even in the absence of inflation. "Jam today is worth more than jam tomorrow." For an individual this preference (i.e. time preference) might be measured by the (real) interest rate on money lent or borrowed. In the public sector too, more weight is given to earlier than to later costs and benefits. This is usually calculated by applying a "discount rate" to cost and benefits. The discount rate defines how rapidly the value today of a future real pound falls away through time, just as a real rate of interest determines how fast the value of a pound invested now will increase through time.⁴ Discounting in central government is discussed in Annex G.

2.31 If *all* costs and benefits could be valued, the preferred option would be the one with the highest "net present value" (NPV), defined as the difference between discounted benefits and discounted costs, or in cost effectiveness analysis, the preferred option would be the one with the lowest "net present cost". Sometimes it is helpful to convert the present value into a constant annual real expenditure stream over the lifetime of the project. This is described as an equivalent annual cost.

2.32 Discounting has a greater impact the longer the period over which costs and benefits extend, or the bigger the difference in timing between costs incurred and benefits received. The mechanics of discounting are explained in paragraphs 4.52-4.63 and Annex H. Discounting is in most practical cases simple to apply through software packages or with a calculator. Tables are presented in Annex H.

2.33 The use of discounting should not be allowed to conceal the detail of costs and benefits involved. It is usually appropriate to show, besides the overall NPV, its main components and how individual costs and benefits are distributed over time.

2.34 Estimating costs and benefits requires assumptions about the future. The effect of different assumptions should be considered. This requires explicit analysis of how the projected outturn varies with each of the potentially important risks and uncertainties. Assumptions which appear prone to risk or uncertainty, and their potential implications, should be highlighted in the presentation of the results. One outcome of an appraisal may be to recommend, for example, that before expenditure is irrevocably committed a pilot is needed, or provision should be made for a review at a convenient break point, with the option of not proceeding further.

2.35 All projects involve risk, which implies a cost to the bearer of that risk. This means in particular that the average of all the possible outcomes of a project weighted by the likelihood of their occurring will exceed the cost if all goes according to plan. Risk analysis in the public sector should aim to eliminate the effects of optimism in both costs and benefits. The appraisal of options involving private finance should also include a thorough

⁴ It is sometimes argued that because a central government department or agency cannot earn interest on cash which it decides to spend later it should use a discount rate of zero. This is wrong. The opportunity cost of public expenditure, in any one year and over time, is in principle the same for all proposals.

(v) Present the results

assessment of the allocation of risk, with the basic principle being that value for money is most likely to be obtained when risk is assigned to those best placed to manage it. The aim should be to achieve the optimum allocation of risk, including risks to project financing. Risk and uncertainty are further discussed in paragraphs 4.43-4.51 and in Annex B. Risk transfer in the context of private finance is discussed in Annex D.

2.36 The results of an appraisal should summarise:

- the objectives;
- the options considered;
- the results obtained;
- what the results imply for the final management or policy decision.

2.37 The supporting analysis should provide additional information on the steps in the appraisal, and the underlying assumptions and calculations. This might include further information on:

- the causal relationship between the immediate, intermediate and ultimate objectives and outputs;
- costs or benefits which cannot easily be valued;
- information on the timing of the costs or benefits (e.g. benefits reach a peak after 10 years);
- the main components of the net present cost or value (or equivalent annual cost);
- sensitivity analysis of the effects of changing key assumptions.

2.38 It is important to record such details as the price basis, the base date for discounting and the choice of discount rate. The price base is needed for expenditure planning, and so that subsequent expenditure can be effectively monitored against plans, and for evaluation.

2.39 The results of an appraisal should normally be accompanied by a description of what information will need to be collected for later evaluation, as discussed in Chapter 3.

Chapter 3: Elements of Evaluation

The process of evaluation

3.1 Evaluation examines the outturn of a project, programme or policy. When carried out it adds value by providing lessons from experience to help future project management or development of a specific policy. It may also contribute to the quality of wider policy debate.

3.2 In preparing for an evaluation it is usually helpful to start with an outline plan, setting out the general boundaries of the proposed evaluation, including the questions which it seeks to answer, the staff and other resources available, provisional timing and cost, and who should be consulted.

3.3 The evaluation itself should normally follow this sequence.

- (i) Establish exactly what is to be evaluated and how the past outturns can be measured.
- (ii) Choose alternative states of the world and/or alternative management decisions as counterfactuals.
- (iii) Compare the outturn with the target outturn, and with the effects of the chosen alternative states of the world and/or management decisions.
- (iv) Present the results and recommendations.
- (v) Disseminate and use the results and recommendations.

(i) Establish exactly what is to be evaluated and how the past outturns can be measured

3.4 The activity to be evaluated needs to be clearly specified. It should be related to the policy or management aims and objectives of the department or agency, and not so narrowly defined as to preclude alternative methods of meeting those aims and objectives. The evaluation might be of a project, programme or policy, particular aspects of the activity, or of key common issues affecting a number of activities. It might be a pilot, designed especially for evaluation.

3.5 The rationale, aims, objectives and outputs should be clear from the original documentation. Any initial differences between partners about objectives, or subsequent changes in objectives, should be noted. If it is not, this is an important finding to report in the evaluation. However, it also makes evaluation more difficult.

(ii) Choose alternative states of the world and/or alternative management decisions as counterfactuals

(iii) Compare the outturn with the target outturn, and with the effects of the chosen alternative states of the world and management decisions

3.6 Objectives and outputs should be defined and quantified as precisely as possible, for use in step (iii) below. It is essential in particular to distinguish between final outputs (which are the policy aim) and immediate or intermediate outputs (which should be seen as inputs to the achievement of the policy aim, and not ends in themselves). Immediate and intermediate outputs will usually be easier to measure than ultimate outputs.¹

3.7 The availability of output and performance measures and other monitoring data, and how these relate to the objectives of the activity should be reviewed. If this information is inadequate consideration should be given to the collection of additional data, e.g. by commissioning surveys or other research. Ideally, data needs should be considered at the outset of the project.

3.8 The definition of exactly what should be compared with what needs clear thinking and should be clearly set down. The outturn of any complex activity will never be exactly as projected in advance. However the reasons for the outturn being in some respects better or worse than expected may be attributable to the "state of the world", or it may be attributable to actions under the control of the responsible body. These latter might include for example the management of a project, the body's own forecasting assumptions, or the inherent design of a policy.

3.9 The technical methodologies used for appraisal and evaluation are frequently similar. Each, for example, should identify, and measure where possible, both the direct and indirect costs and benefits of the project, programme or policy. However, evaluation tends to be based on actual data, appraisal on forecast and projections.

3.10 It will include an assessment, quantified as far as possible, of what happened, a comparison with the target outturn, and a comparative assessment of one, or probably more, counterfactuals - that is alternative outturns which would have occurred if the state of the world or management or policy decisions had been different. Where possible the comparative assessment should include a "control group", to whom the policy was not applied.

3.11 It is usual to take as a benchmark for comparison the base case of what would have happened if the activity under consideration had not been implemented. It will also be useful to consider the consequences of implementing one or more of the alternatives considered at the appraisal stage. Occasionally it may be appropriate to consider an option which was not initially appraised, as long as it was a feasible option at the time of implementation.

¹ The setting of objectives is discussed in the Box to Chapter 2.

3.12 The evaluation should assess the success of the project, programme or policy in achieving its immediate and intermediate objectives. However it should also provide an assessment of how this achievement has contributed to the ultimate objectives.

3.13 There will always be the temptation to attribute better than expected outturns to good management or good policy, and worse than expected outturns to unforeseeable changes in the state of the world. In practice it will never be possible fully to separate these effects but a good appraisal will clearly recognise the distinction between them.

(iv) Present the results and recommendations

3.14 The results of an evaluation should summarise:

- why the outturn differed from that foreseen in the appraisal;
- how effective the activity was in achieving its objectives, and why;
- its cost effectiveness;
- what the results imply for future management or policy decisions.

3.15 The results obtained should generally lead to recommendations for the future. These may include, for example, changes in procurement practice, delivery, or the continuation, modification, or replacement of a programme.

(v) Disseminate and use the results and recommendations

3.16 The results and recommendations from evaluation should feed into future decision making. The methods used to achieve this may well require senior management endorsement. Efforts should be made to disseminate the results widely within the organisation, and for this purpose it may be helpful to use summaries of the main points, and synthesis reports which incorporate the results from a number of evaluations which have common features.

3.17 Evaluation reports and the research which informs them should be placed in the public domain unless there are good reasons, in terms of security or commercial confidentiality, for not doing so.

Chapter 4: Technical Guidance

4.1 This section provides guidance on many of the technical issues which arise in carrying out appraisal and evaluation in central government. It discusses the identification of options, the analysis of costs and benefits, and the handling of risk and uncertainty, followed by discounting, decision rules and the role of expenditure ceilings. Further technical advice may be obtained from HM Treasury.

Identifying options

Options

4.2 It is important, particularly for a major decision, to consider a wide range of options even though many may often be rejected at an early stage. A "do nothing" or "do minimum" option should normally be identified as a base case. This may be the provision of no service, or of the minimum input necessary to maintain or provide a service. (A "do nothing" or "do minimum" option must, of course, be appraised like any other option, taking account of circumstances such as prospective changes in relative prices or levels of demand). Where service improvements are involved, "do minimum" may imply continuation of the present level of service. It is rare for there to be no realistic choice of options.

4.3 The appropriate number of options to be considered depends on the size and scope of the project. Usually only a short list of options require full-scale analysis, but none should be dismissed, or not taken seriously, because it is unusual or "not invented here". Options are sometimes simply omitted because they have lower benefits than some other more costly option, but this is an insufficient reason on its own. Lower benefits combined with no cost saving could of course be a reason for not taking an option to full appraisal stage, but there would need to be sufficient information at hand to make this a clear-cut decision.

Constraints

4.4 Sometimes technically feasible options may appear to be ruled out by legal, financial or political constraints. Although undue time and effort should not be spent on full-scale appraisal of such options, constraints of this kind are not always binding and they should not generally be taken for granted. Where such constraints appear to impose substantial costs, these need to be brought out and developed. Similarly, alleged technical constraints should not be generally accepted without question. They can sometimes be overcome at a cost, or may have been set without full consideration of the costs they impose.

- Objectives** 4.5 The justification for incurring expenditure at all, or otherwise intervening in the market, should be considered in the context of the relevant department or agency business plan or management strategy. Project objectives should be related to departmental or agency strategic aims and objectives as set out, for example, in departmental reports or in statements of government policy. Expenditures should not be classed as unavoidable because, to take common and important examples, they replace worn out assets, or fulfil some safety requirement. It may be better to close the operation, or modify it in some way to provide a different level of service, and use in another way the resources so released.
- Phasing** 4.6 An appraisal should usually consider as an option the alternative timing or phasing of expenditure. Generally incurring expenditure later will defer the benefits of the project, but it may be possible to rephase a project and improve overall performance. Deferring expenditure may also help to reduce risk.
- Component parts** 4.7 An option may affect, or be affected by, other expenditure or public sector activity, for example where its output or costs depend upon another project being undertaken. Where a number of expenditures or activities are linked together and the costs or benefits are mutually dependent, it is important for the proposal to be justified as a whole. Proposals which are related in this way should be appraised as a single option.
- 4.8 Conversely, it should not be taken for granted that every part of a proposal is justified in its own right. In some cases proposals need to be split into separate independent options; an apparently good proposal may include independent elements which give good value along with others which give poor value. The poor value elements should be rejected. In general, the combination of independent elements with the highest NPV should be preferred.
- Time horizons** 4.9 The choice of time horizon can be important. Normally, the time horizon for appraisal is determined by the economic or physical life of the main asset concerned or the period over which the service is required. Time horizons should usually be sufficiently distant to encompass all important cost and benefit differences between the options. They should not be artificially constrained by department or agency planning or budgeting systems.
- 4.10 It should not be taken for granted that costs or benefits persist indefinitely at either a constant level or at a constantly changing rate. For projects expected to have a very long life the effect of shorter horizons should be illustrated for key years. Appraisal of reorganisations and relocations can present particular problems in determining the appropriate time horizon for the appraisal; the horizon needs to reflect the likelihood of future changes to location or organisation for which past experience may provide some guide. The comparison of options with different life times is discussed further in paragraphs 4.60 and 4.61.

Private sector involvement

4.11 Public sector bodies will normally explore the scope for private sector involvement in the provision of public services, whether through competitive tendering for services using existing assets, or through the provision and operation of new assets. Some of the special issues raised by private finance are described in Annex D.

Analysis of costs and benefits

Opportunity costs

4.12 Most goods or services have alternative uses. Thus, they should be costed at their full value in the best alternative use to which they could be put (i.e. their opportunity cost). Paragraph 4.34 below discusses the setting of fees and charges.

4.13 Generally, current market prices reflect opportunity costs, because households and firms have the best knowledge of their own costs and preferences and a strong incentive to respond to market signals and put resources to their best possible use. So, for example, any excess of the price quoted by a domestic contractor over that for an imported equivalent is generally the best available estimate of the national economic benefit from importing. Shadow pricing on a wider scale is common in the appraisal of investments where markets are poorly developed, as is often the case in developing countries. However, shadow prices in the UK economy based on macroeconomic arguments about, international trade or employment, should not be used unless there is specific HM Treasury guidance to the contrary.

4.14 Opportunity costs can arise where no cash payment is charged to the project. One example could be the tying up of equipment or land already owned by the appraising body. Another would be the market value of a historic lease.

Residual values

4.15 Even where an appraisal covers the full expected period of use of an asset, the asset may still have some residual value, in an alternative use within the organisation, in a second-hand market, or as scrap. An appraisal should always record such values and make it clear if the results are sensitive to the assumptions about residual values. Further discussion of residual values is to be found in paragraph 4.59 and Annex F.

Sunk costs

4.16 Costs of goods and services which have already been incurred or are already irrevocably committed should be ignored in an appraisal. They are 'sunk costs'. What matters are costs about which decisions can still be made. However this includes the opportunity costs of continuing to tie up resources which have already been paid for. Thus if an asset such as a site, building, or machine is already owned by the department or agency, the cost of the future use of that asset should be included in the appraisal because, if the project were not to proceed, the asset could be sold or used for another purpose.

Costs and benefits which cannot easily be valued

4.17 In nearly all appraisals there are costs and benefits which have no market price, but which nonetheless are important. Valuation techniques have been developed to enable explicit values to be placed on some of these costs and benefits, describing the willingness to pay (WTP) for, or willingness to accept (WTA) a particular outcome. These may be based on "revealed preference", shown by hedonic pricing¹ or wage differentials, or "stated preferences", such as contingent valuation methodology (CVM). These methods are used to value such things as travel time saved, accident deaths avoided, and use, option and existence values for the environment and historic buildings. The application of these techniques should be handled with care in consultation with economists where necessary. Where explicit values are used based on these techniques, particularly those from stated preference methods, it is usually better to provide range as opposed to point estimates in view of the inherent uncertainties. *Policy Appraisal and the Environment* (DOE, 1991) discusses valuation techniques for the environment. *Policy Appraisal and Health* (DH, 1995) discusses the valuation of health benefits.

4.18 Sometimes an implicit maximum or minimum value of a damaging impact can be estimated from the extra cost which would be incurred to avoid it: a *judgement* can then be made as to whether it really is worth that extra cost, or loss of other benefits.

4.19 All important impacts should in any case be listed with at least a qualitative assessment of their significance and where possible quantitative measures, such as levels of noise or air pollution, even if these have no monetary value placed on them. Impacts of this kind are discussed further in Annex C.

Wider economic consequences

4.20 It is sometimes claimed for public expenditure proposals that they provide wider economic benefits such as tax flowbacks or savings in benefit payments to the Exchequer from lower unemployment, or benefits to the balance of payments. These factors should not be counted as economic benefits or costs. If the proposed project did not go ahead the expenditure on the project would typically be available for use in other ways, with broadly equivalent macro-economic consequences. The case for assistance to particular projects needs to be made in terms of its microeconomic impact, not in terms of any direct effect on macroeconomic variables. The usual assumption, as noted in paragraph 4.13 above, is that market prices generally reflect opportunity costs, and so there will be no need to use shadow prices for such effects.

4.21 A project may, however, bring supply-side benefits to the national economy. It may ease a supply constraint and so bring benefits to one or more sectors, or promote a new technology with general applications. Such effects should be clearly identified, together with an assessment, for example, of why the constraint has persisted or why the technological improvement is particularly worthwhile and is unlikely to occur in the absence of intervention. Programmes and projects of this kind are discussed in Annex E.

¹ Hedonic pricing methods look at how market prices are affected by external, non-marketed impacts, such as the effects of a noisy road or an unsightly view on house prices.

Future price changes

4.22 The normal practice in central government appraisal is to express all costs and benefits in real terms - that is at a given general price level. In practice it is usually simplest, since it often avoids the need for any adjustment, and carries most meaning, to carry out appraisal in terms of costs and benefits valued at "today's" general price level. In principle the prices ruling on any date can be taken as the basis for the calculations, so long as the same date is taken for all costs and benefits. It is usually convenient, though not essential, to use the same date as the base date for discounting (see paragraphs 4.58 and 4.59). The standard discount rate for public expenditure is expressed in real terms and is therefore consistent with costs and benefits measured in real terms.

4.23 Expressing costs and benefits at a constant *general* price level means that, where particular prices are expected to increase at a significantly higher or lower rate than general inflation, this *relative* price change should be brought into the calculation. For example, the price of technology used in information technology/information systems (IT/IS) projects may be expected to continue to fall in real terms. Also, in considering the best method of heating a building, any expected future movements in the prices of different fuels relative to the general price level ought to be taken into account. Similarly pay can be expected to rise in real terms over the longer term. A private finance contract may entail payments indexed to some quantity other than a general index such as the RPI or GDP deflator. Costs during the course of a construction contract may also be expected to rise or fall in real terms, where the contract contains variation of price (vop) clauses. Advice on likely relative price movements should be obtained from the appropriate expert bodies and from finance divisions or economists.

4.24 Sometimes future costs and benefits may be expressed in nominal (i.e. cash) terms. Normally in such cases these costs or benefits should be adjusted to remove the effect of expected future changes in the value of money, normally by deflating future cash flows by forecast levels of the GDP deflator. (The use of an index specific to the service concerned to deflate future cash flows would obscure any relative price effect and distort comparisons with other services.) In cases where nominal values are not adjusted for general price effects a nominal discount rate should be used. Nominal discount rates are discussed in paragraphs 37 and 38 of Annex E, and paragraph 4 (v) of Annex G.

Financial versus economic costs

4.25 Adjustments sometimes need to be made to financial figures to obtain estimates of economic costs. One example is the economic cost of public service employees, which includes not just salary costs, but also the cost of superannuation and other costs, as set out in HM Treasury's *Fees and Charges Guide* (HMSO, 1992). Not all these costs may be directly charged to budget holders. Another example is the economic cost of using capital assets which are already owned, as noted in paragraph 4.16 above. Some economic costs and benefits, as noted in paragraphs 4.17-4.19 above, may have no market price at all, and thus no direct financial cost.

4.26 The economic costs of land and buildings may be expressed as either a capital value or an annual rental, but not both, which would involve double counting. Annex F discusses some issues specific to land and buildings.

Distributional effects

4.27 Distributional issues arise in many central government programmes, for example, between people of different incomes, or ages, or health states, or skills, or locations. Sometimes these effects are self evident, but any important distributional effects should be identified and quantified as far as possible, by disaggregating the analysis of costs and benefits according to the groups affected.

4.28 Costs and benefits should generally be confined to those falling on United Kingdom residents (except of course where, as with Overseas Development Administration (ODA) projects, the objectives are defined in terms of benefits to an aided country, or as in the case of certain environmental projects, the project is deliberately intended to have cross-border effects). Thus any subsidies to UK exports should be counted as costs, and any grants from overseas should be included as benefits in an appraisal. However, for the purposes of appraisal, European Union (EU) grants or subsidies should be treated, as a first approximation, in the same way as wholly UK grants or subsidies, subject to any specific conventions agreed with HM Treasury for appraising the net benefits from EU grants and subsidies in particular programmes or particular cases. Available EU grants and subsidies should, however, be claimed.

Transfer payments

4.29 A transfer payment is one for which no good or service is obtained in return. Transfer payments, such as social security payments to individuals, may change the distribution of income or wealth. They do not of themselves give rise to direct economic costs, except for any associated costs of administration or compliance, because the benefits (to recipients) offset the direct costs (to taxpayers). They do however impose costs via the distortionary impact of the taxation which is needed to finance them. Transfers therefore can have an indirect effect on economic costs. This effect is not precisely quantifiable and is outside the scope of most appraisals, but transfer payments should be appraised with this knowledge in mind.

4.30 Tax receipts and general subsidies to particular goods or services are generally transfers. However both can affect market prices, and account may need to be taken of this as described in paragraphs 4.36-4.39. Exchequer costs are often a mixture of transfers and economic costs. Tax expenditures (subsidies delivered via the tax system) should be counted as Exchequer costs.

4.31 Although redundancy payments may be considered as part of the overall employment contract between management and staff they should be treated as transfer payments since they are not being paid in return for any future labour services. In this respect they are similar to cancellation payments, whose treatment is described in paragraph 4.42 below. Nevertheless redundancy can give rise to local economic and social costs due for example to market failures which inhibit or prevent the re-employment

of redundant workers in the next best alternative form of employment in the locality to their present work, or lead to the displacement of others who are then unable to secure alternative employment in the locality. However, as explained in Annex E, no overall *national* economic costs occur as a result of redundancy.

4.32 Such local costs are only likely to be significant where the numbers of redundancies are large in relation to the size of the relevant travel to work area (TTWA) and where unemployed workers of similar ages, experience and skills to those being made redundant are taking very much longer than the average in the area to find jobs or are becoming inactive. Assessing the impact of redundancy will require advice from economists and analysis of the local labour market, further guidance on which is given in Annex E. Although redundancy payments will rarely be a good indicator of the impact of the local costs arising from redundancy, these costs will of course be included in financial appraisals.

Profits

4.33 Profits accruing to suppliers to public bodies should normally be regarded as part of the costs of the good or service being purchased. Monopoly profits are transfer payments, not economic costs, but they are rarely identifiable and it would not in any case generally be good practice for government, as a purchaser, to give less weight to this element of its suppliers' prices than to other elements. Monopoly profits might however be identifiable as transfers in a cost benefit analysis in cases in which the government is not the purchaser.

Charges

4.34 Public bodies' charges should generally recover the accounting cost of the service concerned (which may be different from the opportunity cost), following the conventions described in the HM Treasury's *Fees and Charges Guide*. The accounting costs and income should be recorded in resource accounts, accruals accounts of NDPBs, memorandum trading accounts and similar accounts.

4.35 Revenue from charging is a benefit to the Exchequer but it does not generally provide a comprehensive measure of benefit in cost benefit analyses, where a wider concept should be employed, although the level of charges will affect the level and distribution of the benefits.

Taxes and subsidies

4.36 Taxes and subsidies (including grants and tax expenditures) can affect relative prices. Market prices which include them may not reflect opportunity costs or benefits, for this and other reasons. Different arguments apply to:

- the effects of general taxes on relative prices;²
- the treatment of taxes or subsidies which have been designed to correct "externalities" (see paragraph 4.39).

² The effect of taxes depends upon the characteristics of demand for and supply of the commodity taxed. If demand changes very little with price and supply is flexible, a tax will generally increase its price, and fall on consumers. If demand changes much more and supply is fixed, the effect of a tax will generally have little effect on its price, and hence will fall on suppliers. For example, the supply of land is inelastic and the usual long term effect of taxes on property is mainly to reduce rents and land values.

4.37 The adjustment of market prices for taxes in appraisal is appropriate only where the adjustment may make a material difference. This is a matter for case by case judgement, or for specific departmental guidance. It is important to adjust for any differences between options in the incidence of tax arising from different contractual arrangements, such as in-house supply versus buying-in, or lease versus purchase. Options attracting different VAT conventions, for example, should be compared as if either the same VAT payments, or no payments, were made in all cases.

4.38 In practice there are only a few cases where it is worthwhile to adjust market prices for indirect taxes such as VAT. It is even more rarely appropriate to make any adjustments to market prices for direct taxes, such as income and corporation taxes, or for import tariffs which are paid to the EU, or for business rates. These should normally be treated like other costs and included in market prices in the normal way. Income tax on fringe benefits (such as the private use of cars provided for employees) should be treated in the same way as other payroll costs. Comparisons between public and private sector provision of a service, which should include adjustments for any important differences in tax treatment, are discussed in Annex D.

Externalities

4.39 The production or use of goods or services can lead to costs or benefits which fall on neither the producer nor the user. Such costs or benefits are said to be "external". Subsidies or taxes are increasingly used to encourage or discourage the consumption or production of goods which have external benefits or costs. In this case the tax or subsidy might in principle be regarded as part of the cost of producing or consuming the good (or service). However, it is sometimes a matter of judgment whether a tax or subsidy is employed (partly or wholly) to offset an externality. In any case it is generally better to quantify such impacts explicitly and value them directly rather than to use the tax as a proxy valuation (see paragraphs 4.17-4.19).

Contingent liabilities and cancellation costs

4.40 Some projects expose the government to contingent liabilities - that is commitments to future expenditure if certain events occur. It is essential for public expenditure control that contingent financial liabilities should be carefully appraised before the project is started or the contract let, and carefully monitored thereafter.

4.41 Appraisal is also concerned with the potential economic cost of such payments. In such cases the economic costs of goods and services are often 'sunk costs', such as capital investment which has to be prematurely written down because an activity has fallen short of expectations.

4.42 One class of contingent liabilities is the cancellation costs for which the government body may be liable if it terminates a contract prematurely. Such liabilities, and the likelihood of their coming about, must be taken into account in appraising the initial proposal. They must also be considered in any subsequent appraisal of whether or not to end a contract prematurely. However, the only direct economic cost at the time of a cancellation payment is that part which pays for future economic costs caused by the ending of the contract.

An example is the cost of the premature, physical dismantling of a special plant. Strictly, any such consequences of changing contract arrangements should also be considered even if the liability falls on the contractor, but in practice it is rare for such costs to be important enough to justify this - and the contractor will normally have recovered the costs of such contingencies in his contract price.

Risk and uncertainty

4.43 An appraisal should take account of risks and uncertainties in the estimates of costs and benefits. Where the outcome is very dependent on a particular estimate, that estimate should be examined to see whether it can be made more reliable. The components of a net present value (NPV) should be presented in a way which allows the most important risks and uncertainties to be readily appreciated. This may involve quoting a range of net present values, each associated with different assumptions. It can sometimes be helpful to quote the value that a key quantity would have to take to alter the ranking of options. Appraisal should also assess the risks and uncertainties associated with factors which have not been valued in money terms.

4.44 A distinction is sometimes made in the financial literature between risk and uncertainty, "risk" being used when probabilities can be precisely estimated and "uncertainty" when they cannot be. In practice, public sector appraisal should always be based on at least implicit judgements about probabilities. However, in some cases probabilities are estimated explicitly and used in formal, quantitative risk analysis, while in others probabilities are not precisely stated. The latter are more common in practice.

4.45 Risk can take many forms. Most familiar is the risk that the project costs or benefits of an option are optimistic, i.e. that they do not fully reflect the chances of, say, cost or time overruns or shortfalls in demand. There may also be management costs attached to the extent of the variability of a project's costs or benefits around their expected value.

Risk transfer

4.46 *Private Opportunity, Public Benefit* (HM Treasury, 1995) brings together, in the context of private finance, a number of the most important risks that can occur to capital projects. These include risks to design and construction; commissioning and operation; technology and obsolescence; and regulation and legislation. The allocation of risk is especially important in the appraisal of private finance options and is discussed further in Annex D.

4.47 Sometimes it may be cost effective to transfer a risk to a third party by means of contractual arrangements with suppliers or by insurance. However, this should normally be confined to the transfer of risks to those who have a particular expertise in its management, or opportunity to reduce it. Guidance on insurance is provided in Chapter 27 of Government Accounting. Insurance does not reduce the importance of appraising the replacement of any lost assets in the normal way.

Sensitivity analysis

4.48 In most central government appraisals the analysis of risk can best be handled by sensitivity analysis. That is by seeing how variations across the plausible range of the important uncertainties could affect the relative merits of the options being compared. Options should in general be appraised on the basis of their expected values, or mean, (i.e. average of all possible) outturns.³ Full allowance should be given for any suspected optimism or pessimism in the figures originally proposed, having regard, for example, to the past record in the particular area, the complexity of the project, and the extent of new technology. It is not sufficient to show the implications of an arbitrary variation of say, 10 per cent around estimated costs or benefits. Some indication of the likely range of variation is needed and also of the extent to which risks to individual elements may combine together or bear heavily on particular users. Risk assessment should also be applied to non-marketed impacts.

4.49 Whether it is worth accepting higher expected costs or lower expected benefits simply to reduce variability is a matter for managerial judgement. There may sometimes be reasons for paying for more certainty to achieve better budgetary control. And some central government projects may impose large risks and uncertainties on individuals - a cost which should be reflected in the appraisal. (Generally, adjusting the discount rate is not an appropriate way of allowing for risk in central government appraisals, especially where comparisons are being made between alternative cost streams where a higher discount rate can favour more risky options).

Reversibility

4.50 The effects of some expenditure are reversible. The effects of others, especially many of those affecting environmental quality, are for practical purposes irreversible. This might be the case where land is drained or pollutants released. Projects with irreversible effects can later rule out other possibilities which might have been of greater benefit. Resources irrevocably tied up or destroyed by irreversible events may later be valued very highly. The loss of, say, a famous, even if little visited, historic site may entail a loss of "existence" or "option" value enjoyed by people from the knowledge that it was there. Reversibility is therefore a factor to be considered in appraisals. Important irreversible effects should be noted in the presentation and may merit further study.

4.51 Further guidance on the handling of risk in appraisals is given in Annex B.

Discounting

Value of the discount rate

4.52 For most applications in central government the real discount rate is 6 per cent. Exceptions to this are explained in Annex G. Exceptions include industrial assistance proposals and projects under the overseas aid programme.

³ This is not the same as the basis of initial project budgets which are generally set in terms of the "most likely" outturn.

Discount factors, present values and equivalent annual costs

4.53 The discount rate is expressed in real terms and should therefore be applied to costs and benefits which are also measured in real terms, as opposed to nominal (i.e. cash) terms. The use of this rate as a cost of capital makes it unnecessary to take any explicit account in appraisal of the interest paid on government borrowing to finance investment.

4.54 The effect of using a discount rate is to reduce the value of projected future costs or benefits to their values as seen from the present day. If someone places equal values on £1 today and the certainty of £1.06 in real terms one year later, this implies a discount rate of 6 per cent per year. For such a person £1 in a year's time is equivalent to only 94.3p now (because $1/1.06=0.943$). This figure of 0.943 is called a "discount factor". The discounted value of a future pound is called the "present value" of that pound. The following figures show how the present value of £1 declines in future years with a discount rate of 6 per cent.

Year of payment (mid year)	Present value (At middle of year 0)
0	£1 = £1
1	£1 x 1/1.06 = £0.943
2	£1 x 1/1.06 ² = £0.890
3	£1 x 1/1.06 ³ = £0.840
10	£1 x 1/1.06 ¹⁰ = £0.558

4.55 The sum of the discounted benefits of an option less the sum of the discounted costs, all discounted to the same base date, is the net present value (NPV) of that option. Where appraisal is undertaken purely in terms of costs, the sum of the discounted costs is the net present cost, although the acronym "NPV" is widely used for this too.

4.56 As an alternative to present values, costs or benefits can be calculated and presented as annuitised values, or "equivalent annual costs". For example, with a discount rate of 6 per cent, a sum of £100 now is equivalent to 10 annual payments of £13.59, the first a year from now, since these 10 annual payments have a total present value of £100. Equivalent annual costs can sometimes be useful for comparing options with different lifetimes, as explained in paragraph 4.61. They can also be useful as a way of costing the use of capital assets, the capital value of the asset being expressed as an equivalent annual cost over the asset's life.

4.57 Tables in Annex H give values of discount factors and equivalent annual costs for a range of discount rates. Annex H also provides formulae for calculating discount factors, present values and equivalent annual costs, together with other discounting formulae which can be useful in special cases. Most computer software packages have routines based on similar formulae.

The choice of base date for discounting

4.58 It does not usually matter which date is chosen as the base or reference date for discounting, though normally the current year is used. The same date should, however, be used throughout the analysis and clearly noted when presenting the results. In practice, it is usually sufficiently accurate to treat all sums accruing during the course of a year as falling at mid-year.

4.59 Where expenditure is spread over several years, it can be convenient to discount all costs and benefits to the middle of the year in which expenditure is first incurred. Then, if this base year is called "Year 0" and subsequent years "Year 1", "Year 2", and so on, the appropriate discount factors will be those for years 1, 2, etc. in the tables in Annex H.

Comparison of options with different lifetimes

4.60 The costs or benefits of alternative proposals can be properly compared only if they cover the same time period. If, for example, equipment A, which would last five years, is being compared with alternative equipment B, which would last seven years, then assumptions have to be made about what would happen between years 5 and 7 (if A were chosen) and about how the choices would differently affect any costs and benefits beyond year 7.

4.61 One way of allowing for different lifetimes is to assume that a piece of equipment would be succeeded indefinitely by similar equipment. In this case options can be most easily compared by the use of equivalent annual costs (see paragraph 4.56). Another way is to estimate a residual value where the appraisal period stops before the end of the lifetime of a piece of equipment. This would generally be the higher of its expected market value and its value in use in the project, which might be approximated by its accounting book value at that time. The choice of asset life is particularly important for buildings (see Annex F).

Discounting of physical quantities

4.62 It is sometimes appropriate to discount over time a physical quantity, rather than a cost or benefit which is expressed in money terms. The only general rule in this case is that the discount rate used should be consistent with the rate being used in the same appraisal for costs and benefits which are in money terms. Thus if the latter rate were 6 per cent, and if there was evidence that a particular physical cost or benefit would increase in real money value over time by 1 per cent a year, then units of that cost or benefits could be discounted at 5 per cent. Annex G explains how any costs or benefits which are considered to have a constant "utility" over time (as opposed to a constant real money value) might be discounted at that part of the 6 per cent rate which is attributable to time preference for utility.

4.63 It can sometimes be helpful to discount units of physical output and costs at the same discount rate, in order to work out a unit cost. A unit cost calculated in this way is the constant price which, if charged for the output, would yield a return equal to the discount rate. Discounting the output in this case is however merely an arithmetical short cut to calculating the constant price needed to achieve that yield. It incorporates no assumption of how the output value to its beneficiaries varies over time.

Alternative decision rules

4.64 Central government expenditures should normally be appraised in terms of their net present value (NPV), or net present costs. The "decision" rule for a given project is then to maximise the NPV, or minimise the net present cost, subject to account being taken of those impacts which cannot be valued. Two other decision rules used widely in the private sector are the internal rate of return and the payback period.

Internal rate of return

4.65 The internal rate of return (IRR) is the discount rate at which the net present value of a proposal is zero; that is, at which discounted benefits equal discounted costs. The decision whether or not to proceed should in principle depend on whether the IRR is higher or lower than the appropriate discount rate. An option with a positive NPV will have an IRR above the discount rate, and in this sense the NPV and IRR decision rules will give the same answer.

4.66 However the IRR criterion can be misleading. In particular, the use of an IRR criterion tends to put arbitrarily lower weights on longer term costs and benefits. Some unusual cases, with net costs in later years, can even have two quite different IRRs. Where there is a well defined discount rate the role of the IRR is at most that of a supporting indicator.

Payback period

4.67 The payback period is the number of years required to return the original investment. For instance, if an investment of £100 produces benefits or cost savings of £25 per year in real terms, the (undiscounted) pay back period is four years. By itself, the payback period is an unsatisfactory decision rule, because (unless applied to discounted cash flows) it takes no direct account of the timing of benefits, and more seriously because it takes no account of any costs or benefits occurring after the payback date.

Expenditure ceilings

4.68 Expenditure may be constrained in particular years. An expenditure constraint does not reduce the importance of appraisal, but rather enhances the importance and technical difficulty of choosing those uses of limited funds which will provide the greatest benefits. It may influence the choice of options, if options which would otherwise be preferred require high expenditure in the period during which the constraint is expected to be most severe.

4.69 However if the constraint is expected to be no less severe in the longer term than the shorter term then this should not generally lead to capital rationing of investments which reduce public costs or increase public revenues. Making room for such investments within the overall expenditure ceiling may cause great difficulty; but the savings they generate will bring equally great relief.

4.70 A device which is sometimes useful in selecting projects when there is an expenditure constraint is to rank them in order of the ratio of their net present value (NPV) to expenditure falling within the constraint. This should be done with care to avoid including separable elements with low ratios as part of a project with a high overall ratio, or rejecting elements with a high ratio which could stand alone because they are included in a project with a lower overall ratio.

4.71 The discount rate should not be increased as a means of handling a general expenditure constraint on an expenditure programme because this would favour short term projects at the expense of long term projects for no good reason.

Annex A: The Management Of Appraisal And Evaluation

General principles

1. Appraisal and evaluation are stages in the general management of projects, programmes or policies. This Annex is designed to help managers in setting up, checking and developing procedures for the effective control of this process. Appraisal and evaluation follow from a sequence of management inputs, starting with a broad view of what is wanted and ending with a look back at the outcome and how any lessons can be learnt and fed into future decisions. Some departments and agencies formalise this in the acronym ROAME or, more recently, ROAMEF. The ROAMEF¹ headings are discussed in the Appendix to this Annex.

2. Responsibilities for carrying out appraisal and evaluation need to be well defined. It must be clear whose job it is to demand appraisal and evaluation, and when; whose job it is to carry these out;² and whose to check that procedures have been applied and applied correctly.

3. The conditions needed for effective appraisal and evaluation include:

- a prevailing attitude that value for money is important;
- clear support from senior management;
- clear definition of responsibilities;
- clear and up-to-date procedural and technical guidance;
- effective incentives for good appraisal and evaluation;
- a willingness to critically assess performance and apply lessons learnt.

4. Where authority is delegated, robust procedures to ensure that appraisal and evaluation are effectively applied are especially important.

¹ ROAMEF stands for Rationale, Objectives, Appraisal, Monitoring, Evaluation, Feedback.

² Evaluation will usually be most effective when it is undertaken by a relatively independent body.

5. Those involved in appraisal and evaluation need to have up-to-date written guidance, both procedural and technical. This nearly always requires departmental guidance from finance divisions or economists, which is consistent with, but supplements, HM Treasury and other central guidance. It can be helpful for departments to consult HM Treasury when preparing their own guidance.

6. Appraisal and evaluation need to draw upon a wide range of skills. Most of the work for a typical appraisal can be carried out by non-specialists, given proper training. Technical specialists are however often needed, from within or from outside government, to provide or assess the significance of any scientific, or engineering, or other technical quantities, such as property valuations.

7. Specialists are also needed to advise on other aspects of data collection, handling or interpretation. For example, statisticians may need to advise on sources of data or issues of classification. Social researchers may need to be involved in collection of new data, where monitoring information is insufficient to test financial impact or where an understanding of the behavioural impact of a policy or intervention is important. Economists may need to help deal with some of the economic issues covered in this guide. Accountants may need to advise on aspects of costing and of resource accounts. Operational researchers may need to develop, in particular, measures of output and performance.

8. There must be effective personal and institutional incentives for good appraisal and evaluation.

The management of appraisal

9. Appraisal should not normally require much active management, beyond a senior level expectation that new proposals should be appraised, and measures to ensure that the department or agency has the technical competence either to do the work or to get it done by others. In a body where value for money is taken seriously, appraisal should flow naturally from the normal course of business.

10. Some continuing management initiative is however needed to ensure that the procedures and their application do not become mechanistic, but that, in design and application, appraisal asks the right, and where necessary, searching questions.

The management of evaluation

11. Evaluation requires much more management initiative (and, in many areas, political commitment) and more intensive monitoring than appraisal. Whereas appraisal is triggered by new proposals, and is usually required as a condition of approval, evaluation has no such trigger, and there is no carrot or stick corresponding to the promise of approval, or threat of withholding approval, for a new project. For evaluation to happen at all there has to be continuing senior level commitment.

12. In practice this requires a clearly defined central responsibility with top level backing, to progress the Department's evaluation programme. The Department for International Development's Projects and Evaluation Committee and the DTI's Evaluation and Policy Improvement Committee are examples of structures designed to achieve this.

13. There are number of possible sources of evaluation, e.g. the sponsor, the manager, the end-users, in house specialists, or external consultants. There is however a strong case for normally maintaining the independence of evaluators from the day to day management of the project, programme or policy. Some evaluation is best undertaken by a specialist evaluation unit.
14. There will always be a problem for independent evaluators of gaining sufficient confidence from management to be able to gain access to records and technical support, yet maintaining sufficient distance from that management to be able to exercise independent judgement.
15. It may be possible to contract out aspects of evaluation to external consultants although it will not always be appropriate to do so, for confidentiality reasons, and because of the cost of informing the consultants of the relevant features of the management and culture of the department or agency. Nevertheless there are often clearly defined blocks of work, frequently demanding technical expertise, which lend themselves to contracting out, and in such cases the decision to employ consultants should be made on value for money grounds.
16. Evaluation is inherently a multi-disciplinary activity, and it should not be left to a few specialists. Contributing to it should be an integral part of all project and programme planners' and managers' activities, involving all relevant specialists.
17. Appraisal and evaluation are interdependent. All appraisals should incorporate an outline design for evaluation. The appraisal should also indicate how the activity would be monitored and how the monitoring data would be collected. If there is an independent evaluation unit, they should be given the opportunity to comment on appraisals and business cases for new projects, and ROAMEF statements for new programmes.
18. The thoroughness of an evaluation is likely to depend upon the amount of expenditure, and the policy interest (for example, importance, novelty (including pilots) and relevance to future activities). Evaluation should be conducted on activities which have gone well in order to identify ingredients for success, as well as those which have generated significant problems.
19. Where projects are part of a programme or ongoing activity it may not be necessary to evaluate all projects, but a representative sample should be selected with regard to coverage, economy, and control.
20. The timing of evaluation should be determined by the characteristics of the particular project. It should also be at the appropriate point in the management process to fit in with decision-taking.
21. The potential value of an evaluation will only be realised when action is taken on it. Processes are needed to ensure that this happens.

Appendix to Annex A: ROAME and ROAMEF

Rationale

1. Within the public sector establishing a rationale will typically involve justifying an activity in terms of its expected impact on economic performance, or in terms of some other stated objective (e.g. social objectives) of government policy, or some combination of the two. Annex E discusses market failure rationales for government intervention.
2. To provide a rationale for intervention it will be necessary for a department or agency to show how:
 - the project fits in with the stated aims and objectives of the department or agency;
 - how the project complements other interventions by the department or agency;
 - how the project interacts with interventions by other departments or agencies.

Objectives

3. Objectives should state what the project is designed to achieve and be consistent with the rationale.
4. It is sometimes useful to identify a hierarchy of objectives: for example, the Department for Education and Employment (DfEE) distinguishes between ultimate, intermediate, and immediate objectives (See Box in Chapter 2). The Logical Framework or Project Framework, which is employed by a number of bodies, including the Department for International Development (DfID) distinguishes between wider objectives, immediate objectives, outputs, and inputs. (see the Box to this Appendix).

Appraisal

5. Appraisal is intended to determine which of a set of options will best achieve the stated objectives.
6. Appraisal should be thought of as a continuous process. It is likely that the appraisal process will be revised, or possibly repeated as circumstances change, and as additional information becomes available. Nevertheless a particularly important step in the appraisal process will occur prior to the commitment of resources or the signing of contracts. The appraisal report is often combined with details of project financing and project management to form a business plan.

- Monitoring** 7. Monitoring is the systematic collection of financial and management information during implementation. It provides an essential source of information, indicating the extent to which objectives are being attained, and giving an early warning of potential problems. Monitoring also provides information for input into the evaluation stage. To be effective fully, plans for monitoring should form part of the initial planning of a project, and it may be necessary to set up monitoring systems needed specifically for evaluation purposes.
- Evaluation** 8. Evaluation is the process of assessing the impact of a project while it is in operation, or after it has come to an end. It involves consideration of the economy, efficiency and effectiveness of the project to determine the value for money obtained from intervention, how well it achieved its objectives and whether there were any unintended outcomes. Evaluation brings to the fore the lessons to be learnt for the future which can in turn be fed into future decision taking.
9. Plans for evaluation should form part of the initial planning of a project. To ensure that evaluation is consistently applied it is important for a department or agency to maintain a clear requirement, endorsed by senior management, that evaluation should be applied, with a senior official having specific responsibility and funding for monitoring and progressing the evaluation programme. It is important to ensure that evaluation results are available in good time to inform future decision making. However, policies and interventions do not always have an immediate impact and it is important to ensure that evaluations take account of longer term impacts.
- Feedback** 10. Feedback is not always welcome. But this reflects its importance. Evaluation reports should reach senior management, and all results of substance should be widely disseminated to staff concerned with future project design, planning, development and management.

The Logical Framework or Project Framework Approach

The "Logical Framework Approach" to the planning, monitoring and ex-post evaluation of aid projects was first developed in the United States in the late 1960s. It has since been taken up and adapted by other development agencies, including the Department for International Development (DfID) in the UK.

The core of the approach is a matrix, described in the DfID as the Project Framework.

On the vertical axis is a hierarchy of inputs and outputs. On the horizontal axis are questions about how each can be measured and about the associated assumptions and risks. As such it is an aid to thinking rather than a set of procedures. It poses a comprehensive set of challenging questions.

The Project Framework matrix is structured as follows.

INPUT or OUTPUT	INDICATORS OF ACHIEVEMENT AND VALUE	HOW INDICATORS CAN BE QUANTIFIED OR ASSESSED	ASSUMPTIONS, RISKS and CONDITIONS
CONTRIBUTION TO SECTOR OR NATIONAL OBJECTIVES	How measured?	Sources of information?	External conditions needed for Immediate Objectives to contribute to Sector or National Objectives?
CONTRIBUTION TO IMMEDIATE OBJECTIVES	How measured?	Sources of information? Need for monitoring?	External factors which may restrict progress from Outputs to achievement of Immediate Objectives?
OUTPUTS	Physical measures of kind, quantity and when.	Sources of information?	External factors necessary for planned Outputs to be delivered on schedule?
INPUTS	What materials, personnel, training etc., at what cost, over what period, provided by whom?	Sources of information?	Decisions/actions outside the control of ODA necessary for inception of the project?

Annex B: Risk and Uncertainty¹

Summary

- Risk analysis should aim to eliminate the effects of optimistic bias, to quantify and value variability and to assess any important irreversibilities.
- Risk and its impacts should be reduced wherever it is cost effective to do so, for example by pilot projects, further research, flexible or standard designs, and the transfer of risks to where they can be handled most effectively.
- The most widely used and most generally useful technique for portraying risk is sensitivity analysis, to show the effect of alternative assumptions on costs and benefits. This should be generally applied. The discipline of considering alternative outcomes in a systematic way will often feed back into new ideas and judgements about both risks and options.
- Other techniques of risk analysis such as scenario planning or Monte Carlo analysis can also be used where appropriate. Generally, adjusting the discount rate is not an appropriate way of allowing for risk in central government appraisals, especially where comparisons are being made between alternative cost streams, where higher discount rates can favour more risky options.

What is risk?

1. Risk is the possibility of more than one outcome occurring. This might be, for example, because construction or operating costs depend on ground conditions, or on weather, or on the success of a new technology; or because the demand for a project's output depends on future incomes which are uncertain; or because of uncertainties about future wage or fuel costs, or changes in consumers' tastes, or competition from other suppliers, or for any of a number of other reasons.

¹ This Annex provides further guidance on handling risk in appraisals. It does not cover the handling of risks during project implementation and operation, which depend upon project management and on forms of contract. Nor does it cover the issues of risk transfer which are specific, and central, to the negotiation of contracts for privately financed projects, which are outlined in Annex D and described more fully in separate guidance. This Annex covers the handling of risk in the appraisal of projects or programmes to the extent that they are managed in the public sector.

2. In everyday language a distinction is often drawn between risk, referring to the likelihood of something going wrong, and uncertainty, meaning that the outcome of a course of action is indeterminate or subject to doubt. Throughout this guidance the word "risk" is used in both senses.²

3. In risk analysis it is usual to describe the average of all possible outcomes, taking account of the different probabilities, as the "expected" outcome. This expected outcome, which is also known as the "mean" or "unbiased" outcome, is generally not the same as either the planned outcome or the most likely outcome. The most likely outcome is that which has the highest probability of occurring. ("Expected" outcomes tend to be worse than "most likely" outcomes, as illustrated in Example 1 below.)

4. In this guidance optimism is used to describe the risk that predicted outcomes do not fully allow for the likelihood of things going wrong. Optimistic bias, about both costs and benefits, is most common in proposals for new ventures or new technology.

5. Variability is used to describe a spread of possible outcomes around an expected outcome. All projects have a range of possible outcomes, although ranges are much wider (eg with the use of new technology), and variability much more important, for some projects than for others. Variability can sometimes impose difficulties for budget management, or on particular individuals affected by the project.

The objectives of risk analysis

6. Risk analysis should aim to eliminate optimistic bias. It should also take careful account of the possible variability of the outcome costs and benefits. Where irreversibility is important, this too should be assessed.

7. The likelihood of optimistic bias should be judged, in the first instance, against the outcomes of previous projects with similar features. Assurances, however sincere, that past problems, or problems like them, will not occur in future should be examined on their merits. Where there is no similar previous experience the component parts of the project, both costs and benefits should be examined separately to remove any overall optimism - remembering that it is nearly always more likely that an outcome will be much worse than an original estimate than that it will be much better.

² A distinction is sometimes made between risk and uncertainty, where "risk" is measurable and refers to situations with known probabilities, and "uncertainty" refers to situations with unknown probabilities. In practice the distinction is rarely clear-cut. A probability may be assigned to a particular event, but it is seldom known with absolute certainty. On the other hand few events are so uncertain that no judgement can be made of the likelihood of their occurring. At the same time the *techniques* of risk analysis do depend upon the precision with which probabilities are known.

Example 1

As a stylised example, to illustrate the differences between the most likely and the expected outcome, suppose that a proposed construction project has three possible outcomes A, B and C, depending on factors such as construction costs, future usage and the weather, with the following probabilities. The net benefit (NPV) is uncertain but can be adequately represented by the following spread of three possible outcomes, reflecting the greater potential, as is usual, for the costs and time scale of construction and maintenance to be in the event very much worse than planned than to be very much better.

	NPV	Probability
A	£11 million	0.2
B	£10 million	0.6
C	£4 million	0.2

The most likely outcome is B, £10 million, because it has the highest probability.

The expected outcome is the sum of each possible outcome³, multiplied by its probability, ie:

$$(0.2 \times £11 \text{ million}) + (0.6 \times £10 \text{ million}) + (0.2 \times £4 \text{ million}) = £9 \text{ million}$$

The most likely outcome, B, if taken as the basis for an investment choice, is therefore optimistically biased by £1 million. In real cases, of course, the number of possible outcomes is usually much greater and their probability less well defined. Judgements about probabilities are however still needed. This is usually best done with the help of sensitivity analysis, as explained below.

8. Risk analysis should also take account, at least qualitatively, of variabilities in outcomes which may bear heavily on particular individuals. An example is the impact of planning blight on the value of houses and land. Another is drainage schemes where uncertain benefits may be concentrated on a small number of households. Yet another is uncertainty about whether journeys will be delayed by roadworks. In all of these cases variability may have a significant cost: individuals would accept a significantly lower expected benefit in exchange for a guaranteed or a much more certain outcome; or conversely they would require a higher expected benefit to compensate them for a less certain outcome. This should be taken into account in appraisal.

9. Variability which is spread very widely, for example by small adjustments up or down in public taxation or borrowing, has no effect except to the extent that costs or benefits are correlated with income.⁴ For most public projects this effect is generally small.⁵

³ In practice it is usually good enough to presume that expected NPVs follow from the expected values of each component cost and benefit. This is strictly accurate only where the probabilities of different costs and benefits are independent of one another. Where they are not independent more complicated methods may be needed.

⁴ The expected money value of a cost or benefit whose money value varies positively with income counts for less than the same expected money value of a cost or benefit whose variations are random or constant, or are inversely correlated with income. This is because its money value is greater when marginal income matters least.

⁵ A technical expression quantifying this effect is given in paragraph 6 of the Appendix to Annex G. A pragmatic approach can be that where the money value of costs or benefits varies more than proportionately with income more weight should be placed on the central assumption about incomes than on the average of high and low income outcomes.

10. Account should also be taken of the managerial costs of variability. A project with a wide spread of possible outcomes and associated cash flows may be more difficult to manage and plan, especially where the project is a large proportion of a fixed budget. As any such extra managerial costs would not normally be included in the project costs they might justify requiring a higher expected NPV than would be acceptable if the costs were more certain.

11. Account should also be taken of irreversibility, where the implementation of a project would rule out important, later investment opportunities or use of the resources which might subsequently be preferred. Examples of irreversibility are destruction of natural environments or historic buildings.

12. Irreversibility is often associated with facilities which people value in terms of "option values" (the value of knowing it is there to enjoy if they wish to do so) or in terms of "existence values" (the value of knowing that it continues to exist, even if they do not expect to make any practical use of it). Such values, while sometimes very important, are not easy to quantify.

**Clarifying and
quantifying risk**

13. The extent of risk and uncertainty confronting project options can be identified, clarified, and where feasible, quantified and valued, using a risk matrix (see Appendix). The effect of various combinations of risk and uncertainty on project outcomes can be analysed using sensitivity analysis.

14. Sensitivity analysis should always be used to examine the robustness of the overall conclusions from the appraisal process. It is especially important when:

- there is uncertainty in the estimates of costs or benefits. This applies to any project entailing significant new technology, or substantial relocation, or any large construction project, or building refurbishment, or forecasts of market shares;
- there are options in which the uncertainties present a potential budgeting problem for management. This applies to any project that is large relative to the total budget, or to projects subject to large uncertainties, such as maybe caused by, say, demand risks.

These conditions apply to many central government investment proposals.

15. Sometimes other techniques may be justified, such as scenarios and Monte Carlo analysis. Techniques for clarifying and quantifying risk are discussed further in the Appendix to this Annex.

**Reducing
the cost
of risk**

16. Acquiring more information about risks affecting a project through pilots or further research can be useful because this allows steps to be taken which either mitigate the adverse consequences of 'bad' outcomes, or increase the benefits of 'good' outcomes. Reducing uncertainty in these ways can reduce the expected costs (or increase the expected benefits) of a project. Pilots are common in large information technology projects, where they provide experience of, for example, the amount of training required, changes in working practices and thus the potential for staff savings. Further research may confirm or disprove the reliability of new technology. In construction projects, site investigations may reduce risks from unforeseen ground conditions or refurbishment costs.

17. Flexible designs may reduce the cost of risk. Where future demand and relative prices are uncertain it may be worth choosing a flexible design adaptable to future changes, rather than a design suited to only one particular outcome. For example, different types of fuel can be used in a dual fired boiler, depending on future relative prices of the alternative fuels. Preparatory earthworks, and suitable designs of bridges can reduce the cost of future road widening should it be justified later by a growth in traffic. Flexibility can also be increased by breaking a project into stages, with successive review points at which the project could be stopped or changed.

18. Building in flexibility will almost always entail some cost. The cost effectiveness of a flexible design should be appraised by estimating the likelihood of different outcomes, the costs of adapting to change during the lifetime of the project and the penalties of "being wrong" if future demand or relative prices differ from those expected.

19. In some cases it may be cost-effective to use standard designs, for example of prisons or hospitals, to reduce risks by incorporating the lessons of past experience and, reducing the number of new elements of design.

20. Risks to one party to a transaction can be reduced by transferring them, at a cost, to another party, either by the terms of contract between suppliers and customers, or by insurance.

21. The government, in general, is a self-insurer. This is mainly because the government can spread risk widely, and it does not need to insure simply to protect corporate financial viability. On the other hand insurance can be cost-effective in some circumstances, where, for example, it leads to more careful examination of risks and requirements, by the insurer, of measures to reduce risks. Where required, advice should be sought from economists or HM Treasury.

22. Budgeting uncertainties may sometimes be reduced, without an unacceptable loss of control, by increasing flexibilities between years or between budgets. Any benefits which this might bring in terms of greater certainty must be set against any adverse effects on incentives.

A Checklist for Handling Risk and Uncertainty

Identify and quantify risks

- Identify the main areas of risk, and important uncertainties, affecting the main costs and benefits;
- Quantify, or at least make broad judgements about, ranges and probabilities of the important factors determining the outturn.

Analyse risks

- Quantify the possible and likely effects of optimistic bias, where possible on the basis of evidence from similar projects in the past;
- Undertake sensitivity analysis and calculate switching points where appropriate;
- Consider whether other methods such as scenarios or Monte Carlo analysis are justified;
- Consider where variability may be important (for example, where it imposes costs on project management; or falls heavily on individuals).

Act to reduce risks

- Consider whether a pilot project or more research is justified;
- Consider the case for more flexible or more standardised designs;
- Consider the case for a more flexible project which avoids maximum commitment until nearer the completion date;
- Consider the scope for better contractual arrangements.

Appendix to Annex B: Techniques for Clarifying and Quantifying Risk

1. This Appendix discusses a number of methods for clarifying and quantifying risk. Sensitivity analysis should be generally applied, but other techniques may also be warranted.

Risk analysis matrix

2. A basic tool for identifying exposures to risk is a risk analysis matrix. This is a listing of the various risks and uncertainties to which particular project options are exposed, together with an assessment of the likelihood of their occurring, and the impact on the outcome of the project. This is sometimes combined with a risk register, which identifies who will bear the risk.

3. An attempt should be made to quantify at least the major risks, although many risks may have to be expressed in qualitative terms. Information on the size of risk exposures can be obtained from evaluation reports on previous similar projects, monitoring data and reports of official bodies such as the National Audit Office (NAO).

Sensitivity analysis

4. Sensitivity analysis is the calculation of how changes in particular assumptions would affect net present values (NPVs), total costs, or other project outcomes. Its application requires judgement about the weight to give to alternative assumptions.

Example 1

A new IT system costs £1 million and is expected to yield staff savings of £150,000 per year over a period of 10 years. Discounting at 6 per cent, the NPV of these costs and benefits is £104,000.

Suppose the estimates of staff savings assumed that the IT system would replace 15 staff with an average cost per person of £10,000. Two possible sensitivity tests are:

- (i) What if the IT system replaces only 10 staff? Staff savings would then fall to £100,000 per year and the NPV turns negative (minus £264,000).*
- (ii) What if salaries rise in real terms by 2 per cent per year? The present value of staff savings would increase to £1.22 million, and the NPV is £216,000.*

5. Sensitivity analysis is a useful and often essential guide to what further information would be worthwhile. It can help draw attention to those factors which require especially careful assessment or management. (These factors will generally include both project or policy inputs such as choice of location, and states of the world such as future changes in relative prices.) It is useful as a way of allowing different assessors to see how their different views of the likely costs and benefits would affect the outturn.

6. Sensitivity analyses need to be well designed and clearly presented. The alternative outcomes need to be chosen carefully, to focus especially on those uncertainties which are most important, and on where uncertainties are much greater in one direction than another. All important risks must be considered and account should be taken of any important relationships between factors. Checklists of, for example, all potential "abnormals" (e.g. subsoil uncertainties) for buildings are often helpful. The advice of experts such as architects, surveyors, engineers, or industrial experts should be sought where appropriate.

7. Sometimes the calculations for each option may be independent. In other cases the same variables may affect several options, perhaps in very different ways.

8. In some projects the probabilities of different outcomes can be estimated objectively by statistical techniques. Examples are the risk of floods in flood protection schemes or the risk of accidents or fires. More often probabilities cannot be calculated in this way, because the necessary data either does not exist or is not available. On the other hand some past data are almost always available to allow at least a broadly informed judgement to help apply and interpret sensitivity analysis. Commercial insurance premiums can sometimes be a helpful guide to probabilities. Employing subjective probabilities is better than ignoring some important risks altogether.

9. Sensitivity tests should be informed wherever possible by the use of past data to appraise the reliability of estimates; for example past records on cost and time overruns on construction projects; and records on the accuracy of forecasts of demand.

10. It can be helpful to show how different assumptions about the chance of particular variations affect the expected NPV. It can also be helpful to group together variables in the sensitivity analysis by setting up "pessimistic" and "optimistic" variants, allowing a broad assessment of the likelihood of these outcomes to be made by those responsible for deciding whether a project should proceed.

11. It may be that a single factor is crucial to the decision whether or not a project or option is worth undertaking. In such cases, a useful form of sensitivity analysis is to see how much the value of this factor would have to fall (if it is a benefit) or rise (if it is a cost) to make it not worth undertaking the option. This value is called a switching value or switching point. Once the switching point has been established, it may then be relatively easy to assess the likelihood of the outturn being worse than this.

Scenarios

12. Major decisions can justify the use of fully structured scenarios. "Scenario planning" looks at the consequences of various possible states of the world for anything from an individual investment project to an entire corporate strategy. A scenario is not a forecast, but an internally consistent description of a possible future economic and political environment. Scenarios are

often useful for planning an investment programme and may also be justified for exceptionally large and complicated projects.

13. Scenarios should be chosen to draw senior management's attention to the major technical economic and political uncertainties upon which the success of the project or option or strategy depends. Generally the best approach is to set up two, or possibly three, scenarios. If three scenarios are chosen, they should differ in different dimensions so that no one scenario is seen as central or the most likely.

14. The expected NPV can be calculated for each scenario. It may also be helpful to undertake some sensitivity analysis within a scenario.

15. Scenario planning is sometimes associated with the decision criteria of maximin-returns (i.e. the option which offers the least bad "worst possible" outcome) or, more often, minimax-regret (i.e. the option which offers the least potential cause for regret). These criteria can be presentationally helpful, but can give no more than a partial picture of how the options compare. There is no escape from having to judge, at least implicitly, the relative likelihood of each scenario.

Monte Carlo analysis

16. Monte Carlo analysis allows an assessment of the consequences of simultaneous uncertainty about key inputs, taking account of correlations between these inputs. It involves replacing single entries with probability distributions of possible values for key inputs. Typically, the choice of probabilistic inputs will be based on prior sensitivity testing. The calculation is then repeated a large number of times randomly to combine different input values selected from the probability distributions specified. The results consist of a set of probability distributions showing how uncertainties in key inputs might impact on key outputs.

Decision rules and decision trees

17. "Decision rules", such as *maximin outturn* or *minimax regret*, are sometimes useful and can help to clarify the relative characteristics of alternative options.

18. Decision trees are graphical representations of the set of possible strategies and can be useful for analysing projects involving sequential decisions. Different strategies result in different NPVs depending on the events (or states of the world) which occur.

Rough and ready techniques

19. A *premium on the discount rate* is sometimes used as a way of allowing for optimism, where the discount rate is applied to future benefits such as sales revenues, or where there is an important risk of premature obsolescence. It may occasionally be a useful device for helping to offset optimistic forecasts of benefits where the approving body has limited control over the forecasts itself. However, applying a premium to the discount rate is generally not a sound approach to option appraisal. Besides being crude, it pushes decisions in favour of options with higher operating costs, which are not necessarily less prone to optimism, than those with lower operating costs.

20. A *pay back period* is the number of years before a project breaks even in terms of its total (discounted or undiscounted) benefits (net of on-going costs) equalling its capital costs. A payback period ignores all benefits and costs arising after the break- even date and so is likely to distort project choice. It can, however, sometimes be useful as a supplement, though not an alternative, to other techniques for handling risk. It may be used as part of an assessment of optimistic bias where, for example, a long pay back period may suggest that a project's viability is fragile.

Annex C: Costs and Benefits Not Easily Valued

Introduction

1. Appraisal and evaluation within central government are almost always concerned with some important impacts for which there is no market value. This is true of many of the principal outputs. It is also usually true of side effects, for example on the environment, or the efficiency of the economy (external effects on economic efficiency are discussed in Annex E), or on the delivery of other government policies. The identification and, where possible, valuation of environmental costs and benefits has become still more important with the acceptance of a policy of "sustainable development".
2. Sometimes these impacts can be valued, in ways which are widely enough accepted to be used as a basis for policy decisions. This applies routinely to, for example, the valuation of working and of leisure time in the calculation of the costs and benefits of a road scheme. It may apply in some appraisals to specific environmental impacts, or for example to the value placed by people on changes in the standards of some public amenity. Appraisal which makes substantial use of valuations of this kind is described as "cost benefit analysis". Cost benefit analysis is however not the norm even in public sector appraisal and evaluation. More often than not, all of the non-marketed costs and benefits are compared on the basis of quantitative and sometimes only qualitative assessment, with no valuation, and this is often the best approach.
3. It is never possible in a real life appraisal or evaluation to put a monetary value on all the important factors. There will usually be impacts which can be quantified and which might in principle be valued, but for which no well enough accepted method is currently available. There will always be some wider managerial or political dimensions which are inherently judgements for those who are responsible for the final decision.
4. This Annex is not concerned with these latter, wider considerations, although they may weigh heavily in the final stages before an important decision is taken. It does however address those impacts which, even though they have no market price, can still be handled, and are best handled, within a tight analytical framework.
5. This Annex first describes the ways in which some impacts can be valued, and so incorporated in cost benefit analysis. It then moves on to the more comprehensive

matrix or impact statement approach, by which impacts which cannot be valued are set out in a way which best helps judgement about the relevant trade offs. It finally discusses how, within this latter approach, some impacts may be numerically scored and weighted to produce a ranking of options.

Valuation of non-marketed impacts for use in cost benefit analysis

6. The valuation of *marketed* goods is generally straightforward. Markets typically produce information on the price at which a good is demanded and supplied, and thus generally market prices can be used as the basis for appraisal and evaluation.¹

7. Where a good is not marketed however, what is observed is at best a quantity demanded or supplied in the absence of a price. For example, there is no market in increased risk of death or injury, except indirectly through, for example, voluntary expenditure, or higher wage rates for more compared with less risky jobs.

8. The problem of valuation is therefore likely to involve the inference of a "price" revealed by consumers' behaviour, or derived from their stated willingness to pay. The former approach is often described as "revealed preference" and the latter as "stated preference". Revealed preference is based on evidence from market transactions, for example the correlation of noise disturbance with house prices, holding other relevant factors constant. (The term "hedonic pricing" is sometimes used to describe this methodology). "Stated" preferences are normally obtained by means of carefully constructed questionnaires and interviews, for example using contingent valuation techniques. Empirical results from either approach usually require critical examination.

9. Approaches to valuation can sometimes be borrowed from other contexts or similar programmes, but the values derived are often specific to a particular area of application. For example, the characteristics of the consumers or client group may differ, or the demand for units of output will depend in part on the relative prices of other goods and services. These may vary. Such factors limit the extent to which values can be generalised.

10. Non-marketed goods are generally best valued in terms of people's willingness to pay for marginal changes in supply. Sometimes reference is also made to the costs of preventing the loss of, or replacing, a non-marketed good (such as a natural habitat or recreational facility). This does not of course provide a measure of its value. It can however provide a figure to help focus discussion upon whether the good is worth as much as this expenditure, and it may help to show the implicit value placed on such goods in past decisions.

11. It is often difficult to assess the reliability of estimates emerging from a single study using a single method. Valuations may be unreliable, for example because respondents to a contingent valuation questionnaire may give inconsistent responses, or because valuations may take insufficient account of personal budget constraints.

¹ In exceptional circumstances, where it is considered that the market price is distorted for instance by monopoly power or non-corrected externalities, advice from economists should be sought as to whether a correction is required.

Estimates can be given more weight if different methods give similar results, or if the study has been replicated by other researchers with similar results. Ranges of possible values are generally preferable to point estimates.

12. The Appendix to this Annex provides a number of current applications of valuation techniques in central government.

The analysis of impacts which cannot be valued

13. When there is no generally accepted method for valuing impacts, it should not be assumed that such impacts are immediately "unquantifiable". In practice most effects can be quantified in their established units. For example, there are a number of quantitative indices of noise nuisance based on loudness, duration and variability of noise levels. Comparison of the relevant measurements before and after a project illustrates impact. Even if an effect cannot be quantified it may be possible to devise scales of measurement that differentiate between options according to a given characteristic.

14. Having quantified each impact, in its own units or by a scaling system (see accompanying Box), it is possible to compile a comprehensive matrix or impact statement for alternative options. Under such a methodology impacts are set out in a way which best helps inform judgement about the relevant trade-offs that are available.

The Use of Scales

Several types of scale can be used for measurement.

- An *ordinal* scale provides a ranking of the options on the basis of the characteristic being assessed. It enables one to say, for example, that option A is "more accessible" than option B, but not by how much more.
- On an *interval* scale the difference between the measurements is meaningful, so one score can be subtracted from another. (An example is a temperature scale, where a temperature of 22°C is closer to 20°C than to 25°C, but in no useful sense "10% hotter" than 20°C.)
- A *cardinal* scale differs from an interval scale in that it has an origin. Thus ratios between scores may be calculated, and an option which scores twice as highly as another may be said to perform twice as well on that characteristic. An example of a cardinal scale might be a scale of, say, 0-5 broadly proportional to the number of people adversely affected by a proposal.

If some options lead to lower benefits on some criteria compared to doing nothing, it can be helpful to allow negative scores, for example on a scale of -5 to +5, with zero implying "no change".

Good practice in the use of scales includes:- the scaling system should be understandable, adaptable and cost-effective (relative to the value of information obtained); the "right" scaling method should be used, and there should be an explicit statement of the methods and assumptions used to derive scores.

15. The comprehensive matrix approach provides the relevant data necessary to inform decision making in a relatively accessible form. It is widely used in planning or transport applications where environmental assessments are required and distributional impacts may be important. It can also be used in conjunction with separate monetary assessments. This approach can have as a subset the numerical scoring, weighting and ranking of impacts (see accompanying Box).

Scoring, Weighting and Ranking

Scoring, weighting and ranking is a technique for measuring outputs which have different dimensions. It is most widely used for proposals which have multiple outputs, such as is often the case in regeneration (see Appendix 1 to Annex E) and environmental projects. The use of this technique requires the clear identification of outputs and objectives (See Box in Chapter 2).

Outputs are first assigned a score based on an appropriate scaling system (see Box on *The Use of Scales*), which needs to be applied consistently. Different outputs are then given a weight according to their perceived importance in enabling objectives to be met. The scores and weights are then combined to give a single number so that different options can be ranked in terms of effectiveness.

Scoring, weighting and ranking requires judgement about the relative scores and weights to apply to different outputs. The sources of these scores and weights need to be explicit. Generally they should be based on some competent and independent empirical measurement, or possibly a consensus of expert opinion, or explicitly on political judgement, where such measurement or consensus is not available.

Sensitivity analysis should be applied to test the robustness of the ranking on options to alternative weightings.

Scoring, weighting and ranking can be useful as a means of highlighting various trade-offs between options, although outputs need, of course, to be related also to inputs to determine cost-effectiveness. If alternative options are being compared which differ in scale, the value for money of extra benefits of the larger option should be assessed against its extra costs.

Appendix to Annex C: Practical Applications

1. This Appendix presents some practical applications of valuation techniques currently used in central government.

Valuation of savings in travel time

2. Within central government, the methodology for valuing time adopted by the Department of Transport (DOT)¹ to derive values used in appraising road schemes and other transport projects is well established. Different values are used for "employers'" time and "own" time (or working and non-working time).

3. The *value of employers' time* in the DOT's methodology is the value of time savings to the employer, at the margin. The cost of labour to the employer consists of wages before income tax, employees' and employers' National Insurance Contributions (NICs), superannuation and any other relevant labour costs. These costs are reasonably easy to estimate although some valuation issues arise. Journeys to and from work are included in leisure time.

4. The value of non-work time savings is estimated largely via stated preference techniques. There are very few opportunities for revealed preference (i.e. market) situations to reveal the trade off between time and cost, and where they exist, a large number of confounding influences means that revealed preference values are not well determined. The range of the revealed preference values which are available, however, encompass the better determined stated preference values. Values vary between individuals, in accordance with household circumstances, income levels, working status, and stress related aspects of travel. Variations by mode are mostly related to income, although appraisals are based in practice on a standard value, which is a weighted average of the value for all travellers, in accordance with their income levels, household circumstances, and use of modes as shown in the National Travel Survey.

5. All time savings are valued at the same rate per minute or part thereof, whatever the extent of the saving or duration of the journey. It is sometimes argued that employees cannot make an additional contribution to production if the time saving is small. While this is obviously true in many cases, businesses usually have a bank of unused savings from many sources (not only in transport), and a further small saving can be sufficient to tip the balance, and lead to a larger than proportionate contribution to production. A similar argument applies to savings in non-work time. Thus an average value is felt to be the best approximation in practice

¹ "Values for journey time saving and accident prevention", Department of Transport, 1987.

6. For highway appraisals, it is assumed that the value of savings in travel time increase over time in proportion to assumed increases in GDP per head. This judgement is relatively uncontroversial for employer's time. But for *own time* it balances a number of factors which might either tend to increase or decrease the value of time savings relative to income. These might include a decline in the marginal utility of money as incomes increase, changes in the length of the working week and changes in the quality of travelling conditions.

7. The direct application of the DOT's estimates to other programmes might be inappropriate if the characteristics of the client group are not similar to those of transport users, and if the circumstances differ. Nevertheless, the estimates may serve as orders of magnitude. Departments should consult their economists about specific applications.

8. Ease of access is clearly something consumers are prepared to pay for, though with the current system of pricing roads and public transport, there are very few opportunities for users to show their preferences for saving time. Where, however, fares on public transport are raised to capture the value of time savings to users, care must be taken to avoid double counting of time savings and of this element of revenue.

9. More widely, there are decisions involving the location of public facilities such as hospitals and crown courts, where accessibility to users is a factor to be balanced against other costs and benefits. These costs might be partly captured in an appraisal which looks only at costs to government, if for example travel expenses are paid or users conveyed at public expense. But it is likely there will be costs falling on the general public which should also be reflected in the appraisal.

10. The costs of access include the time spent travelling. In practice, the value to the individual of savings in travelling time will depend on the alternative use which might be made of it. But even if travelling is regarded as less satisfying than the alternative use of time, the cost will be determined jointly with, for example, comfort and reliability; while the time spent on some leisure journeys may be regarded as a benefit.

Avoidance of premature death and non-fatal injuries

11. The appropriate starting point for valuing reductions in the risk of death or injury, as for savings in travelling time, is a measure of the individual's willingness to pay. This may not fully incorporate the valuations of other members of society, such as relatives and friends, or any further value placed by society at large on avoiding the premature death of individuals. The values generally in use are based on estimates of individuals' willingness to pay for small incremental changes in their own risk of loss of life or injury.

12. Most appraisals of health or safety programmes, or environmental hazards, are concerned with alterations to the risk of injury or death for unnamed individuals or "statistical lives". The changes in the probabilities of premature death or of serious injury are generally small and the population at risk covers a broad cross section of the community. Thus it is the value to unnamed individuals of these marginal changes in risk which are valued rather than the "lives" of named individuals. However, the term "value of life" is a shorthand used in much of the literature.

13. In principle, such values of life can be estimated by revealed preference using, for example, the size of wage differentials for more or less risky occupations; or price versus safety trade-offs in choice of transport mode; or willingness to pay for safety devices such as smoke alarms. However, confounding factors combined with the possible misperceptions by consumers of the probabilities of premature death make estimations of the revealed value of life very uncertain.

14. Sophisticated research techniques can avoid or reduce many of these confounding factors and ensure that the respondents are aware of (even if they do not understand) the probabilities of death involved. Nevertheless, there will always be a gap of uncertain size between people's stated willingness to pay in such circumstances and what they actually would do.

15. For the UK, the DOT value the reduction of the risk of death in the context of road transport at about £0.83m (in 1996 prices). These estimates include lost output, medical, ambulance and police costs, insurance costs, damage to property, and human costs. In the context of road safety improvements, the number of deaths avoided typically depends on small changes in the probability of individuals becoming involved in fatal accidents. Values are updated in line with assumed changes in GDP per head.

16. The DOT also use explicit monetary values for non-fatal casualties, based on a willingness to pay approach. Serious and slight casualties are valued separately and the values are updated in line with assumed changes in GDP per head.

17. The values for the avoidance of premature death and the cost of injuries in road safety applications used by the DOT may not be directly applicable to other programmes. Individuals are not likely to be indifferent about the cause and circumstances of premature death and will compare, say, sudden death with death following painful illness. Different groups may also have different attitudes to risk, reflected in the value placed on avoiding a given risk of premature death, or may be influenced by the degree of control they feel they or others have over their own safety. However, if tailored to these circumstances, the general approach may have wider applications.

Health impacts

18. Health impacts are rarely a question simply of lives lost or saved. In policy areas which mainly affect health, an alternative approach may be used, to take account of changes in life expectancy (including expected life years where lives are lost or saved) and, wherever possible, changes in the quality of life. The quality-adjusted life year (QALY) is the most commonly used measure of health benefit. It weights life expectancy for health-related quality of life over time. QALY values² are broadly analogous to willingness to pay values, the significant difference being that the numeraire is years of life in full health instead of money.

² The EuroQal instrument provides a simple and consistent framework for measuring general health and deriving QALY values.

19. Health interventions being compared may have similar or different clinical effects. The former may be compared by cost-effectiveness analysis, the benefits being measured in natural units such as blood pressure, for example. The latter may be compared by "cost utility analysis", the benefits being measured by QALYs.

20. However, when health impacts have to be weighed against non-health effects it may be necessary to set a monetary value on the health impacts. This is more problematic, though a number of techniques of monetary valuation may be applicable to health. In principle a survey approach could estimate the public's willingness to pay for certain health impacts.

21. Where health effects are not serious, they can be treated as loss of time, as described above. Several estimates exist for the value of time in different circumstances and might be applied to this approach. However this approach is not appropriate for loss of life, and acts as a lower bound to the value of health effects, since it omits any consideration of pain and suffering. Further guidance on the assessment and valuation of health impacts is given in the Department of Health's guidance *Policy Appraisal and Health (1995)*.

Annex D: Private Finance

Introduction

1. This Annex is concerned with the appraisal of privately financed projects for the provision of public services. The general principles of public sector appraisal apply equally to the use of private finance, which does however present some special features.

2. This Annex provides a background to the considerable specific guidance on the use of private finance in the public sector. The Appendix to this Annex outlines the main features of current HM Treasury guidance. The Bibliography lists current departmental guidance.

3. More detailed advice on the use of private finance can be obtained from HM Treasury and from within departments.

What is private finance?

4. Private finance is a procurement technique which involves the private sector more fully in the supply of public services so as to provide better value for money for taxpayers and consumers.

5. Private finance is about exploiting the full range of private sector management disciplines and entrepreneurial skills so as to achieve more cost-effective and higher quality public services. It has two fundamental policy requirements: that value for money be demonstrated for any expenditure by the public sector, and that the private sector genuinely assumes risk.

6. In facilitating greater private sector involvement private finance is similar to privatisation and contracting out. However, it differs from privatisation in that the public sector retains a significant role in privately financed projects either as the main purchaser of the services provided or as the main enabler of the project. It differs from contracting out in that it involves the private sector designing, building/constructing, managing, operating and financing projects for the provision of public services.

7. Private finance emphasises the outputs required to achieve policy goals, as opposed to the inputs needed. The use of private finance highlights the public sector as a procurer of services as opposed to a demander of capital assets. Output requirements should be specified in such a way as to provide maximum flexibility for competing private sector bidders. In framing output requirements the public sector should specify what services it needs and let the private sector decide how to deliver these.

8. In the simplistic example of an estuarial crossing, where the policy goal is to increase choice for transport users, the project manager should specify what the outputs required are in terms of, for example, traffic flow and environmental requirements, and leave the question of how these are best to be achieved, either by a bridge, tunnel or ferry service, to the private sector.

9. Private finance applies to three broad types of activity in the public sector: financially free standing projects; services sold to the public sector; and joint ventures. Further guidance on these type of projects is available in *Private Opportunity, Public Benefit* (HM Treasury, 1995).

Affordability

10. The assessment of affordability by the procuring body is as important for privately financed projects as for those which are publicly financed. The preliminary assessment of options should include a costed option to provide a broad check of the likely affordability of the project before procurement begins.

11. For conventionally procured projects, capital expenditure controls have the effect of limiting long-term expenditure commitments. With privately financed projects, public bodies must pay close attention to the forward commitments they build up, which may run in some cases for twenty years or more into the future.

Value for money

12. Approval of privately financed projects, as with conventional projects, should depend on value for money. This entails appraisal of whether or not the project is potentially worthwhile, as with conventional projects; and then appraisal of alternative methods of provision, i.e. the choice of supplier.

13. The decision whether to proceed or not follows the general principles outlined in this book. An initial appraisal should be made early in the proposal before inviting private sector bidders. A revised appraisal should be undertaken once bids have been made. The choice of supplier is discussed in paragraphs 23-28 below.

14. Privately financed projects offering the greatest potential for value for money gains are likely to be those with the most scope for transferring manageable risk to the private sector (risk transfer is discussed in paragraphs 17-22 below); and those which maximise the services to be provided by the private sector supplier in association with the asset; and those that have the greatest scope for generating additional revenue flows by sales to third parties.

15. The private sector can bring a wide range of managerial, commercial and creative skills to the provision of public services to improve value for money in the public sector. To obtain the optimal level of private sector involvement output requirements should be specified in such a way as to allow maximum scope for flexibility and innovation in the design of solutions.

16. Greater responsibility for and freedom with the design and management of assets should improve the quality of assets and their management. More widely, private sector involvement may lead to improvements or extension in the scope of projects. It may also stimulate further related developments which increase project value, or encourage more enterprise in the policy area.

Risk transfer

17. The main benefit of risk transfer is generally from the better incentives and rewards which it can provide for the private sector to supply more cost-effective and higher quality services. The principle that should govern risk transfer in the use of private finance is that risk should be allocated to whoever is best able to manage it.

18. Although there may be policy reasons to encourage risk transfer, the aim is to achieve optimum risk allocation, not transfer for its own sake. Risk transfer from the public sector beyond this optimum level will lead to a decline in value for money.

19. Risks come in many forms, many of them project specific, but the categories listed below are of sufficient general importance to be worth considering for the great majority of privately financed projects:

- Design and construction risk - to cost and time.
- Commission and operating risks - including maintenance.
- Demand (or volume/usage) risks.
- Residual value risk.
- Technology/obsolescence risk.
- Regulation and similar risks (including taxation, planning permission).
- Project financing risk.

20. As a general rule private finance schemes should always transfer to the private sector design, construction and operating risks (in terms both of cost and performance). The degree of transfer of other risks will be a matter of negotiation.

21. Successful negotiation needs a clear understanding by the procurer of the risks presented by the project, the broad impact which they may have on the suppliers incentives and financing costs, and the upper and lower limits of risk transfer which might be considered for negotiation.

22. At the start of the appraisal process managers will need to identify as many of the individual risks involved in the project as possible. Following this, wherever possible, risks should be quantified. Annex B discusses some methods of doing so. In some cases quantification can be supported by historical data from similar types of projects.

In other cases it will rely more on expert advice and practitioner experience. Once risks have been identified and costed an assessment is required of how they can best be managed to optimise value for money.

Choice of supplier and the public sector comparator

23. The process of choosing a supplier to achieve value for money will normally include a comparison between competing privately financed options, and in appropriate cases a publicly financed alternative - a public sector comparator.

24. The choice of private sector supplier will normally be made after a competitive tendering process, which will involve negotiation with a short-list of bidders. As a result of this process the best privately financed option should emerge.

25. A public sector comparator should be used where this is required by the policy guidance on private finance. The current guidance is set out in *Private Opportunity, Public Benefit* (HM Treasury, 1995, pp19-21). Certain kinds of privately financed projects currently do not require a public sector comparator, but this should be interpreted sensibly. Public sector comparators are not currently required for financially free standing projects which involve no public expenditure, nor for joint ventures where the project would not have gone ahead without private finance. However, the public sector contribution to a joint venture should still be appraised by looking at alternative uses to which the money could be put.

26. If there is no requirement to use a public sector comparator, but a privately financed service is still in principle acceptable, public bodies will need to rely on competition between privately financed bids to secure value for money. There may sometimes be additional benchmarks available, which along with the information obtained in the process of identifying and analysing risks and in constructing the output specification, could provide a positive input into the negotiation process and the assessment of value for money.

27. The construction of the public sector comparator is not always straightforward. It will typically be based on a set of hypothetical contracts to design, build and manage a public sector facility, based on recent experience of actual costs. Assessment will be needed of the likely costs and risks of both acquiring and then operating an asset to provide a service which meets the performance standards expected of the private sector over the life of the contract. Where the service is a new one there may be no ready-made comparisons available, although it should be possible to construct some proxy measure.

28. The identification and costing of risks is likely to be one of the more problematic components of the public sector comparator. However, such costing is essential if an unbiased public sector comparator is to be calculated.

29. Project managers should identify and cost as many of the individual risks as possible, in line with the analysis undertaken when determining the optimal level of risk transfer. In particular information on cost overruns (to operating and maintenance as well as construction costs) in similar projects should be explicitly considered.

Tax issues

30. Differences in tax treatment should not bias the choice in favour of either public or private financing, or the choice of individual private bidder. Tax savings achieved by suppliers are equally costs to the exchequer and hence to the taxpayer. If, for example, there is material scope for private financing to make use of tax concessions this should not be allowed to affect comparisons between options.

31. In some cases adjustment may be needed to ensure that VAT does not distort the comparison between public and private supply. The treatment of VAT should be such that it falls equally (whether this be fully or not at all) on all the options being compared.

32. In practice nearly all cases can be considered in terms of costs gross of tax, using the discount rate of 6 per cent to compare the costs of the alternative options. In a very few cases it may be considered worthwhile to compare financing costs, more precisely, on a *net of tax* basis. In this case public financing costs, at the cost of government borrowing, are compared with private financing costs net of the additional taxation incurred with private financing (instead of allowance for this additional taxation being included in the use of a 6 per cent cost of public financing); both public and private finance costs then being discounted at the 6 per cent time preference rate. However, such cases are rare, and complicated, and will always need to be discussed in detail with HM Treasury.

Appendix to Annex D: HM Treasury

Guidance on Private Finance

This Appendix lists the main current HM Treasury guidance¹ on the use of private finance. This is not an exhaustive list. Guidance is evolving constantly as the use of private finance develops further.

■ *Private Opportunity, Public Benefit*, November 1995.

The main general guidance on the Private Finance Initiative (PFI). Discusses the purpose, scope and principles behind the PFI. Provides advice on managing a PFI project and on key contractual issues. Also offers a number of practical examples. Supersedes *Breaking New Ground*, HM Treasury, November 1993.

■ *PFI in Government Accommodation*, 2nd edition, October 1996.

A statement of best current practice for those involved in the procurement of government accommodation services. Describes the PFI process, risk, contractual issues and the procurement process in government accommodation projects. Supersedes *Private Finance Initiative in Government Accommodation*, HMSO, October 1995.

■ *Private Finance Initiative - Guidelines for Smoothing the Procurement Process*, April 1996.

Advice for managers with responsibility for progressing the PFI, drawing on experience to date.

■ *Writing An Output Specification*, October 1996.

Explains how to recognise and understand the key elements in constructing output specifications for PFI projects.

■ *Basic Contractual Terms*, October 1996.

Sets out certain terms and conditions in PFI contracts, which are considered to be good precedents.

■ *Further Contractual Issues*, January 1997.

A sequel to *Basic Contractual Terms*. Provides guidance on some of the key issues which are common to many PFI projects.

■ *Transferability of Equity*, October 1996.

Advice on when investors in PFI projects should be free to transfer their investments in and out of a particular project.

■ *A Step by Step Guide to the Procurement Process*, Forthcoming 1997.

¹ The guidance listed here is joint HM Treasury and Private Finance Panel Executive (PFPE) guidance. For other PFPE guidance see Section E of the Bibliography at the back of this guide.

Annex E: Market Interventions Aimed at Raising Economic Activity

Introduction

1. This Annex covers issues arising in the appraisal of programmes which involve public sector intervention in private sector markets with the aim of raising economic activity at national, regional or sectoral level. It covers programmes which have an economic efficiency objective, for example small firm support, export promotion, innovation and technology; as well as programmes where the government intervenes to achieve a social objective, for example regional and local regeneration (though many regeneration programmes will have an economic as well as social objective).

2. The Annex sets out the general principles to be applied rather than detailed guidance, which is prepared for each programme by the appropriate department. Appendix 1 of this Annex provides additional guidance on the appraisal of regeneration programmes.

3. The method of appraisal will depend on the nature of the intervention and the objective of the programme (economic or social). But generally three criteria are applied to all programmes of this kind. These are national economic efficiency, additionality and cost-effectiveness. In addition for regional and industrial assistance programmes, e.g. Regional Selective Assistance (RSA) a further criterion of project viability is considered.

National economic efficiency

4. The government should not, in general, intervene in private sector markets unless the resulting costs and benefits represent an efficient use of national resources. However, the status of the efficiency criterion depends on the objective of the programme. Where the objective is economic, then programme expenditure must cause an improvement in economic efficiency. Where the programme has a social objective, for example employment creation in assisted areas, programme expenditure should not lead to a reduction in economic efficiency - though at the margin, where expenditure would be highly cost-effective in achieving the programme's objectives, then a small reduction in national economic efficiency might be acceptable.

5. Economic efficiency can only be improved if government intervention is able to successfully correct some market failure (after allowing for administrative and distortionary effects of intervention). For programmes with an economic objective, it is therefore

necessary to demonstrate that a market failure exists, and that it can be successfully corrected. This is discussed in more depth in the section on "Market failure and intervention" below.

6. Where possible the impact on economic efficiency should also be tested analysing the inputs and outputs of the programme (or project where appropriate) using the methods outlined in the main text. This analysis is known, in this context, as the efficiency test. However, for many programmes with an economic objective (for example, export promotion) it is very difficult to identify and value all inputs and outputs. Therefore the assessment of the impact on economic efficiency has to rely on market failure analysis.

7. For programmes with a social rationale, it is not necessary to establish the existence of market failure. In this case the "efficiency test" is always applied.

8. In some cases (e.g. RSA) the information used to undertake the efficiency test is supplied by an applicant firm. In these circumstances it is important to check as far as possible that the forecasts given are unbiased. For example, how does the implied market growth compare to other forecasts? Is the projected market share over-optimistic? In addition sensitivity analysis should be carried out using alternative values for the key variables.

9. Because of crowding-out¹ at the macroeconomic level, direct effects on employment (including redundancy and adjustment costs) and the balance of payments should not be included in an efficiency test. However, employment effects should normally be considered in other parts of the appraisal if they are likely to impact on other policy objectives, e.g. urban and regional regeneration (see the discussion on additionality below).

10. Supply side effects should however be taken into account. Such effects may occur as the indirect consequence of a programme, such as, for example training and technology spillovers in the case of regeneration programmes; or they may be the specific aim of a programme aimed at correcting a market failure, e.g. programmes designed to provide information to small firms and exporters (as discussed below). Where such benefits are included they should not merely be stated, but the appraisal should specify how and why such benefits will occur (and why they would not occur in the absence of the project). An assessment should be provided of the scale and importance of the benefits, and appropriate evidence should be provided to support the assessment. In the case of regional and urban programmes indirect supply side effects should be substantial to warrant inclusion in the appraisal, since it would normally be expected that some indirect effects would occur.

¹ Crowding out occurs if, for example, the level of public expenditure increases, but other variables in the economy adjust (in particular interest rates and the exchange rate), and cause the level of private sector expenditure to decline.

Market failure and intervention

11. Normally a discount rate of at least 8 per cent in real terms should be used for appraising efficiency. With long-running programmes, departments will be able to judge from experience whether the discount rate achieves an acceptably low failure rate.

12. Generally markets provide the best means of allocating resources. This creates a presumption against intervention in private sector markets. However, if it can be demonstrated that market failure is occurring, then this may, subject to the conditions discussed below, provide a rationale for government intervention.

13. It is important that the the rationale for intervention given in the appraisal states the underlying cause or causes of the market failure and does not only describe the consequences of these failures. A description of the consequences of the underlying causes (e.g. insufficient competition or missing markets), or the location of the market failure (e.g. product market or capital market) provides valuable information, but does not in itself provide a rationale for intervention. Failure to identify the underlying cause or causes is likely to lead to an inappropriate policy response. The causes of market failure are discussed in Appendix 2 of this Annex.

14. The diagnosis of market failure should be based on an appropriate analysis of the workings of the market in question, including an assessment of the relevant empirical evidence. Evidence needs to be provided to demonstrate that there are strong grounds for believing that market failure is the most likely explanation for the observed behaviour in the market. This evidence needs to show that market failure is causing a substantial resource misallocation (evidence that only demonstrates the existence of market failure and a symptom of market failure, without demonstrating a causal link is insufficient).

15. However, establishing the existence of market failure that is causing a substantial resource misallocation is by no means sufficient to justify government intervention. It must be demonstrated that intervention can, in a cost-effective manner, lead to an improvement in economic efficiency, after taking into account administrative costs and the distortionary costs of intervention. This requires, amongst other things, that intervention should aim to tackle the causes rather than the consequences of market failure.

16. The scope for intervention is reduced by limitations in the capacity of the public sector to accurately diagnose and design policies to correct market failure.

Additionality

17. Additionality is the extent to which an activity, which is a policy objective, is undertaken on a larger scale, takes place at all, or earlier, or within a geographical area of policy concern, as a result of public sector intervention. It should always be defined relative to the policy objectives of the programme.

18. Additionality should be measured at programme and project level. The assessment of additionality will vary with the nature and the objective of the programme. For programmes involving industrial and regional assistance, the assessment of additionality needs to cover project additionality, displacement and substitution.

19. A project is said to be (fully) additional if, without assistance, the project would not happen at all. However additionality is not solely a matter of an output being produced or not, but is often partial. For example, in the case of assistance being given to a project, additionality may be partial in the sense that, without assistance:

- the project might have been carried out in another location of some lower priority;
- the same project might have been carried out later;
- a different project might have been carried out, or the same project on a smaller scale or to a lower standard of quality.

20. Assisted projects should receive only the minimum assistance required to bring them about (so partial additionality should be reflected in levels of assistance offered). Any excess over this amount is "deadweight".

21. Displacement is the degree to which an increase in activity promoted by government policy is offset by reductions in activity elsewhere. For example, assisting one firm to create employment in an Assisted Area may cause a reduction in employment in another firm in that, or some other, Assisted Area.

22. Substitution normally refers to a situation in which a firm substitutes one activity for a similar activity to take advantage of government assistance. For example, if an incentive is given to employ long-term unemployed workers, then a firm may substitute an applicant who is in long-term unemployment for another applicant who is not, leading to no local increase in employment.

23. The analysis of additionality normally requires an analysis of the product, labour, and in some cases capital markets which are affected by intervention. For example, when assessing the level of displacement of an employment creation programme, it is necessary to examine the characteristics of the jobs created, or protected, in relation to the characteristics of the local labour market.

24. This point is also relevant where a department needs to assess the impact of its own recruitment and redundancy decisions on a particular local area (for example, where a large scale redundancy is being considered, an assessment of the potential regional impact may be required).

25. The effort used to appraise additionality should be appropriate to both the level of expenditure involved and the timescale of the project. Where potentially large changes to employment (either as a result of employment creation, protection or redundancy) are concerned, the assessment of displacement will normally require a thorough analysis of the local labour market. When considering whether to offer a grant designed to protect employment in a particular firm, one consideration is whether the grant is necessary to protect employment in that firm. The local labour market might also be analysed in terms of age, skills and experience of those whose jobs are being protected and how these compare with the characteristics of the unemployed, particularly the long-term unemployed, and those who have recently found employment. The analysis might also assess the likelihood of new investment in the region in the event that these job losses occurred (given the inflow onto the local job market of labour with particular skills and experience). If on the other hand only small changes to employment are likely, then a less detailed analysis may be more appropriate.

26. For assessing project additionality, in the case of grants, where small sums are involved, judgement based on direct questioning of the applicant may be sufficient, or it may be possible to define the qualifying conditions for assistance in a way which ensures that any accepted proposal is additional. In larger cases, an in-depth analysis of the applicant's business may reveal useful information. The assessment of additionality in cases where grants are paid should not be based on unsubstantiated claims by applicant firms, for example, that a project's return was too low compared to its internal hurdle rates, or that an alternative location was being considered (either in a non-Assisted Area or overseas).

27. In the case of very high hurdle rates, the firm should have to demonstrate that it does in fact use high hurdle rates, and justify the use of such a high rate. Generally a very hurdle rate indicates an inefficient investment criterion, and is therefore a good reason to reject an application, since the government should not encourage inefficient behaviour. Moreover a firm that uses an inefficiently high hurdle rate is likely to offer poor prospects for future investment.

28. Where the firm claims that an alternative location is being considered, for example where it claims a grant is being offered, then sound evidence to support the claim should be provided, normally in the form of detailed investment appraisals of each option.

Cost-effectiveness

29. Cost-effectiveness is the ratio of the policy outputs of a project or programme, such as job creation, to costs to the taxpayer. It is important that public expenditure on projects or programmes should be cost-effective in achieving policy objectives. The most basic condition for cost-effectiveness is that the activity supported should actually occur, i.e. the additionality criterion should be satisfied. Where a grant is paid, arrangements to secure repayment of that grant in the event of premature closure, or failure to deliver the promised jobs, may help to ensure this.

30. A project or programme that would have a positive net present value (NPV) may fail a test of cost-effectiveness if it were to have a low ratio of net benefit to public expenditure. For projects which include the objective of job creation in Assisted Areas, it is common to assess cost-effectiveness in meeting this objective in terms of "cost per job", calculated as the gross public expenditure per job created (i.e. net of displacement in labour and product markets, and after adjusting for the extent that the project may not be fully additional) in all the Assisted Areas. Formal cost per job limits, and their method of calculation, are laid down from time to time.

31. Normally, appraisals need not take account of the impact of direct taxes such as income or corporation tax. However, the level of UK tax payable by a foreign-owned company may be significantly less than that which a UK based company might pay. Where this is the case, differences in tax liability should be counted as a tax expenditure and regarded as a part of the assistance provided. (Profits earned by foreign-owned companies, except that part paid as UK corporation tax, are assumed in a national efficiency test to accrue to foreigners.)

32. Where industrial assistance programmes have multiple objectives beside job creation, such as environmental improvement, these other benefits (and any associated costs) should also be covered in the appraisal. However, it is in general not appropriate to sub-divide projects, nor to net off some of the costs (by attributing them to the outputs of the scheme) before calculating the cost per job, since the cost per job limits for such programmes are intended to be applied to jobs producing worthwhile outputs.

33. It is important that *all* forms of assistance from public sector sources should be counted. Where assistance takes the form of cash grants, this cost is obvious, but there are many other possible forms of assistance, for some of which the true cost is less transparent. Common examples include participating grants, equity finance, cheap loans, premises at low rents, and land, infrastructure, training support or advice provided free of charge. Where assistance is given in the form of goods, services or property for which no charge, or only a small charge, is made, these should be valued at whichever is the higher of the marginal cost of provision or market value.

34. In considering cost-effectiveness, the relevant cost is total expenditure by the public sector. A grant or loan may bring with it Structural Funds support from the European Union. However, although such support should be sought where appropriate, as an addition to UK support, Structural Funds receipts are normally treated in the same way as grants from the UK Exchequer in appraising cost-effectiveness. (In some cases fuller treatment may be appropriate - see paragraph 4.28 of the main text.)

35. Equity finance could turn out either to be pure grants or to produce some return. Where assistance is part of a continuous programme with a history of achieved returns, it may be possible to estimate the cash returns directly. This may apply, for example, to development agencies' investment portfolios, which are subject to financial duties. Elsewhere, it may be appropriate to assume the returns will be zero.

36. The provision of subsidised factory premises presents similar problems. However, a best estimate of the level of rent should be discounted and set against the capital cost of providing the premises. Prospective returns need to be adjusted for expected occupancy rates and rent reviews. Where the lifetime of the assisted project is shorter than the expected life of the factory, a realistic estimate of terminal value should be made.

37. In most cases, government assistance to industry is given by grants. In some cases, such as where the market failure causes an inadequate access to capital, it can be more cost-effective to give loans. The rate of interest on these loans is usually the "Broadly Commercial Rate" (BCR), set at the National Loan Fund (NLF) rate plus 3 per cent. Where loans are given, the net grant equivalent to the firm is calculated by discounting at the market rate (usually taken to be the BCR) any difference between the actual repayments and repayments at that market rate. (The concessionary lending rate for explicitly subsidised loans under existing schemes is 3 per cent less than the BCR.) Where a comparison is made between alternative phasings of grants these comparisons are made by discounting at the market rate: this calculation provides a net grant equivalent in a form which can be used to monitor EU and UK requirements for levels of subsidy in terms of the value of the discounted grant as a percentage of the discounted fixed capital costs.

38. In principle, in appraising cost-effectiveness, expenditures should be discounted at the central government discount rate of 6 per cent in real terms. This reflects the cost to *taxpayers* of a phased grant or loan. In practice, if the projected expenditures are in nominal terms, they should be discounted at a corresponding nominal discount rate. As noted in Annex G, paragraph 4(v), this nominal discount rate should be higher than 6 per cent by an amount equal to the projected rate of general inflation provided by HM Treasury.

Viability

39. Where a programme involves the provision of assistance (e.g. grant) to private sector firms, it is necessary to assess the viability of the project, since it would be wasteful for public money to be invested in a project that was not commercially viable and failed prematurely.² If assistance is granted, it should be sufficient to enable the project cash flows plus subsidy to satisfy commercial investment criteria. Assistance should be granted only to firms which are themselves considered to be viable. The quality of management is very important, both in general and with specific regard to those charged with carrying out the project. Any previous track record may help to inform the judgement on viability.

² There should be a strong presumption against projects receiving assistance more than once, because this would encourage poor management in both the assisted firm and the responsible government department. It is, in any case illegal to encourage a firm which has become insolvent to continue trading.

Appendix 1 to Annex E: Regeneration

1. This Appendix considers some specific issues that arise in the appraisal and evaluation of regeneration projects which have both a social (redistributive) and economic rationale. In many cases these projects are aimed at the regeneration of local areas, although some are targeted at entire regions.¹ These issues are discussed in more detail in "*A Framework for the Evaluation of Regeneration Projects and Programmes*", HM Treasury, 1994.

2. The objectives of regeneration programmes are likely to include one or more of the following: improvements in labour supply and skills; improvements in the quality of life; improvement of the physical environment; and assisting local businesses. Appraisal should clearly identify the objectives and outputs of the project. In terms of social rationales the appropriate outputs may include, for example, reductions in crime or improvements in the capacity of community organisations. Increases in local employment may also be included as an output in terms of social objectives, even if national employment is unchanged.

3. Appraisal should quantify the estimated outputs of each activity of the project, both in monetary and non-monetary terms. It should also provide an assessment of the cost-effectiveness of the project.

4. It is important to distinguish between immediate and intermediate outputs and final outputs or outcomes. The immediate and intermediate outputs of a project are often relatively easy to identify, but they do not necessarily contribute to the project's ultimate objectives. Some immediate and intermediate outputs and final outcomes are illustrated in Table 1 below.

5. If a project has a number of distinct parts the immediate or intermediate outputs must be separately identified. Appraisal of a project which provided both skills training and health provision, for example, might lead on examination to a change of relative emphasis on different parts of the project.

6. The allocation of expenditure to outputs can help the assessment of cost-effectiveness.² All government expenditure should be taken into account including, where appropriate: central and local government expenditure; tax expenditures (e.g. Business rates relief), and any contributions from European funds (e.g. ERDF).

¹ The rationale for regeneration projects needs to be stated so that it is clear, (a) who the intended beneficiaries of the project are and how they will be reached; and, (b) by what means the functioning of markets are improved as a result of the project.

² In regeneration projects, partners may pursue separate objectives. Where these are clearly distinct it may be appropriate to consider the different outputs attained against each partner's objectives; and to calculate a separate cost-effectiveness measure for each.

TABLE 1: ILLUSTRATIONS OF IMMEDIATE AND INTERMEDIATE OUTPUTS AND FINAL OUTPUTS

POLICY AREA	IMMEDIATE AND INTERMEDIATE OUTPUTS	FINAL OUTPUTS/ OUTCOMES
Job search/job matching.	Number of job seekers assisted.	Value of extra local (or national) output, or improvement in efficiency of job search.
Development of skills.	Training places/numbers completing training.	Value of extra human capital, earnings capacity.
Social outputs: - schools. - health centres. - leisure facilities.	Exam results (schools); People treated (health); and numbers using sports facilities.	Improvements in human capital (schools); Measures of health gain (health centres).
Environmental improvement.	Hectares cleared; effect on stock of derelict land.	Value of amenity improvement (increase in environmental score).

7. Most local regeneration projects involve partnership between the public, private and voluntary sectors. Partnerships between the local community, business and government are important for the sustainability of regeneration projects and the well-being of local communities. Appraisal should include a description of the partnership and where possible its impact on the area.

8. The geographical focus of regeneration projects means that it is important to assess whether a project diverts employment or production away from competing firms. Displacement means that project outputs may not be "additional" at the local or national level. The extent of displacement will vary according to the supported activity and the size of the area considered.

9. The appropriate area for analysis of displacement effects will also depend on the type of project. The spatial unit of analysis will normally be smaller for local regeneration projects than for large infrastructure projects. In the case of employment displacement, the area considered should usually approximate to the local labour market. In some cases the DfEE's published Travel to Work Areas (TTWAs) may be an appropriate spatial area. However, there will also be cases where this measure may not be appropriate for a specific targeted programme. Therefore an assessment of the actual travel to work area may be needed. This would take account of the existence and cost of transport facilities and the expected income levels of the targeted labour force.

Appendix 2 to Annex E: The Causes of Market Failure

1. A necessary, but not sufficient condition for government intervention to improve economic efficiency is that there is some form of market failure. We cannot always observe market failure, rather we observe the real or apparent consequences. However, these observations (e.g. the inability of a firm to obtain finance) can result from a number of causes, and may arise in the absence of market failure. Therefore, to correctly diagnose if market failure is in fact occurring, and to identify an appropriate policy response, it is necessary to establish what is causing the observed consequences.

2. The following factors can give rise to market failure: public goods, externalities, imperfect information and barriers to entry and exit. These are discussed in turn below.

Public goods

3. Public goods are those which are non-rival in consumption and imperfectly excludable. These conditions give rise to "free-rider" problems, and the market will produce an inefficiently low level of output.

Externalities

4. Externalities occur where a firm's economic activity produces benefits for other firms or individuals, or costs to others which it does not have to meet itself. Almost all economic activities generate externalities, so it is necessary to restrict the case for intervention to where specific, substantial externalities can be identified. In principle, the most appropriate solution is to change the system of property rights to internalise the externality, but this may not always be possible. Examples of externalities include training and technology spillovers, and environmental costs and benefits.

Imperfect information and uncertainty

5. For a transaction to occur the identity and the location of buyers and sellers must be known and the prices at which they are willing to trade. Buyers also need to know the quality of the good or service, and the value of the benefit it can provide to them. Sellers need to know the reliability of a buyer if purchase is by instalments, or by deferred payment (e.g. banks as sellers of money need to know the reliability of borrowers).

6. In some senses information can be treated as a commodity, although there is a complication in that the content of the good being purchased cannot be fully revealed prior to purchase. The market does not fail if information is not freely available, but it does if it is not available at a price closely related to the cost of providing it.

7. The public good nature of some information may also mean that information is not provided at an efficient level. Problems may also arise if there are economies of scale in the production of information.

8. It is not always appropriate to view information as a traded commodity. In many cases it is provided freely by agents on one side of a transaction to those on the other (e.g. the information that a salesperson provides a potential buyer). Asymmetry of information gives rise to problems of adverse selection and moral hazard, leading to uncertainty and an inefficiently low level of transactions.

9. Information problems are possibly the principal cause of capital market failures, particularly in the case of growth orientated small firms and innovative firms. As well as problems of adverse selection, the costs of monitoring and appraisal can restrict the availability of finance to smaller firms. This is because the proportional cost that a finance provider incurs to collect information to appraise and monitor an investment will tend to fall as the level of investment rises, as a similar process has to be undertaken irrespective of the level of investment. Intervention may be justified if it can, in a cost-effective and economically efficient way, reduce the costs of collecting and providing the information needed for appraisal and evaluation.

**Risk and
uncertainty**

10. The risk and uncertainty that arises as a result of imperfect information will mean that risk averse investors will seek a higher rate of return on risky investments. The fact that investors will seek high returns for projects with a high level of risk and uncertainty does not in itself justify intervention. Projects which have a high level of risk and uncertainty impose a real cost on investors and therefore need to earn a high return. However, where the government can reduce uncertainty by providing information more efficiently than the market, then there may be a case for intervention. There may also be a case for intervention if there is insufficient competition among finance providers so that they are able to earn excess returns on lower risk investments and so avoid higher risk projects.

11. Insufficient competition among finance providers should also reduce the incentives to acquire the information and expertise needed to appraise more unusual investment projects, such as those which use novel technologies. The uncertainty that would arise from their inability to appraise such projects adequately may cause providers of finance either to avoid such investments, or to require inefficiently short pay-back periods.

Barriers to entry and exit

12. Where there are barriers to entry, there may be insufficient actual or potential competition to ensure that the market in question produces an efficient level of output. The appropriate policy response will depend on the nature of the entry barrier. The following factors can give rise to entry barriers: absolute cost advantages; economies of scale; and product differentiation. In addition sunk costs, by acting as a barrier to exit can deter entry. This situation may well be exacerbated through strategic behaviour on the part of incumbent firms e.g. by investing in excess capacity or through a predatory pricing policy. In general, situations where competition is inadequate are matters for competition policy authorities, though there may sometimes be implications for other areas of policy towards industry.

Dynamic effects

13. It is important when considering the case for intervention to examine the dynamic nature of market failure. This is likely to be particularly important in the case of interventions related to science, technology and innovation. Allowing for dynamic effects may increase the potential for resource misallocation from market failure, but at the same time it places greater demands on the limited information available to policy makers. In such situations the gains from successful intervention may be greater than in the case of static market failures, but the ability of government to make successful interventions is likely to be more limited.

Limitations to effective government intervention

14. There are limitations in the ability of policy makers to accurately diagnose market failure, and to design policies that correct market failures in a way that is cost-effective and does not create significant distortionary costs. There are a number of factors which significantly constrain the scope for effective government intervention. These include the complexity of many of the situations where market failure leads to economic under-performance; and the fact that government cannot possess the wealth of firm specific information about customers, markets, production systems etc. which go into individual commercial decisions.

Annex F: Land and Buildings

1. This Annex describes some of the issues that arise in appraisals which include the use of land and buildings, and how these should be handled.

2. The appraisal of many property issues, such as the acquisition and disposal of standard office accommodation, can be dealt with in terms of cash flows, although any wider economic considerations should be acknowledged.

3. If a proposal uses, or releases land or buildings the value of the property rights in the land and buildings should be taken into account. This applies *whether or not* the land or buildings are to be bought sold or rented. If it is a new build project the cost of construction will need to be considered. Common errors in appraisal are to omit either the rental or capital value of land and buildings already owned, or to double count the cost by including *both* the capital cost and rental value.

4. Property usage can be costed in terms of either annual rentals or capital values. The choice of whether to work with one or the other is usually made on grounds of practical convenience. It is normally appropriate to use capital values in appraising freehold property, properties with development value, and properties held on ground leases with more than ten years unexpired. In other cases it is usually appropriate to use annual rentals.

The basis of valuation

5. The valuation of property in appraisal should measure the opportunity cost of the land and buildings. The values should be up-to-date and based on the most valuable use possible. Discussed before are some common problems which arise in assessing current values and estimating future values.

Assessing current values

6. An assessment of the value of a *site* in the most valuable alternative use should be based on the advice of property experts, either in-house valuers or suitably experienced Chartered Valuation Surveyors or Incorporated Valuers.

7. Where the market value of a site is enhanced by planning permission the property should be valued to reflect the actual or potential planning approval assuming that there

is market demand for that particular use. If there is no planning approval for further development the potential for obtaining such approval should be estimated (by drawing on appropriate professional advice) and reflected in the valuation. Conversely the value of a property may be depressed by restrictions on development. It should be considered whether or not these can be lifted and the result of this should be reflected in the valuation. Cases involving potential development value will require advice from qualified property experts.

8. The value of a property may depend upon the use for which it is being valued, e.g. as a residence, shop or office. For most central government appraisals, the alternative use with the highest market value of all the feasible alternatives should be considered. Feasibility in this context is assessed as the market would assess it, by taking into account market demand for that use together with the planning position.

9. Market prices will not always reflect the actual or potential amenity value or environmental impact of a particular land use. Assessment of such non-marketed impacts is discussed in Annex C. Generally, where there is such an impact, for example along the route of a proposed new road, land should be valued at its market price as described above, but due weight should be given to an environmental impact statement which should reflect any environmental costs or benefits (including existence and option values which may be important for unique historic sites and buildings) of the change of use which are not captured in the market price.

10. Where the current use of land is subsidised, it is sometimes necessary to adjust market prices to reflect the impact of the subsidy. In particular the market price of agricultural land may need to be adjusted when appraising a potential change of use. Market prices reflect private rather than social costs and benefits. The value to producers of agricultural protection is incorporated in the market price of agricultural land. When considering changes in the marginal amounts of agricultural land it will generally be appropriate to make a downward adjustment to the market price of the land to reflect the expected effects on the UK taxpayer of future UK and EU subsidies.

11. Assessing the value of buildings in their most profitable use is fairly straightforward where the building can be readily adapted to different users' requirements, such as standard office accommodation. However many public sector buildings, such as prisons and hospitals, may not be readily adaptable to other purposes. In the absence of an alternative use for the buildings, the higher of the value of the site for redevelopment, and a valuation in current use of the site plus buildings should be used.

12. Even if there is no developed market in particular types of property there may still be relevant market information. This might be obtained by identifying possible alternative uses, and valuing accordingly; or from limited price evidence from market transactions of similar buildings, e.g. private hospital sector evidence to assess the market value of an

NHS hospital, although care should be taken to ensure that like is compared with like, for example in terms of size. The advice of property experts and economists should be sought when estimating values in these ways.

13. Another approach, called *depreciated replacement cost*, is sometimes used where there is insufficient relevant market information. Depreciated replacement cost is the open market value of the land, plus the current gross replacement cost of the buildings and their site works, less allowance for all factors such as age, condition, and functional and environmental obsolescence, which result in the existing property being worth less than a new replacement.

14. Actual rent paid on leasehold property (the *passing rent*) will often differ from the market rent. Two cases are particularly important:

- (i) *Modern leases* are often set for 15, 25 or 35 year periods, (possibly with infrequent break points), with rents subject to review at (usually) 5 yearly intervals, so that market and passing rents are likely to diverge between reviews. If market rents exceed passing rents this will give rise to a "profit rent" until the next rent review. If the passing rent exceeds the market rent the property is referred to as "over rented". Such leases usually contain *upward only rent review* (UORR) clauses, so that if a rent is set at the top of the property cycle "over renting" may persist for a number of review periods;
- (ii) *Historic leases* may be subject to no, or very infrequent, rent reviews, so that the market rental may possibly not be payable until the lease expires. In such cases the "profit rent" can be a valuable property interest in its own right.

These differences can provide the option of selling or buying leaseholds.

15. The rent passing on apparently similar properties may reflect different economic realities, and may not be directly comparable. For example, on one office block the rent may be on full repairing and insuring terms, which means that the tenant pays for repairs and insurance. On a physically identical block a tenant might be paying the same rent and yet the landlord is responsible for insurance and repairs. In appraising different options advice must be taken on what the lease terms stipulate in respect of the rent.

16. Difficulties can also occur where disposal of property is involved, i.e. the sale of freehold property, or the assignment or subletting of leasehold property. In all cases there will be significant disposal costs, i.e. legal fees, marketing costs and removal costs to be taken into account. In a poor market there will be the question of timing. Such problems will be particularly severe where there is excess supply in the market for the particular type of accommodation, and/or the property is over rented for the reasons discussed in paragraph 14 above. In such cases it might be possible to dispose of a

lease by paying a reverse premium, which will be at least equal to the present value of the difference between the passing rent and the market rent until the market improves or the termination of the lease. Alternatively it would be necessary to retain the vacant property until the market improves or the lease terminates.

17. Costs to central government as a whole must be taken into account in the appraisal calculation. This will be important in the case of jointly occupied buildings (JOBs) where there might be difficulties in finding a replacement tenant if one occupier were to quit, so imposing additional costs on the major occupier.

Estimating future values

18. Account needs to be taken of the expected changes in property rents, as modern leases provide for rent reviews at, usually, 5 yearly intervals. Property prices and rents have historically exhibited greater volatility than consumer prices or the GDP deflator so that current market prices may provide a poor guide to future levels. In addition small changes in the amplitude and phasing of property price cycles can often have very significant effects on the net present value (NPV) of an option, so that sensitivity analysis is particularly important. Advice on longer run trends in property prices should be taken from property specialists or economists.

19. Where property, or legal interest in property, is being costed in terms of capital values, rather than rents, the residual value or disposal value, if any, at the end of the proposed period of use, or at the end of the appraisal period, should be counted as a benefit. However holding gains due to changes in real land prices should not be counted as benefits to a project if they would have occurred even if the project had not taken place (and whether or not the land was held by the public sector).¹

20. Appraisals should include such effects where the prospective gain is itself a consequence of the public sector activity. This may be the case with appraisals of urban regeneration projects, or of flood protection. In such cases great care is needed, as the appreciation itself is likely to be most uncertain. Property experts should be consulted and sensitivity analysis applied to ensure that the project is robust to substantial shortfalls in the prospective gains. It is also important to specify fully the alternatives with which the proposal is being compared. In the case of flood protection any increase in the value of the land protected is an adequate measure of the benefit of the protection only where there is no other site which could be substituted for it. Other options also need to be considered. Care is needed to avoid double counting which would result from including other measures of benefit in such cases.

¹ There is a technical case for including such holding gains, as the expectation of them will be reflected in the initial market price, so there is a "cost" to offset the subsequent "benefit". Nevertheless there are managerial reasons for excluding them. It would not be a good incentive to public sector management if property appreciation were to make financial targets easier to achieve. The public sector should be discouraged from tying up an asset that the market values increasingly highly. Nor is it generally appropriate to divert scarce resources into property price forecasting - beyond the normal use of consultancy advice on the timing of specific disposal. In addition accounting conventions do not count as a profit any real capital appreciation beyond the initial book value.

The appraisal period

21. It may be helpful to separate the value of the land from the buildings. This is because buildings usually depreciate in real terms over their lifetime. The site value behaves differently in that it may appreciate or depreciate. Depreciation may be attributable to, for example, contamination, mineral workings, or heavy foundations.

22. The real residual value of the buildings at the end of the appraisal period is difficult to ascertain because buildings do not necessarily depreciate on a straight line basis. Professional property advice should be sought. For the site the usual assumption is that its value remains the same in real terms, subject to the exceptions occurring in paragraphs 20 and 21 above. However it may be necessary to clear the site before the site value can be realised.

23. When deciding on the appraisal period it is necessary to distinguish between the economic life of a building and its physical life. For instance a modern office building will typically have an expected physical life of about sixty years. However in the course of its physical life the value of the building could be enhanced by refurbishment. When this is the case an appraisal will be required to determine the relative merits of refurbishment, redevelopment and disposal. The economic life of the building is the period up to the point of possible refurbishment. There will usually be a number of refurbishments during the life of a building, so that the economic life will usually be much shorter than the physical life.

24. It is difficult to forecast the economic life with accuracy, although it will typically be 15-25 years for a new building. In the case of leasehold buildings modern standard institutional leases are often for 15, 25 or 35 years. It is a reasonable rule of thumb to appraise over the lease length of a leasehold building unless there are compelling reasons not to do so. This also facilitates freehold versus leasehold comparisons.

25. Although the appraisal period should normally be equal to the remaining economic life of a building, in exceptional circumstances, where buildings are constructed for a specific purpose, and no market exists for such property, it may be appropriate to appraise a building over its physical life. An example is provided by court buildings, which are usually designed to last at least 60 years without a major refurbishment involving decanting of staff. Similar considerations may also apply to hospitals and prisons, although views on the appropriate designs of such institutions may change over time in ways that are impossible to forecast, so that it is wise to give some weight to the benefit of design solutions which allow for flexible internal layouts.

26. If the life of the project being appraised exceeds the economic life of the building it will be necessary to take into account the costs of decanting from the building, and of its refurbishment and redevelopment. If, on the other hand, the economic life of the building exceeds the life of the project then the estimation of the residual value of freehold property, and the ease with which leasehold property can be assigned or sub-let, becomes particularly important.

27. Allowance should be made for an appropriate level of ongoing maintenance costs. If maintenance is not carried out to an appropriate standard this will be reflected in the increased costs of refurbishment, or reduced sale price of a freehold property, while in the case of leasehold property dilapidation payments will be incurred at the termination of the lease.

28. Business rates, or contributions in lieu of rates (CILORs), should be included among the costs of the project, as there is a presumption that the supply of land is inflexible, so that in the long term the effect of taxes on property will be to reduce rents and land values.

Purchasing or leasing?

29. The appraisal should normally include both freehold and leasehold options. It is frequently the case that the purchase of a building will offer better value for money than leasing because the government's capital finance costs are lower than those of the private sector. Sometimes this advantage is offset by factors such as location, availability, and provision of services and assumption of risk by the private landlord.

30. Leases on land and property are normally classified as operating leases, which implies that the capitalised value of the lease does not have to be counted against expenditure provision. Difficulties may arise if the lease offered appears to be a finance lease, which is a lease that transfers substantially all the risks and rewards of ownership of an asset to the lessee.² The capitalised value of a finance lease will count in General Government Expenditure (GGE) and a corresponding reduction may be made in expenditure provision.³ Difficult cases should be discussed with finance divisions or HM Treasury at an early stage.

Surplus land

31. Projects should not use more land than is cost-effective. Available plots of land for new developments may not precisely match requirements, but where a plot exceeds requirements the surplus should be disposed of as soon as possible. An exception to this rule is in cases where future expansion is anticipated, for example with a phased development, and where the extra land would not be available later. Central government does not hold land for speculative gain.

32. Including the value of land already owned focuses the attention of the appraising body on the costs of retaining vacant land. It is sometimes argued that vacant land on government sites could not be used for any other purpose because of the demands of security, and so the opportunity cost of such land is zero. However, it is generally possible, by the reorganisation of the body's land portfolio as a whole, to release land elsewhere. In practice, land which can be used for a public sector project nearly always has an opportunity cost.

² For a full definition see SSAP21, *Accounting for Leases and Hire Purchase Contracts* (issued August 1984). The Guidance Notes on SSAP21 observe (paragraph 140) that many leases of land and buildings are only for a small part of the useful life of the building and the lessee does not obtain the economic benefits arising, for example any increase in value. The paragraph concludes that most leases involving land and buildings would therefore be classified as operating leases.

³ Similar treatment is appropriate for purely financial arrangements such as deferred purchase, where all the risks remain with the public sector.

Annex G: The Cost of Capital, Discount Rates and Required Rates of Return

General principles

1. The government specifies a *cost of capital*, chosen to ensure the efficient costing of central government inputs and outputs relative to those of the private sector. A *discount rate* is also needed for comparing public expenditures over time, so as to compare alternative ways of producing public service outputs and, less often, when final outputs can be valued, for use in cost benefit analysis.

2. The same figure of 6 per cent in real terms is set as the cost of capital and as the standard discount rate. The technical derivation is described in the Appendix to this Annex. Some exceptions to the standard discount rate are described below.

3. Some central government bodies, selling their outputs in competitive markets, are controlled in terms of a *required rate of return* on their assets. As explained later, this may be equal to or higher than the cost of capital.

Discount rates in special cases

4. The standard discount rate should be applied to all but a few areas of public expenditure. Non-standard rates can be appropriate where:

- time preference for public expenditure or income is not the relevant concept;
- the numeraire is a quantity other than real public expenditure or income;
- there is exceptional systematic risk;
- there is a special policy adjustment for the particular body;
- discounting is extended into the very long term.

Cases where time preference for public expenditure or income is not the relevant concept

- (i) Where discounting is used *to predict market responses* to public activities, such as a change in a tax regime or timing of a charge or grant, the appropriate rate is that used by the producer or consumer in question.
- (ii) When a discount rate is needed to convert a series of future cash flows to a capital sum (or vice versa) in a way which, as a policy objective, *leaves the receiving body no better or worse off*, then the relevant rate is that which reflects the particular interests of the receiving body. This will usually be the body's marginal borrowing or lending rate, depending upon exactly which alternatives are being compared. (A 6 per cent discount rate is still appropriate for appraising the interest of the taxpayers as opposed to the receiving body.)
- (iii) For projects under *the overseas aid programme* a single discount rate is used for each recipient country, derived from estimates of the opportunity cost of capital within the recipient economy. (These appraisals also use shadow prices and seek in this and other respects to conform with international best practice - particularly that of the World Bank.)
- (iv) *Industrial assistance* is provided as a proxy for commercial lending in the particular market. As explained in Annex E, it should generally be assessed at a rate close to the cost of commercial funding, were such funds available, for the particular project or programme. As also explained in Annex E, the grant equivalent of an industrial assistance loan is calculated by discounting, at the "Broadly Commercial Rate" (in nominal terms, not real terms), the difference between the actual repayments and repayments at the BCR rate.

Cases where the numeraire is a quantity other than real public expenditure or income

- (v) When discounting *cash flows which are defined in nominal terms* the normal practice should be to convert these nominal flows to real terms, using a projected rate of general inflation provided by HM Treasury. This puts all costs and benefits into the same, real terms units and all can be discounted at the same, real discount rate. Sometimes however, in practice, a nominal discount rate may be required to discount the nominal cash flows directly. This nominal rate should be higher than the real rate by an amount equal to the projected rate of general inflation.

- (vi) When discounting a *quantity which is changing in real monetary value over time* it may occasionally be more convenient to adjust the discount rate, as a short cut, instead of adjusting the cost or benefit for the change in value over time and then discounting at the standard rate. (These two approaches should give the same answer. However, adjusting the standard discount rate may possibly avoid unnecessary assumptions. An example is the discounting over time of marginal utility, as illustrated in paragraph 17 of the Appendix to this Annex.)

Cases where there is exceptional systematic risk

- (vii) It is not uncommon in private sector practice (although discouraged by financial management textbooks) to increase the discount rate as a way of offsetting *optimistic bias* in estimates of costs or benefits. However in virtually all public sector applications, as explained in Annex B, the possibility of optimistic bias should be handled in other ways and not by changing the discount rate. However the case for increasing the rate should be considered for costs or benefits which show exceptional *systematic risk* - that is exceptionally high covariance with future income. The first step should be to estimate the effect of this risk using the expression in paragraph 6 of the Appendix to this Annex. HM Treasury should be consulted in such cases.

Cases where there is a special policy adjustment for the particular body

- (viii) For those bodies controlled by a *required rate of return* on their total assets discount rates for investment appraisal may be negotiated separately for the particular body at values chosen to obtain the required average return.

Cases where discounting extends to the very long term

- (ix) When the appraisal of a project or a policy depends materially upon the discounting of effects in the very long term - beyond say 50 years into the future - departments may consider whether a lower discount rate may be appropriate. In this case, the decision on the discount rate should be made on a case by case basis, in consultation with HM Treasury, although in practice 6 per cent will serve as the normal assumption.

Required rates of return

- 5. Some central government bodies sell goods or services commercially, either to the government itself or, like the nationalised industries, to the economy in general. These activities may be controlled by requiring prices to be set to provide an *average*

required rate of return (RRR) on the capital employed by the activity as a whole.¹ RRRs are measured in current costs (i.e. real terms) and before deduction of tax and interest.

6. For public sector supply to government itself prices should be equal to costs, and so provide a return of 6 per cent on average as well as at the margin. The RRR, if such a regime is used, should therefore be 6 per cent. (This does not of course prevent much higher returns being earned by competing *private* sector suppliers, where they can be more efficient.)

7. For output sold commercially to the private sector prices should generally be set to obtain a higher average return. This reflects the fact that average returns in the economy as a whole appear to be higher than marginal returns, which could arise from producers' increasing returns to scale or from less than perfect competition. A value of no less than 8 per cent should normally be expected for commercial sales by public services to the private sector; this is also the standard real rate of return that has been applied to the nationalised industries.

¹ For historical reasons the nationalised industries' RRR have applied only to their new investment programmes, with a lower return being accepted on their earlier capital base. This does not apply to the public services, where any RRR applies to all of the capital employed in producing the particular output.

Appendix to Annex G: Technical Note on Discount Rates and Required Rates of Return

1. The technical background to the cost of capital and discounting in government and to the setting of required rates of return is complex. However the underlying rationale is as follows:

- (i) Resource expenditure by government has an opportunity cost, because the resources would otherwise be available for other uses, to provide immediate consumption benefits and be at least partly invested to produce a return. There is a further cost of the distortions caused by taxation, at the margin, to fund increments in public expenditure.
- (ii) These opportunity costs apply equally to extra expenditure and to expenditure savings, and, in general, apply as much to later as to earlier years. They are therefore generally not relevant to the simple comparison of public expenditures over time, for which the conceptual basis depends on people's *time preference* for consumption.¹
- (iii) However the costing of public sector output needs to employ a *cost of capital* which gives an efficient comparison at the margin with private sector supply.²
- (iv) For some government bodies, selling commercially to the private sector, financial targets need to be set in terms of average returns on their total capital employed. These targets need to reflect the difference in private sector markets between costs of capital and average returns.

2. These two rates, for time preference rate and for cost of capital, are different concepts and under any realistic assumptions they will not be identical. However for almost all practical purposes a single number is set, which lies within the plausible range for both rates.

¹ Or for public expenditure or for income. For practical purpose it is assumed that time preference for marginal changes in all of these quantities is the same.

² The government borrowing rate is not by itself a satisfactory basis for comparing public and private sector supply, because it does not reflect the different levels of tax and because it excludes any cost or benefit from the variability in project cash flows.

3. Each rate has three components. One of these components (the allowance for risk) is the same for both, but the others are quite different. Apart from risk, the *time preference* rate is derived from judgements about how much (generally richer) people in the more distant future would benefit from extra marginal income, relative to people in the nearer future, and about how much relative weight should in any case be given to the marginal welfare of future populations. The risk free *cost of capital*, in contrast, is derived from the risk free market rate, plus an adjustment for taxation.

4. The factor for risk does not arise from optimistic bias in estimates of costs or benefits, nor from random variability in project outturns. Optimistic bias, as explained in Annex B, should be handled in other ways. This leaves variability, in both directions with an average value of zero, about the expected outcome. Most of this variability, for public sector projects, is spread too widely and thinly through the economy to impose a significant cost on average on taxpayers, although clearly this is *not* the case for optimistic bias, the costs of which fall fully on taxpayers and can be substantial. However the welfare impact per £1 of project cost or benefit will be affected if these costs or benefits are correlated with future incomes.

5. Costs or benefits of a given expected value will have a lower welfare impact if they are uncertain and if this uncertainty is positively *correlated with income* (i.e. if they are likely to be higher if income is higher and lower if income is lower). This is because the welfare value of an extra £1 is less when incomes are higher. For various reasons, such as higher labour costs or higher valuation of service benefits, the real monetary value of the costs and benefits of many public sector projects is likely to be higher if incomes are high and lower if incomes are low. This effect is sometimes described as systematic risk, because it relates to costs or benefits which vary systematically with income.

6. The conventional expression³ for the amount by which the real monetary value of a future cost or benefit of this kind should be reduced, to obtain its "certainty equivalent" value, is:

$$- [YU''/U'] [\text{cov}(X,Y)/E(Y)]$$

where Y is income, $E(Y)$ being its expected value,

X is the project cost or benefit,

U is utility, U' and U'' being the first and second derivatives of U with respect to income, and

$\text{cov}(X,Y)$ is the covariance of X and Y , which is equal to $\rho \sigma_x \sigma_y$ where ρ is the correlation coefficient of X and Y and σ_x and σ_y are the standard deviations.

7. There are different approaches to quantifying the term in the first bracket of this expression, which is often described as the "coefficient of relative risk aversion".

8. In the welfare economics of public financing, especially for developed economies, risk is generally concerned with marginal changes in the income of future populations, where the term can be expected to follow quite literally from the utility function from which the expression is

³ This expression was perhaps first applied to investment appraisal in the well known "Little and Mirlees" World Bank methodology of 1974, and has since become more widely established.

derived. Its value in this case would be equal to the "elasticity of marginal utility" and would be expected to be very similar to the elasticity, $-b$, discussed below in the context of rising per capita incomes of the population over time. This implies a (negative) value of around 1 or 2. An adjustment on this basis, for costs or benefits which vary in direct proportion to income, is much less than half a per cent and this small adjustment is included in the 6 per cent cost of capital and time preference rate.⁴

9. Financial economics, and the analysis of consumer behaviour, is in contrast generally concerned with the risk premia which people require from investment in the stock market and, more recently, more complex analysis of people's risk aversion in planning their personal portfolio allocation. Studies of this kind generally show considerably higher apparent "coefficients of relative risk aversion" which may be as high as 30 or more. That these figures are much higher is not, from a welfare analysis perspective, surprising. The behavioural implications of risk of this kind - such as, for example, regret at lost opportunities, concern about relative income or relative investment success, concern to avoid big fluctuations in personal income over time, and asymmetrical rewards to investment managers for success and failure - are profoundly more diverse and complex than those raised by marginal changes of taxation.

10. Thus while the simple expected utility analysis on which the expression in paragraph 6 is based is sufficient for small variations which are not directly perceived, it cannot capture the complex investor preferences associated with high risk financial assets. However in practice the effect of *systematic* risk appears to be small for activities procured or supplied by the public sector, whether publicly or privately financed. The risk free market rate for the UK is now often taken as the rate of return on indexed gilts. In 1996 this was generally a little over 3° per cent. The average pre-tax rate of return to equity has varied widely over the years but over the long term has averaged just under 6° per cent. A low risk cost of equity would be closer to the risk free rate and equal to say 5 or 6 per cent. The cost of debt finance would generally be rather lower than this and would further reduce the total *private sector low systematic risk* cost of capital to the general region of 5 per cent.^{5,6} The *public* sector cost of capital is the sum of the risk free rate and adjustments for tax, which for private sector firms is typically of the order of 1 percentage point or less, and risk as described above. This again gives a total in the general region of 5 per cent.

11. The upshot is that the costs or benefits of systematic risk of income correlated public sector activities are generally small, and where there are competitive private sector bids for an activity, this will be reflected similarly in both public and private sector costs of capital. If competitive private sector bids for such an activity are higher than the cost of a public sector comparator, then all of the costings should be re-examined.

12. The government borrowing rate also provides a direct, but imperfect measure of *time preference*, since this rate, post tax, is the low risk rate at which people choose at the margin to

⁴ It might be formally tidier to define the time preference rate in terms of *certain* costs and benefits and to handle *variability* separately case by case. However, it is simpler in practice to include in the standard rate an adjustment for variability which is sufficient for the great majority of practical applications.

⁵ For some privately financed projects there may be other risks which are not in practice readily diversifiable by private sector financiers, but which would be spread widely with public financing.

⁶ The regulators of the privatised utilities now typically aim for pre-tax real returns on assets of around 6 to 8 per cent (or 8-9 per cent for BT), although the most serious area for debate in these still early years of the regulatory regimes are the methods of defining the asset base and its depreciation.

save. Real low risk expected rates available to savers have historically been below 4 per cent. On the other hand many people borrow at much higher rates and no clear conclusions about time preference can be drawn from market rates. There are in any case factors other than time preference, such as the value of holding a stock of liquid assets, which can affect the interest rates at which people choose to lend and borrow.

13. The most common analytical approach to national or social time preference for consumption is to regard it as the sum of two components. One component, a , is an estimate of pure time preference for "utility", having regard to people's perhaps lesser concern for the marginal utility of more distant generations, and to the chance of some general catastrophe which would largely eliminate any future benefits. The other, larger component reflects the fact that future populations are expected to have higher incomes, so that a marginal £1 of consumption will anyway bring them less utility.

14. The extent to which the marginal utility of consumption declines as the level of consumption increases is usually quantified in terms of the "elasticity of the marginal utility of consumption". This is a negative number, say $-b$. If b is assumed to be constant, which is not unduly restrictive, this leads to a discount factor for year t of $1/(1+a)(1+g)^{bt}$ where g is the annual rate of growth of per capita income. The annual discount rate is therefore equal, for practical purposes, to $a+bg$. Quantification of both a and b is a matter partly of judgement. Long term values of around 1⁷ per cent per year for a and of 1.5 for b are, in this context, not implausible.^{7,8} g may be around 2 per cent per year.

15. The practical choice of 6 per cent, from the top of the range, for the cost of capital and the time preference rate, is an operational judgement, reflecting, for example, concern to ensure that there is no inefficient bias against private sector supply, and for most practical decisions this choice, rather than say 4 or 5 per cent, has little if any impact. It is usually far more important to choose options well, to assess risks soundly and to estimate costs and benefits reliably (and then to manage the expenditure well thereafter). However occasionally the precise value of the discount rate can have a substantial impact and these special cases should be considered on their merits.

⁷ The elasticity of marginal utility of consumption, $-b$, is given by CU''/U' , where C is consumption and U is utility of consumption. It can be visualised in terms of how much the pleasure given to someone by an extra £1 of money to spend depends upon his or her income (although for social time preference the relevant comparison is not between the same people with different incomes, but between earlier and later populations with different incomes). If an extra £1 would give to someone the same pleasure, whether his income were £10,000 pa or £20,000 pa, this would imply for that person an elasticity of zero. (This would be surprising because, as with most goods and services, extra money would be expected to give less pleasure at the margin, the more that the person has.) An elasticity of -1 would imply that, with an income of £10,000, the extra £1 would give twice as much pleasure as it would with an income of £20,000. Elasticities of -2 and -3 would imply respectively four times (2^2) and eight times (2^3) as much. The judgement required is conceptually fairly simple. It is nothing to do with the morality of more or less income redistribution. It is only very loosely related to attitudes to risk, for it is about the marginal utility of small variations in income which are not directly perceived (as distinct from gains or losses, such as theft, or fluctuations in the value of personal financial assets, relative to a known baseline, which have much more complex impacts). In practice a value for b of around 1.5 for the marginal utility of income is fairly widely accepted. Relevant empirical data, mainly from savings behaviour, is very difficult to interpret, but does not clearly imply any higher or lower value.

⁸ The factor a is usually assumed to make a smaller contribution to time preference than b , but is even more subjective. It includes very general risks, such as the probability of some military, biological, or natural physical catastrophe, which in the light of history, and of changing technology, cannot be negligible. It also has an ethical dimension, as it depends also upon how much the current generation collectively (or the government on its behalf) cares about future populations. There is little evidence on this, although it appears that people care substantially more about themselves and their young children than about more distant populations. It is sometimes suggested that a policy of "sustainable development" implies a lower value of a . A policy of more concern about environmental sustainability because an increased threat of greenhouse or other catastrophic impacts, or the higher valuation which people give to environmental quality as prosperity increases, would have no such implication. However a lower value of a would of course be implied if it were shown that current generations cared more about the marginal welfare of future generations than had been the case in the past, or conversely a higher value would be implied if they cared less.

16. Any such cases are likely to be concerned with very long term impacts, where, as noted in paragraph 4 (ix) of the main text of this Annex, a lower discount rate may be appropriate. In these cases it may be reasonable to test the implications of using a number towards the lower end of the 4-6 per cent range.

17. Some costs and benefits, such as for example risk of death or change in health state, might be seen as having a broadly constant utility value over time, regardless of changes in income. If so, then such future costs or benefits could be valued in "today's" values and discounted at a , so avoiding the need to calculate separately a rate of increase in their value over time.

18. The setting of a *required rate of return*, for a body selling commercially to the private sector, at a rate higher than the cost of capital, presumes that the average return of a commercial body's activities is above its marginal return, which in turn is broadly equal to its cost of capital. This is consistent with the data on past private sector costs of capital and returns on assets.

Annex H: Discounting Formulae and Tables

1. This Annex summarises a number of formulae and provides some tables, as practical aids for appraisals. Many of the formulae are programmed into business or financial software packages. For most appraisals, it will be appropriate to set out the cost and benefits year by year in a spreadsheet.²

The present value, at the middle of year 0, of a payment of £1 made at the middle of year n is given by:

Present value of £1

$$D_n = \frac{1}{(1 + r)^n} \quad \text{)w}$$

where r is the *discount rate*.¹ D_n is called a "*discount factor*".*E*

Example: A payment of £150 at the middle of year 5 has a present value at the middle of year 0 of:

$$£150 \times \frac{1}{(1.06)^5} = £150 \times 0.7473 = £112.1$$

Discount factors are given in Table 1.4

The annual mid-year payment, made for n years starting at the middle of year 1, with a present value at the middle of year 0 of £1 is given by:

Equivalent annual cost of £1

$$A_n = \frac{r}{1 - D_n} \quad \text{)A}$$

is called the "*equivalent annual cost*" of £1.*E*

¹ Throughout Annex H, formulae require discount rates, inflation rates, etc. to be expressed in decimal form rather than percentage form, i.e. 0.06 for a rate of 6 per cent, rather than 6. All numerical examples assume a discount rate of 6 per cent, except where otherwise stated.

Example: A payment of £500 at the middle of year 0 is equivalent to 12 mid-year annual payments, starting at the middle of year 1, of:

$$£500 \times \frac{0.06}{\left[1 - \frac{1}{(1.06)^{12}}\right]} - £500 \times 0.1193 = £59.6$$

5. Equivalent annual costs are given in Table 2.

Present value of £1 per year

6. The present value, at the middle of year 0, of a stream of annual mid-year payments of £1 starting in year 1, is given by the reciprocal of the equivalent annual cost, that is by:

$$\frac{1}{A_n} = \frac{1 - D_n}{r} \tag{3}$$

Example: 15 annual mid-year payments of £75, starting in year 1, have a present value at the middle of year 0 of:

$$£75 \times \frac{\left[1 - \frac{1}{(1.06)^{15}}\right]}{0.06} = £75 \times 9.712 = £728.4$$

7. Factors giving the present values of annual payments are tabulated in Table 3.

Discounting mid-year payments that start in year 0

8. In some cases the mid-year payments may start in year 0 rather than year 1. In such cases the figures in Table 2 should be multiplied by $(1/(1 + r))$ and the figures in Table 3 should be multiplied by $(1 + r)$.

Example

(i) A payment of £500 in the middle of year 0 is equivalent to 12 mid-year annual payments of £59.6 starting in year 1 (from paragraph 4).

A payment of £500 in the middle of year 0 is equivalent to 12 mid-year annual payments starting in year 0 of:

$$£500 \quad 0.1193 \quad 0.9434 = £56.3.$$

(ii) 15 mid-year annual payments of £75 starting in year 1 have a present value in year 0 of £728.4 (from paragraph 6).

15 mid-year annual payments starting in year 0 have a present value in year 0 of:

$$£75 \quad 9.712 \quad 1.06 = £772.1.$$

Payments at intervals other than one year

9. In some appraisals, payments may occur part way through a year, or at regular intervals other than a year, for example quarterly, or every five years. The above formulae can still be applied directly even though n is not a whole number. However, in the formulae for regular payments (equations (2) and (3)), the discount rate r per year should be replaced by the discount rate r per interval; r is given by $1 + r = (1 + r)^p$ (where p is the interval between payments expressed as a fraction of a year, or a whole number of years) and the number of years n should be replaced by the number of periods n .

Example

- (i) *The present value now of a payment of £100 made in 11 months time, discounted at 6 per cent per year, is given by equation (1):*

$$\frac{£100}{(1.06)^{11/12}} = £94.8$$

- (ii) *The present value of eight quarterly payments of £50, the first in three months time, at a discount rate of 6 per cent per year, is given by equation (3), putting r in place of r , and n in place of n :*

$$£50 \times \frac{\left[1 - \frac{1}{(1.06)^8} \right]}{1.06 - 1} = £374.8$$

Discounting mid-year payments to year start or year end base date

10. Many costs, such as annual fuel or maintenance costs, are often better attributed to mid-year than to the year end. Where the discounting base date is itself mid-year (of year 0), the factors in the tables can be used directly. Where the base date is the end of year 0, the discount factors in Tables 1 and 3 may be multiplied by $(1 + r)$ and the equivalent annual costs in Table 2 by $1/(1 + r)$. For a discount rate of 6 per cent, these adjustments are 1.030 and 0.971.

- (i) A payment of £150 at the middle of year 5 has a present value at the *middle of year 0* of $£150 \times 0.7473 = £112.1$ from Table 1, and at the *end of year 0* of $£150 \times 0.7473 \times 1.030 = £115.4$.
- (ii) A payment of £500 at the middle of year 0 is equivalent to 12 annual mid-year payments, starting in year 1, of $£500 \times 0.1193 = £59.6$. If the original payment had been made at the end of year 0, it would have been equivalent to 12 annual mid-year payments of $£500 \times 0.1193 \div 0.9713 = £57.9$

11. All the formulae in this Annex can be adapted in a similar way.

Regular annual payments starting later than year 1

The present value, at the middle of year 0, of m annual mid-year payments of £1, starting in year $n + 1$, can be calculated by combining discount factors (D_n) and factors for the present value of annual payments ($1/A_n$).

Example:

15 annual mid-year payments of £75 in years 7-21 have a present value at the middle of year 6 of £75 x 9.712 = £728.4 (from paragraph 6). Therefore at the middle of year 0, six years earlier, they have a present value of £75 x 9.712 x 0.7050 = £513.5.

Payments expressed in nominal terms

12. In some appraisals, payments may be expressed in nominal or cash terms, that is before removing the effects of general inflation. Before discounting at a real discount rate, such nominal flows must be converted to real terms. The two calculations can be combined *if the annual rate of inflation can be assumed to be constant.*

13. If the annual rate of future inflation is *i*, then a payment of £1 in nominal terms at the middle of year *n* will have a real value (in the money value of year 0) of:

$$£ \frac{1}{(1 + i)^n}$$

The present value of this payment at the middle of year 0, if the real discount rate is *r*, is:

$$£ \frac{1}{(1 + i)^n} \times \frac{1}{(1 + r)^n} = £ \frac{1}{[(1 + i)(1 + r)]^n}$$

$(1 + i)(1 + r) - 1 = i + r + ir$ is the "nominal" discount rate corresponding to the real discount rate of *r*. In many cases, particularly for low rates of inflation, it will be sufficiently accurate to use a nominal discount rate of *i + r*. If this approximation is made, and the percentage rate of inflation taken as a whole number, then the factors in Tables 1 to 3 can be used.

(i) *Inflation over the next five years is expected to average 4 per cent per year. A single payment of £100, in nominal terms, is due in the middle of year 5. The present value at the middle of year 0, at mid-year 0 general price level, can be calculated approximately from Table 2, using a discount rate of 6 + 4 = 10 per cent. The approximate present value is, therefore, £100 x 0.6209 = £62.1. A more precise figure for the discount rate would be 10.24 per cent (since $(1.04 \times 1.06) - 1 = 0.1024$). This would give a present value of :*

$$£100 \times \frac{1}{(1.1024)^5} = £61.4$$

(ii) *Inflation over the next six years is expected to average 4 per cent per year. A payment of £50 is due at the middle of each year, fixed in nominal terms. The present value of this stream of payments (at the middle of year 0 and middle year 0 general price level) can be calculated approximately using Table 3, for a discount rate of 10 per cent, giving £50 x 0.4355 = £217.8.*

A more precise value for the discount rate would be 10.24 per cent (since $(1.04 \times 1.06) - 1 = 0.1024$). The present value of the payments at this discount rate can be calculated from equation (3). Thus:

$$£50 \times \left[\frac{1 - \frac{1}{(1.1024)^6}}{0.1024} \right] = £61.4$$

Changes in relative prices

14. Appraisals sometimes need to take account of changes in the relative price of a particular good or service; that is, a change relative to the general price level. If the price of a good or service can be assumed to increase *at a constant rate* of *j* per year *relative to general inflation*, then the allowance for this relative price change can be combined with the discounting calculation. The "adjusted" discount rate will be $[(1 + r)/(1 + j)] - 1 = (r - j)/(1 + j)$. The approximation of using $r - j$ is often accurate enough, particularly where *j* is small.

Example: Certain costs are expected to increase at an average rate of 2 per cent per annum relative to prices generally. An appraisal contains estimated costs at mid-year 0 prices. The approximate present value of these costs, at the middle of year 0, can be obtained by discounting them at a rate of $6 - 2 = 4$ per cent. A more precise value for the discount rate is 3.9 per cent since $(1.06/1.02) - 1 = 0.039$.

Internal rate of return

15. The internal rate of return is the discount rate at which the net present value of a project is zero. If the annual net benefits (i.e. benefits minus costs) of a project in successive years are $B_0, B_1 \dots B_n$ the IRR is the value of *r* which solves the equation:

$$0 = B_0 + \frac{B_1}{(1 + r)} + \frac{B_2}{(1 + r)^2} + \dots + \frac{B_n}{(1 + r)^n}$$

The value of *r* can be determined iteratively by a standard software package.

Table 1 - Present Value of £1

		Discount rate per cent											
		1	2	3	4	5	6	7	8	9	10		
Year												Year	
1		0.9901	0.9804	0.9709	0.9615	0.9524	0.9434	0.9346	0.9259	0.9174	0.9091	1	
2		0.9803	0.9612	0.9426	0.9246	0.9070	0.8900	0.8734	0.8573	0.8417	0.8264	2	
3		0.9706	0.9423	0.9151	0.8890	0.8638	0.8396	0.8163	0.7938	0.7722	0.7513	3	
4		0.9610	0.9238	0.8885	0.8548	0.8227	0.7921	0.7629	0.7350	0.7084	0.6830	4	
5		0.9515	0.9057	0.8626	0.8219	0.7835	0.7473	0.7130	0.6806	0.6499	0.6209	5	
6		0.9420	0.8880	0.8375	0.7903	0.7462	0.7050	0.6663	0.6302	0.5963	0.5645	6	
7		0.9327	0.8706	0.8131	0.7599	0.7107	0.6651	0.6227	0.5835	0.5470	0.5132	7	
8		0.9235	0.8535	0.7894	0.7307	0.6768	0.6274	0.5820	0.5403	0.5019	0.4665	8	
9		0.9143	0.8368	0.7664	0.7026	0.6446	0.5919	0.5439	0.5002	0.4604	0.4241	9	
10		0.9053	0.8203	0.7441	0.6756	0.6139	0.5584	0.5083	0.4632	0.4224	0.3855	10	
11		0.8963	0.8043	0.7224	0.6496	0.5847	0.5268	0.4751	0.4289	0.3875	0.3505	11	
12		0.8874	0.7885	0.7014	0.6246	0.5568	0.4970	0.4440	0.3971	0.3555	0.3186	12	
13		0.8787	0.7730	0.6810	0.6006	0.5303	0.4688	0.4150	0.3677	0.3262	0.2897	13	
14		0.8700	0.7579	0.6611	0.5775	0.5051	0.4423	0.3878	0.3405	0.2992	0.2633	14	
15		0.8614	0.7430	0.6419	0.5553	0.4810	0.4173	0.3624	0.3152	0.2745	0.2394	15	
16		0.8528	0.7284	0.6232	0.5339	0.4581	0.3936	0.3387	0.2919	0.2519	0.2176	16	
17		0.8444	0.7142	0.6050	0.5134	0.4363	0.3714	0.3166	0.2703	0.2311	0.1978	17	
18		0.8360	0.7002	0.5874	0.4936	0.4155	0.3503	0.2959	0.2502	0.2120	0.1799	18	
19		0.8277	0.6864	0.5703	0.4746	0.3957	0.3305	0.2765	0.2317	0.1945	0.1635	19	
20		0.8195	0.6730	0.5537	0.4564	0.3769	0.3118	0.2584	0.2145	0.1784	0.1486	20	
21		0.8114	0.6600	0.5375	0.4388	0.3589	0.2942	0.2415	0.1987	0.1637	0.1351	21	
22		0.8034	0.6468	0.5219	0.4220	0.3418	0.2775	0.2257	0.1839	0.1502	0.1228	22	
23		0.7954	0.6342	0.5067	0.4057	0.3256	0.2618	0.2109	0.1703	0.1378	0.1117	23	
24		0.7876	0.6217	0.4919	0.3901	0.3101	0.2470	0.1971	0.1577	0.1264	0.1015	24	
25		0.7798	0.6095	0.4776	0.3751	0.2953	0.2330	0.1842	0.1460	0.1160	0.0923	25	
26		0.7720	0.5976	0.4637	0.3607	0.2812	0.2198	0.1722	0.1352	0.1064	0.0839	26	
27		0.7644	0.5859	0.4502	0.3468	0.2678	0.2074	0.1609	0.1252	0.0976	0.0763	27	
28		0.7568	0.5744	0.4371	0.3335	0.2551	0.1956	0.1504	0.1159	0.0895	0.0693	28	
29		0.7493	0.5631	0.4243	0.3207	0.2429	0.1846	0.1406	0.1073	0.0822	0.0630	29	
30		0.7419	0.5521	0.4120	0.3083	0.2314	0.1741	0.1314	0.0994	0.0754	0.0573	30	
40		0.6717	0.4529	0.3066	0.2083	0.1420	0.0972	0.0668	0.0460	0.0318	0.0221	40	
50		0.6080	0.3715	0.2281	0.1407	0.0872	0.0543	0.0339	0.0213	0.0134	0.0085	50	
60		0.5504	0.3048	0.1697	0.0951	0.0535	0.0303	0.0173	0.0099	0.0057	0.0033	60	
70		0.4983	0.2500	0.1263	0.0642	0.0329	0.0169	0.0088	0.0046	0.0024	0.0013	70	
80		0.4511	0.2051	0.0940	0.0434	0.0202	0.0095	0.0045	0.0021	0.0010	0.0005	80	
90		0.4084	0.1683	0.0699	0.0293	0.0124	0.0053	0.0023	0.0010	0.0004	0.0002	90	
100		0.3697	0.1380	0.0520	0.0198	0.0076	0.0029	0.0012	0.0005	0.0002	0.0001	100	
		Discount rate per cent											
		11	12	13	14	15	16	17	18	19	20		
Year												Year	
1		0.9009	0.8929	0.8850	0.8772	0.8696	0.8621	0.8547	0.8475	0.8403	0.8333	1	
2		0.8116	0.7972	0.7831	0.7695	0.7561	0.7432	0.7305	0.7182	0.7062	0.6944	2	
3		0.7312	0.7118	0.6931	0.6750	0.6575	0.6407	0.6244	0.6086	0.5934	0.5787	3	
4		0.6587	0.6355	0.6133	0.5921	0.5718	0.5523	0.5337	0.5158	0.4987	0.4823	4	
5		0.5935	0.5674	0.5428	0.5194	0.4972	0.4761	0.4561	0.4371	0.4190	0.4019	5	
6		0.5346	0.5066	0.4803	0.4556	0.4323	0.4104	0.3898	0.3704	0.3521	0.3349	6	
7		0.4817	0.4523	0.4251	0.3996	0.3759	0.3538	0.3332	0.3139	0.2959	0.2791	7	
8		0.4339	0.4039	0.3762	0.3506	0.3269	0.3050	0.2848	0.2660	0.2487	0.2326	8	
9		0.3909	0.3606	0.3329	0.3075	0.2843	0.2630	0.2434	0.2255	0.2090	0.1938	9	
10		0.3522	0.3220	0.2946	0.2697	0.2472	0.2267	0.2080	0.1911	0.1756	0.1615	10	
11		0.3173	0.2875	0.2607	0.2366	0.2149	0.1954	0.1778	0.1619	0.1476	0.1346	11	
12		0.2858	0.2567	0.2307	0.2076	0.1869	0.1685	0.1520	0.1372	0.1240	0.1122	12	
13		0.2575	0.2292	0.2042	0.1821	0.1625	0.1452	0.1299	0.1163	0.1042	0.0935	13	
14		0.2320	0.2046	0.1807	0.1597	0.1413	0.1252	0.1110	0.0985	0.0876	0.0779	14	
15		0.2090	0.1827	0.1599	0.1401	0.1229	0.1079	0.0949	0.0835	0.0736	0.0649	15	
16		0.1883	0.1631	0.1415	0.1229	0.1069	0.0930	0.0811	0.0708	0.0618	0.0541	16	
17		0.1696	0.1456	0.1252	0.1078	0.0929	0.0802	0.0693	0.0600	0.0520	0.0451	17	
18		0.1528	0.1300	0.1108	0.0946	0.0808	0.0691	0.0592	0.0508	0.0437	0.0376	18	
19		0.1377	0.1161	0.0981	0.0829	0.0703	0.0596	0.0506	0.0431	0.0367	0.0313	19	
20		0.1240	0.1037	0.0868	0.0728	0.0611	0.0514	0.0433	0.0365	0.0308	0.0261	20	
21		0.1117	0.0926	0.0768	0.0638	0.0531	0.0443	0.0370	0.0309	0.0259	0.0217	21	
22		0.1007	0.0826	0.0680	0.0560	0.0462	0.0382	0.0316	0.0262	0.0218	0.0181	22	
23		0.0907	0.0738	0.0601	0.0491	0.0402	0.0329	0.0270	0.0222	0.0183	0.0151	23	
24		0.0817	0.0659	0.0532	0.0431	0.0349	0.0284	0.0231	0.0188	0.0154	0.0126	24	
25		0.0736	0.0588	0.0471	0.0378	0.0304	0.0245	0.0197	0.0160	0.0129	0.0105	25	
26		0.0663	0.0525	0.0417	0.0331	0.0264	0.0211	0.0169	0.0135	0.0109	0.0087	26	
27		0.0597	0.0469	0.0369	0.0291	0.0230	0.0182	0.0144	0.0115	0.0091	0.0073	27	
28		0.0538	0.0419	0.0326	0.0255	0.0200	0.0157	0.0123	0.0097	0.0077	0.0061	28	
29		0.0485	0.0374	0.0289	0.0224	0.0174	0.0135	0.0105	0.0082	0.0064	0.0051	29	
30		0.0437	0.0334	0.0256	0.0196	0.0151	0.0116	0.0090	0.0070	0.0054	0.0042	30	
40		0.0154	0.0107	0.0075	0.0053	0.0037	0.0026	0.0019	0.0013	0.0010	0.0006	40	
50		0.0054	0.0035	0.0022	0.0014	0.0009	0.0006	0.0004	0.0003	0.0002	0.0001	50	
60		0.0019	0.0011	0.0007	0.0004	0.0002	0.0001	0.0001	0.0000	0.0000	0.0000	60	
70		0.0007	0.0004	0.0002	0.0001	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	70	
80		0.0002	0.0001	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	80	
90		0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	90	
100		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100	

Table 2 Equivalent Annual Cost of £1

		Discount rate per cent											
Years	1	2	3	4	5	6	7	8	9	10	Years	1	
1	1.0100	1.2000	1.0300	1.0400	1.0500	1.0600	1.0700	1.0800	1.0900	1.1000	1	1	
2	0.5075	0.5150	0.5226	0.5302	0.5378	0.5454	0.5531	0.5608	0.5685	0.5762	2	2	
3	0.3400	0.3468	0.3535	0.3603	0.3672	0.3741	0.3811	0.3880	0.3951	0.4021	3	3	
4	0.2563	0.2626	0.2690	0.2755	0.2820	0.2886	0.2952	0.3019	0.3087	0.3155	4	4	
5	0.2060	0.2122	0.2184	0.2246	0.2310	0.2374	0.2439	0.2505	0.2571	0.2638	5	5	
6	0.1725	0.1785	0.1846	0.1908	0.1970	0.2034	0.2099	0.2163	0.2229	0.2296	6	6	
7	0.1486	0.1545	0.1605	0.1666	0.1728	0.1791	0.1856	0.1921	0.1987	0.2054	7	7	
8	0.1307	0.1365	0.1425	0.1485	0.1547	0.1610	0.1675	0.1740	0.1807	0.1874	8	8	
9	0.1167	0.1225	0.1284	0.1345	0.1407	0.1470	0.1535	0.1601	0.1668	0.1736	9	9	
10	0.1056	0.1113	0.1172	0.1233	0.1295	0.1359	0.1424	0.1490	0.1558	0.1627	10	10	
11	0.0965	0.1022	0.1081	0.1141	0.1204	0.1268	0.1334	0.1410	0.1469	0.1540	11	11	
12	0.0888	0.0946	0.1005	0.1066	0.1128	0.1193	0.1259	0.1327	0.1397	0.1468	12	12	
13	0.0824	0.0881	0.0940	0.1001	0.1065	0.1130	0.1197	0.1265	0.1336	0.1408	13	13	
14	0.0769	0.0826	0.0885	0.0947	0.1010	0.1076	0.1143	0.1213	0.1284	0.1357	14	14	
15	0.0721	0.0778	0.0838	0.0899	0.0963	0.1030	0.1098	0.1168	0.1241	0.1315	15	15	
16	0.0679	0.0737	0.0796	0.0858	0.0923	0.0990	0.1059	0.1130	0.1203	0.1278	16	16	
17	0.0643	0.0700	0.0760	0.0822	0.0887	0.0954	0.1024	0.1096	0.1170	0.1247	17	17	
18	0.0610	0.0667	0.0727	0.0790	0.0855	0.0924	0.0994	0.1067	0.1142	0.1219	18	18	
19	0.0581	0.0638	0.0698	0.0761	0.0827	0.0896	0.0968	0.1041	0.1117	0.1195	19	19	
20	0.0554	0.0612	0.0672	0.0736	0.0802	0.0872	0.0944	0.1019	0.1095	0.1175	20	20	
21	0.0530	0.0588	0.0649	0.0713	0.0780	0.0850	0.0923	0.0998	0.1076	0.1156	21	21	
22	0.0509	0.0566	0.0627	0.0692	0.0760	0.0830	0.0904	0.0980	0.1059	0.1140	22	22	
23	0.0489	0.0547	0.0608	0.0673	0.0741	0.0813	0.0887	0.0964	0.1044	0.1126	23	23	
24	0.0471	0.0529	0.0590	0.0656	0.0725	0.0797	0.0872	0.0950	0.1030	0.1113	24	24	
25	0.0454	0.0512	0.0574	0.0640	0.0710	0.0782	0.0858	0.0937	0.1018	0.1102	25	25	
26	0.0439	0.0497	0.0559	0.0626	0.0696	0.0769	0.0846	0.0925	0.1007	0.1092	26	26	
27	0.0424	0.0483	0.0546	0.0612	0.0683	0.0757	0.0834	0.0914	0.0997	0.1083	27	27	
28	0.0411	0.0470	0.0533	0.0600	0.0671	0.0746	0.0824	0.0905	0.0989	0.1075	28	28	
29	0.0399	0.0458	0.0521	0.0589	0.0660	0.0736	0.0814	0.0896	0.0981	0.1067	29	29	
30	0.0387	0.0447	0.0510	0.0578	0.0651	0.0726	0.0806	0.0888	0.0973	0.1061	30	30	
40	0.0305	0.0366	0.0433	0.0505	0.0583	0.0665	0.0750	0.0839	0.0930	0.1023	40	40	
50	0.0255	0.0318	0.0389	0.0466	0.0548	0.0634	0.0725	0.0817	0.0912	0.1009	50	50	
60	0.0222	0.0288	0.0361	0.0442	0.0528	0.0619	0.0712	0.0808	0.0905	0.1003	60	60	
70	0.0199	0.0267	0.0343	0.0427	0.0517	0.0610	0.0706	0.0804	0.0902	0.1001	70	70	
80	0.0182	0.0252	0.0331	0.0418	0.0510	0.0606	0.0703	0.0802	0.0901	0.1000	80	80	
90	0.0169	0.0240	0.0323	0.0412	0.0506	0.0603	0.0702	0.0801	0.0900	0.1000	90	90	
100	0.0159	0.0232	0.0316	0.0408	0.0504	0.0602	0.0701	0.0800	0.0900	0.1000	100	100	
		Discount rate per cent											
Years	11	12	13	14	15	16	17	18	19	20	Years	1	
1	1.1100	1.1200	1.1300	1.1400	1.1500	1.1600	1.1700	1.1800	1.1900	1.2000	1	1	
2	0.5839	0.5917	0.5995	0.6073	0.6151	0.6230	0.6308	0.6387	0.6466	0.6545	2	2	
3	0.4092	0.4164	0.4235	0.4307	0.4380	0.4453	0.4526	0.4599	0.4673	0.4747	3	3	
4	0.3223	0.3292	0.3362	0.3432	0.3503	0.3574	0.3645	0.3717	0.3790	0.3863	4	4	
5	0.2706	0.2774	0.2843	0.2913	0.2983	0.3054	0.3126	0.3198	0.3271	0.3344	5	5	
6	0.2364	0.2432	0.2502	0.2572	0.2642	0.2714	0.2786	0.2859	0.2933	0.3007	6	6	
7	0.2122	0.2191	0.2261	0.2332	0.2404	0.2476	0.2549	0.2624	0.2699	0.2774	7	7	
8	0.1943	0.2013	0.2084	0.2156	0.2229	0.2302	0.2377	0.2452	0.2529	0.2606	8	8	
9	0.1806	0.1877	0.1949	0.2022	0.2096	0.2171	0.2247	0.2324	0.2402	0.2481	9	9	
10	0.1698	0.1770	0.1843	0.1917	0.1993	0.2069	0.2147	0.2225	0.2305	0.2385	10	10	
11	0.1611	0.1684	0.1758	0.1834	0.1911	0.1989	0.2068	0.2148	0.2229	0.2311	11	11	
12	0.1594	0.1614	0.1690	0.1767	0.1845	0.1924	0.2005	0.2086	0.2169	0.2253	12	12	
13	0.1482	0.1557	0.1634	0.1712	0.1791	0.1872	0.1954	0.2037	0.2121	0.2206	13	13	
14	0.1432	0.1509	0.1587	0.1666	0.1747	0.1829	0.1912	0.1997	0.2082	0.2169	14	14	
15	0.1391	0.1468	0.1547	0.1628	0.1710	0.1794	0.1878	0.1964	0.2051	0.2139	15	15	
16	0.1355	0.1434	0.1514	0.1596	0.1679	0.1764	0.1850	0.1937	0.2025	0.2114	16	16	
17	0.1325	0.1405	0.1486	0.1569	0.1654	0.1740	0.1827	0.1915	0.2004	0.2094	17	17	
18	0.1298	0.1379	0.1462	0.1546	0.1632	0.1719	0.1807	0.1896	0.1987	0.2078	18	18	
19	0.1276	0.1358	0.1440	0.1527	0.1613	0.1701	0.1791	0.1881	0.1972	0.2065	19	19	
20	0.1256	0.1339	0.1424	0.1510	0.1598	0.1687	0.1777	0.1868	0.1960	0.2054	20	20	
21	0.1238	0.1332	0.1408	0.1495	0.1584	0.1674	0.1765	0.1857	0.1951	0.2044	21	21	
22	0.1223	0.1308	0.1395	0.1483	0.1573	0.1664	0.1755	0.1848	0.1942	0.2037	22	22	
23	0.1210	0.1296	0.1383	0.1472	0.1563	0.1654	0.1747	0.1841	0.1935	0.2031	23	23	
24	0.1198	0.1285	0.1373	0.1463	0.1554	0.1647	0.1740	0.1835	0.1930	0.2025	24	24	
25	0.1187	0.1275	0.1364	0.1455	0.1547	0.1640	0.1734	0.1829	0.1925	0.2021	25	25	
26	0.1178	0.1267	0.1357	0.1448	0.1541	0.1634	0.1729	0.1825	0.1921	0.2018	26	26	
27	0.1170	0.1259	0.1350	0.1442	0.1535	0.1630	0.1725	0.1821	0.1918	0.2015	27	27	
28	0.1163	0.1252	0.1344	0.1437	0.1531	0.1625	0.1721	0.1818	0.1915	0.2012	28	28	
29	0.1156	0.1247	0.1339	0.1432	0.1527	0.1622	0.1718	0.1815	0.1912	0.2010	29	29	
30	0.1150	0.1241	0.1334	0.1428	0.1523	0.1619	0.1715	0.1813	0.1910	0.2008	30	30	
40	0.1117	0.1213	0.1310	0.1407	0.1506	0.1604	0.1703	0.1802	0.1902	0.2001	40	40	
50	0.1106	0.1204	0.1303	0.1402	0.1501	0.1601	0.1701	0.1800	0.1900	0.2000	50	50	
60	0.1102	0.1201	0.1301	0.1401	0.1500	0.1600	0.1700	0.1800	0.1900	0.2000	60	60	
70	0.1101	0.1200	0.1300	0.1400	0.1500	0.1600	0.1700	0.1800	0.1900	0.2000	70	70	
80	0.1100	0.1200	0.1300	0.1400	0.1500	0.1600	0.1700	0.1800	0.1900	0.2000	80	80	
90	0.1100	0.1200	0.1300	0.1400	0.1500	0.1600	0.1700	0.1800	0.1900	0.2000	90	90	
100	0.1100	0.1200	0.1300	0.1400	0.1500	0.1600	0.1700	0.1800	0.1900	0.2000	100	100	

Table 3 Present Value of £1 per annum

		Discount rate per cent											
		1	2	3	4	5	6	7	8	9	10		
Years												Years	
1	0.9901	0.9804	0.9709	0.9615	0.9524	0.9434	0.9346	0.9259	0.9174	0.9091		1	
2	1.9704	1.9416	1.9135	1.8861	1.8594	1.8334	1.8080	1.7833	1.7591	1.7355		2	
3	2.9410	2.8839	2.8286	2.7751	2.7232	2.6730	2.6243	2.5771	2.5313	2.4869		3	
4	3.9020	3.8077	3.7171	3.6299	3.5460	3.4651	3.3872	3.3121	3.2397	3.1699		4	
5	4.8534	4.7135	4.5797	4.4518	4.3295	4.2124	4.1002	3.9927	3.8897	3.7908		5	
6	5.7955	5.6014	5.4172	5.2421	5.0757	4.9173	4.7665	4.6229	4.4859	4.3553		6	
7	6.7282	6.4720	6.2303	6.0021	5.7864	5.5824	5.3893	5.2064	5.0330	4.8684		7	
8	7.6517	7.3255	7.0197	6.7327	6.4632	6.2098	5.9713	5.7466	5.5348	5.3349		8	
9	8.5660	8.1622	7.7861	7.4353	7.1078	6.8017	6.5152	6.2469	5.9952	5.7590		9	
10	9.4713	8.9826	8.5302	8.1109	7.7217	7.3601	7.0236	6.7101	6.4177	6.1446		10	
11	10.3676	9.7868	9.2526	8.7605	8.3064	7.8869	7.4987	7.1390	6.8052	6.4951		11	
12	11.2551	10.5753	9.9540	9.3851	8.8633	8.3838	7.9427	7.5361	7.1607	6.8137		12	
13	12.1337	11.3484	10.6350	9.9856	9.3936	8.8527	8.3577	7.9038	7.4869	7.1034		13	
14	13.0037	12.1062	11.2961	10.5631	9.8986	9.2950	8.7455	8.2442	7.7862	7.3667		14	
15	13.8651	12.8493	11.9379	11.1184	10.3797	9.7122	9.1079	8.5595	8.0607	7.6061		15	
16	14.7179	13.5777	12.5611	11.6523	10.8378	10.1059	9.4466	8.8514	8.3126	7.8237		16	
17	15.5623	14.2919	13.1661	12.1657	11.2741	10.4773	9.7632	9.1216	8.5436	8.0216		17	
18	16.3983	14.9920	13.7535	12.6593	11.6896	10.8276	10.0591	9.3719	8.7556	8.2014		18	
19	17.2260	15.6785	14.3238	13.1339	12.0853	11.1581	10.3356	9.6036	8.9501	8.3649		19	
20	18.0456	16.3514	14.8775	13.5903	12.4622	11.4699	10.5940	9.8181	9.1285	8.5136		20	
21	18.8570	17.0112	15.4150	14.0292	12.8212	11.7641	10.8355	10.0168	9.2922	8.6487		21	
22	19.6604	17.6580	15.9369	14.4511	13.1630	12.0416	11.0612	10.2007	9.4424	8.7715		22	
23	20.4558	18.2922	16.4436	14.8568	13.4886	12.3034	11.2722	10.3711	9.5802	8.8832		23	
24	21.2434	18.9139	16.9355	15.2470	13.7986	12.5504	11.4693	10.5288	9.7066	8.9847		24	
25	22.0232	19.5235	17.4131	15.6221	14.0939	12.7834	11.6536	10.6748	9.8226	9.0770		25	
26	22.7952	20.1210	17.8768	15.9828	14.3752	13.0032	11.8258	10.8100	9.9290	9.1609		26	
27	23.5596	20.7069	18.3270	16.3296	14.6430	13.2105	11.9867	10.9352	10.0266	9.2372		27	
28	24.3164	21.2813	18.7641	16.6631	14.8981	13.4062	12.1371	11.0511	10.1161	9.3066		28	
29	25.0658	21.8444	19.1885	16.9837	15.1411	13.5907	12.2777	11.1584	10.1983	9.3696		29	
30	25.8077	22.3965	19.6004	17.2920	15.3725	13.7648	12.4090	11.2578	10.2737	9.4269		30	
40	32.8347	27.3555	23.1148	19.7928	17.1591	15.0463	13.3317	11.9246	10.7574	9.7791		40	
50	39.1961	31.4236	25.7298	21.4822	18.2559	15.7619	13.8007	12.2335	10.9617	9.9148		50	
60	44.9550	34.7609	27.6756	22.6235	18.9293	16.1614	14.0392	12.3766	11.0480	9.9672		60	
70	50.1685	37.4986	29.1234	23.3945	19.3427	16.3845	14.1604	12.4428	11.0844	9.9873		70	
80	54.8882	39.7445	30.2008	23.9154	19.5965	16.5091	14.2220	12.4735	11.0998	9.9951		80	
90	59.1609	41.5869	31.0024	24.2673	19.7523	16.5787	14.2533	12.4877	11.1064	9.9981		90	
100	63.0289	43.0984	31.5989	24.5050	19.8479	16.6175	14.2693	12.4943	11.1091	9.9993		100	

		Discount rate per cent											
		11	12	13	14	15	16	17	18	19	20		
Years												Years	
1	0.9009	0.8929	0.8850	0.8772	0.8696	0.8621	0.8547	0.8475	0.8403	0.8333		1	
2	1.7125	1.6901	1.6681	1.6467	1.6257	1.6052	1.5852	1.5656	1.5465	1.5278		2	
3	2.4437	2.4018	2.3612	2.3216	2.2832	2.2459	2.2096	2.1743	2.1399	2.1065		3	
4	3.1024	3.0373	2.9745	2.9137	2.8550	2.7982	2.7432	2.6901	2.6386	2.5887		4	
5	3.6959	3.6048	3.5172	3.4331	3.3522	3.2743	3.1993	3.1272	3.0576	2.9906		5	
6	4.2305	4.1114	3.9975	3.8887	3.7845	3.6847	3.5892	3.4976	3.4098	3.3255		6	
7	4.7122	4.5638	4.4226	4.2883	4.1604	4.0386	3.9224	3.8115	3.7057	3.6046		7	
8	5.1461	4.9676	4.7988	4.6389	4.4873	4.3436	4.2072	4.0776	3.9544	3.8372		8	
9	5.5370	5.3282	5.1317	4.9464	4.7716	4.6065	4.4506	4.3030	4.1633	4.0310		9	
10	5.8892	5.6502	5.4262	5.2161	5.0188	4.8332	4.6586	4.4941	4.3389	4.1925		10	
11	6.2065	5.9377	5.6869	5.4527	5.2337	5.0286	4.8364	4.6560	4.4865	4.3271		11	
12	6.4924	6.1944	5.9176	5.6603	5.4206	5.1971	4.9884	4.7932	4.6105	4.4392		12	
13	6.7499	6.4235	6.1218	5.8424	5.5831	5.3423	5.1183	4.9095	4.7147	4.5327		13	
14	6.9819	6.6282	6.3025	6.0021	5.7245	5.4675	5.2293	5.0081	4.8023	4.6106		14	
15	7.1909	6.8109	6.4624	6.1422	5.8474	5.5755	5.3242	5.0916	4.8759	4.6755		15	
16	7.3792	6.9740	6.6039	6.2651	5.9542	5.6685	5.4053	5.1624	4.9377	4.7296		16	
17	7.5488	7.1196	6.7291	6.3729	6.0472	5.7487	5.4746	5.2223	4.9897	4.7746		17	
18	7.7016	7.2497	6.8399	6.4674	6.1280	5.8178	5.5339	5.2732	5.0333	4.8122		18	
19	7.8393	7.3658	6.9380	6.5504	6.1982	5.8775	5.5845	5.3162	5.0700	4.8435		19	
20	7.9633	7.4694	7.0248	6.6231	6.2593	5.9288	5.6278	5.3527	5.1009	4.8696		20	
21	8.0751	7.5620	7.1016	6.6870	6.3125	5.9731	5.6648	5.3837	5.1268	4.8913		21	
22	8.1757	7.6446	7.1695	6.7429	6.3587	6.0113	5.6964	5.4099	5.1486	4.9094		22	
23	8.2664	7.7184	7.2297	6.7921	6.3988	6.0442	5.7234	5.4321	5.1668	4.9245		23	
24	8.3481	7.7843	7.2829	6.8351	6.4338	6.0726	5.7465	5.4509	5.1822	4.9371		24	
25	8.4217	7.8431	7.3300	6.8729	6.4641	6.0971	5.7662	5.4669	5.1951	4.9476		25	
26	8.4881	7.8957	7.3717	6.9061	6.4906	6.1182	5.7831	5.4804	5.2060	4.9563		26	
27	8.5478	7.9426	7.4086	6.9352	6.5135	6.1364	5.7975	5.4919	5.2151	4.9636		27	
28	8.6016	7.9844	7.4412	6.9607	6.5335	6.1520	5.8099	5.5016	5.2228	4.9697		28	
29	8.6501	8.0218	7.4701	6.9830	6.5509	6.1656	5.8204	5.5098	5.2292	4.9747		29	
30	8.6938	8.0552	7.4957	7.0027	6.5660	6.1772	5.8294	5.5168	5.2347	4.9789		30	
40	8.9511	8.2438	7.6344	7.1050	6.6418	6.2335	5.8713	5.5482	5.2582	4.9966		40	
50	9.0417	8.3045	7.6752	7.1327	6.6605	6.2463	5.8801	5.5541	5.2623	4.9995		50	
60	9.0736	8.3240	7.6873	7.1401	6.6651	6.2492	5.8819	5.5553	5.2630	4.9999		60	
70	9.0848	8.3303	7.6908	7.1421	6.6663	6.2498	5.8823	5.5555	5.2631	5.0000		70	
80	9.0888	8.3324	7.6919	7.1427	6.6666	6.2500	5.8823	5.5555	5.2632	5.0000		80	
90	9.0902	8.3330	7.6922	7.1428	6.6666	6.2500	5.8823	5.5556	5.2632	5.0000		90	
100	9.0906	8.3332	7.6923	7.1428	6.6667	6.2500	5.8824	5.5556	5.2632	5.0000		100	

An Appraisal and Evaluation Checklist

Introduction

This section provides a checklist of questions to be asked in the formulation of good appraisal and evaluation. This checklist can be photocopied and used as a guide to ensure that a proposal follows many of the main principles outlined in this guide.

Clarity of objectives (paragraphs 2.4-2.6, Box in Chapter 2, paragraph 3.5)

1. **Are the objectives consistent with strategic aims and ultimate objectives** as set out in, for example, departmental reports and statements of government policy
2. **Does the proposal focus on outputs**, as opposed to inputs, and how these outputs contribute to ultimate objectives?
3. **Are the objectives defined in ways which allow their subsequent achievement to be evaluated?**

Choice and definition of options (paragraphs 2.8-2.10, 4.2-4.11)

4. **Is the range of options being considered wide enough**, having regard to, for example: quantity or quality of output; timing or phasing; location; the scope for private finance? Has the do nothing or do minimum option been explicitly considered?
5. **Has any potentially promising option been ruled out** before detailed appraisal on grounds of technical feasibility or other constraints (e.g. legal, political, financial)? If so, should these constraints be questioned? Or estimates made of the costs they impose?
6. **Can the options be split into independent components** for separate appraisal? (A proposal may have separable components which provide much better value than others.)

Estimation of costs and benefits (paragraphs 2.11-2.13, 4.17-4.19, Annex C)

7. Has account been taken of:
 - (i) **capital and operating costs** (incl. contingency costs and residual value), staff costs (incl. overheads), maintenance, administration, rates etc. ?
 - (ii) **other costs and benefits which can be valued in money terms** e.g. cost savings, non-marketed impacts?
 - (iii) **quantified measures or at least descriptions of those costs and benefits which cannot be easily valued** in money terms?

Valuation (paragraphs 2.14-2.17, 4.12-4.42)

8. **Have all costs and benefits been expressed in real terms and discounted at the appropriate rate** (usually 6 per cent)? **Has account been taken of any relative price effects** where they may be important?
9. Have costs been properly estimated? For example,
 - (i) **opportunity costs used to value goods?**
 - (ii) sunk costs omitted, but inclusion of **opportunity cost of existing assets?**
10. Have adjustments been made for taxes and subsidies where appropriate, such that they do not distort the final decision:
 - (i) **indirect taxes such as VAT treated consistently** between options;
 - (ii) **transfer payments recorded separately.**

*Assessment of risk and uncertainty*¹ (paragraphs 2.18, 2.34-2.35, 4.22-4.24, 4.43-4.51, Annex B, Annex D)

11. If forecasts have been used are these from the most reliable source and what is their accuracy?
12. **Have all important risks and uncertainties been identified for each option?**
13. Has **sensitivity analysis** been used? Are other methods of risk assessment also appropriate?
14. For privately financed options has the nature and level of **risk transfer** been sufficiently examined?

NPV calculation (paragraphs 2.31-2.33, 4.55-4.57)

15. **Is the time period for the NPV calculation long enough to encompass all important costs and benefits?** Or has adequate account been taken of subsequent costs and benefits? Is the timing of all costs and benefits clear for each option?

Presentation of results (paragraphs 2.36-2.38)

16. **Have the results been clearly presented?** Is it clear who will benefit and who will bear the cost of each option?

Evaluation (paragraph 2.39, Chapter 3, Annex A)

17. In the case of appraisal:
 - (i) **Are outline plans for evaluation clear** and considered at the time of the appraisal?
 - (ii) Does the proposal being appraised **include satisfactory plans for monitoring?**
18. In the case of evaluation:
 - (i) Is it clear **exactly what activities are being evaluated?**
 - (ii) Is it clear **exactly what these activities and their outturns are being compared with**, and why?
 - (iii) Are the **plans for dissemination and feedback** as effective as they could be?

¹ A separate checklist on the handling of risk and uncertainty appears at the back of Annex B.

Glossary

Additionality	The extent to which an activity which is a policy objective is undertaken on a larger scale, takes place at all, or earlier, or within a geographical area of policy concern, as a result of public sector intervention.
Annuitised value	See <i>Equivalent annual cost</i> .
Appraisal	The process of defining objectives, examining options and weighing up the costs and benefits and risks and uncertainties <i>before</i> a decision is made.
Bequest value	See <i>Existence value</i> .
Capitalized value	The sum of the discounted values of a future stream of costs or receipts.
Cash terms	Expenditure measured in nominal or outturn prices, as used in the Public Expenditure Survey and the Estimates. See also <i>Exchequer cost</i> .
Contingent valuation	See <i>Stated preference</i> .
Contingency	An allowance included in the estimated cost of a project to cover unforeseen circumstances.
Cost benefit analysis (CBA)	A term used to describe analysis which seeks to quantify in money terms as many of the costs and benefits of a proposal as possible, including items for which the market does not provide a satisfactory measure of economic value. The expression is sometimes confined to these costs and benefits alone and sometimes used to describe an analysis of all the welfare costs and benefits.
Cost effectiveness analysis	The comparison of alternative ways of producing the same or similar outputs, which are not necessarily given a monetary value.

Cost of capital	The cost attributed to money raised for investment, expressed as an annual percentage rate.
Deadweight	Expenditure to promote a desired activity which would in fact have occurred without the expenditure.
Discounting	The comparison of quantities which are distributed over time by converting them to a present value, by applying a discount rate.
Discounted cash flow (DCF)	An umbrella term for analyses which discount a time stream of costs and benefits to derive a present value.
Discount rate	The annual percentage rate at which the present value of a future pound, or other unit of account, is assumed to fall away through time.
Displacement	The degree to which an activity promoted by government policy is offset by reductions in activity elsewhere.
Economic appraisal or evaluation	Appraisal or evaluation which takes into account a wide range evaluation of welfare costs and benefits. How wide depends upon the context. It may include all welfare costs and benefits, or all those which affect GDP, or all those which can be valued in money terms.
Economic cost (or benefit)	Cost or benefit used in economic appraisal or evaluation.
Equivalent annual cost	The constant annual cost (or annuitised value) which is equivalent to (i.e. has the same present value as) a project's actual costs.
Evaluation	Retrospective analysis of a project, programme, or policy to assess how successful or otherwise it has been, and what lessons can be learnt for the future. The terms 'Policy evaluation' and 'Post-project evaluation' are often used to describe evaluation in those two areas.
Exchequer cost	Cost in terms of public sector expenditure and revenues.
Existence value	The value placed by people on the continued existence of an asset for the benefit of present or future generations. The latter is sometimes referred to as bequest value. See also <i>Use value</i> .
Financial appraisal	Analysis of cash flows.
GDP deflator	An index of the general price level in the economy as a whole, measured by the ratio of gross domestic product (GDP) in nominal (i.e. cash) terms to GDP at constant prices.

Holding gain	The increase over time in the value of an asset.
Impact statement	A description, quantified where possible, of all the significant impacts of a proposal, and of how they are distributed between those affected.
Internal rate of return (IRR)	The discount rate which would give a project a present value of zero.
Investment appraisal	The appraisal of an investment proposal.
Market value	The price at which a commodity could be bought or sold.
Matrix approach	Presentation of the results of an appraisal as a matrix of costs and benefits, not all of which may be valued in money terms. A form of impact statement.
Net present value (NPV)	See <i>Present value</i> .
Opportunity cost (or Economic cost)	Value in most valuable alternative use.
Option appraisal	A term used in some departments and agencies to describe any form of appraisal.
Option value	The value of the availability of the option of using an environmental or other asset (which in this context is usually non-marketed) at some future date. See also <i>Use value</i> .
Present value	The capitalised value of a stream of future costs or benefits. The term <i>Net present value</i> (NPV) is often used to describe the difference between the present value of a stream of costs and a stream of benefits.
Price index	A measure of the amount by which prices change over time. <i>General price indexes</i> cover a wide range of prices and include the <i>GDP deflator</i> and the <i>Retail Price Index (RPI)</i> . <i>Special price indexes</i> apply to one commodity or type of commodity.
Private finance	Used in the public sector to describe the supply by the private sector of public services, including the provision of assets and their financing.
Real price	The nominal (i.e. cash) price deflated by a general price index, e.g. RPI or GDP deflator, relative to a specified base year or base date.

Real terms	The value of expenditure at a specified general price level: that is a cash price or expenditure divided by a general price index.
Relative price effect	The movement over time of a <i>specific</i> price index (such as construction prices) relative to a <i>general</i> price index (such as the GDP deflator).
Required rate of return (RRR)	A target average rate of return for a public sector trading body, usually expressed, for central government bodies, as a return on the current cost value of total capital employed.
Residual value	The expected value of a capital asset at some future date.
Resources/Resource cost	Terms used in a variety of senses, according to context. In resource accounting, "resource costs" are accruals accounting costs expressed in real terms. In economic analysis a distinction is sometimes drawn between "transfers", such as social security payments and "resource costs" which are payments for goods or services. In departments and agencies "resources" is sometimes used to describe expenditure from their budgets, or sometimes requirements of staffing.
Revealed preference	Willingness to pay for something which is non-marketed, as revealed by other expenditure choices.
Sensitivity analysis	Analysis of the effects on an appraisal of varying the projected values of important variables.
Shadow price	A value, other than a market price, ascribed to some quantity in economic analysis.
Stated preference	Willingness to pay for something which is non-marketed, as derived from people's responses to questions about preferences for various combinations of situations and/or controlled discussion groups. Some practical applications are described as 'contingent valuation'.
Substitution	The situation in which a firm substitutes one activity for a similar activity (such as recruiting a different job applicant) to take advantage of government assistance.
Switching point or switching value	The value of an uncertain cost or benefit at which the best way to proceed would switch, for example from approving to not approving a project, or from including or excluding some extra expenditure to preserve some environmental benefit.

Time preference rate	Preference for consumption (or other costs or benefits) sooner rather than later, expressed as an annual percentage rate.
Use value	Value of something which is non-marketed provided by people's actual use of it. See also <i>Existence value</i> and <i>Option value</i> .
Volume terms	A measure of the physical quantity of a resource obtained by dividing nominal (i.e. cash) expenditure by a price index specific to the particular resource, e.g. construction prices.
Welfare cost (or benefit)	Any effect on human well-being.

Bibliography

A: DEPARTMENTAL GUIDANCE

The following list, which is not exhaustive, consists of standing guidance which is periodically updated or re-issued unless cancelled or superseded. For further information on guidance and instruction documents the relevant department should be contacted.

Ministry of Agriculture, Food and Fisheries (MAFF)

Flood and Coastal Defence: Project Appraisal Guidance Notes, 1993.

A guide on the general principles of economic appraisal of flood and coastal defence projects.

Policy Evaluation Guidance, 1993.

Guidance for programme managers on the principles and practice of policy evaluation.

Fishing Harbour Grants - Conditions of Grant and Guidance Notes, 1987.

Ministry of Defence (MOD)

PFI Guidance for the Ministry of Defence, 1996.

General guidance on the design and management of PFI projects in the MOD.

Competing for Quality in Defence Services, 1996.

General guidance on the design and management of 'competing for quality' projects in the MOD.

Management Strategy (JSP 414) Part IV, Chapter 16 'Investment Appraisal and Post Project Evaluation', 1991.

Management strategy issued as a joint services publication providing a guide to MOD's planning and financial management system introduced in 1991.

Department of the Environment (DOE)

*Policy Appraisal and the Environment*¹: A Guide for Government Departments, HMSO, 1991.

A guide on the treatment of environmental issues in policy analysis.

Policy Evaluation: The Role of Social Research, B Doig and J Littlewood, HMSO, 1992.

Environmental Appraisal in Government Departments, HMSO, 1994.

A booklet which describes how government departments have used and applied the techniques described in *Policy Appraisal and the Environment*.

Resource Management Handbook, FC Division, 1996.

See particularly, Chapter A8: Performance measurement; and Chapter A10: Policy evaluation

A Guide to Risk Assessment and Risk Management for Environmental Protection, HMSO, 1995.

A guide, primarily for policy makers in the public sector, outlining the principles behind the assessment of environmental risks.

Health and Safety Executive (HSE)

Policy Appraisal and Evaluation, GAP No.23, 1st edition, 1995.

Guidance for policy branches on the appraisal and evaluation of new proposals for health and safety regulations.

Department of Health (DH)

Policy Appraisal and Health, 1995.

A guide to the economic appraisal of projects, programmes and policies affecting health.

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A guide to assessing the contribution of alternative interventions to meeting national targets for reductions in mortality from strokes and heart disease.

Capital Investment Manual, HMSO, 1994.

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Department of National Heritage (DNH)

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A general guide to appraisal and evaluation within the DNH and its NDPBs.

Department of Finance and Personnel, Northern Ireland (NIO)

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Appraising An Economic Appraisal: A Checklist Approach. PPRU Occasional Paper No.18, 2nd edition, 1991.

A short paper for specialists and non-specialists intended to assist in the review and assessment of economic appraisals in the public sector.

Economic Appraisal: The Technique of Weighting and Scoring. PPRU Occasional Paper No.25, 1993.

A detailed non-specialist guide setting out the principles behind the weighting and scoring technique and how to use it in practice.

Evaluation in the Northern Ireland Civil Service: A Guide for Departments, 1994.

A detailed guide to help evaluate expenditure policies and programmes.

The PFI in Northern Ireland: Guidance on Outline and Full Business Cases, Version 1, 1996.

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Scottish Office (SO)

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A manual explaining the economic principles and practice of the appraisal of trunk road schemes.

Prisons - Option Appraisal Procedure Guide: Scottish Home and Health Department, 1990.

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The Business Investment Decision: A Guide to the Financial Appraisal of IT and Accommodation Projects in the DSS, 1994.

A guide explaining the principles and procedures relating to the appraisal of non-routine expenditure proposals within the DSS.

The Private Finance Initiative: A Partnership between Public and Privates Sectors, 1994.
A guide explaining how the PFI should be applied to the DSS's project planning, development procurement and approvals processes.

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Investing in the Assisted Areas: A Guide to Regional Selective Assistance, 1995.
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Economic Assessment of Road Schemes: COBA Manual; Design Manual for Roads and Bridges, Vol.13, Section 1, HMSO, 1996.

A manual of economic appraisal for use in the assessment of inter-urban road schemes in England and Wales. It is supplemented by URECA, used for the assessment of urban schemes and QUADRO which is used to appraise costs of delay at road works.

Guidelines for Public Transport Project Appraisal: Applications for Section 56 Grant, Annex A to DOT Circular 3/89.

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The following references are on the theory of cost benefit analysis and public sector appraisal:

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The following addresses the problems of investment appraisal in less developed countries: Little I M D and Mirless J A, *Project Appraisal and Planning for Developing Countries*, Heinemann, 1974.

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Teasdale P, *Evaluation of Active Labour Market Policies: A Bibliography*, DFEE, 1996.

² There are currently five books in the Blueprint series. All are published by Earthscan.

D: HM TREASURY GUIDANCE

Requests for HM Treasury publications, other than those published by HSMO (now *The Stationery Office*) should be made to the HM Treasury's Public Enquiry Unit, Tel: 0171 270 4558; Fax: 0171 270 5244.

Information on HM Treasury publications is also available on HM Treasury's Internet service. The address is <http://www.hm-treasury.gov.uk>

Evaluation

Policy Evaluation: A Guide to Managers, HMSO, 1988.

A Framework for the Evaluation of Regeneration Projects and Programmes, 1995.

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The Fees and Charges Guide, HMSO, 1992.

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The Resource Accounting Manual, Forthcoming 1997.

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Mayston D, *Output Indicators in the Public Services, A Report for HM Treasury*, 1994.

Executive Agencies: Setting Targets and Measuring Performance, HMSO, 1992.

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Seeking Help from Management Consultants, HMSO, 1990.

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The Economic Appraisal of Property Options: a Manual of Procedures and Techniques, 1993.

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Privatisation of Central Government Activities: A Guide for Departments, 1995.

Challenge Funding

The Challenge Handbook: Advice for Government Departments establishing Challenge Initiatives, 1996.

Public Purchasing: Central Unit on Procurement (CUP) Guidance⁵

No 54: *Value Management*, 1996.

Explains the project sponsor's responsibilities for optimising and achieving value for money.

No 52: *Programming and Progress Monitoring for Works Projects*, 1995.

Describes some of the techniques available for programming and progress monitoring.

No 51: *Introduction to the EC Procurement Rules*, 1995.

Sets out where the EC procurement rules apply. Also applies to the generality of public contracts.

No 47: *Contract Management*, 1994.

Provides advice on how to manage contracts successfully.

No 43: *Project Evaluation*, 1993.

Sets out the principles of project evaluation.

No 41: *Managing Risk and Contingency for Works Projects*, 1993.

Explains the project sponsor's responsibilities for managing risk and setting and controlling appropriate levels of contingency.

No 40: *The Competitive Tendering Process*, 1993.

Provides an overview of the various stages in the competitive tendering process.

No 38: *Approval of Works Projects*, 1993.

Sets out the project sponsor's responsibilities for obtaining approval for works projects.

⁵CUP has issued 54 Guidance Notes between 1986 and 1996. The following is a selection of more recent guidance.

E: OTHER CENTRAL GUIDANCE

Office of Public Services (OPS)

General

Guidance on Guidance: An Index to Useful Documents, 1996.

Provides an extensive review of central government guidance on a number of topics.

Competing for Quality

Competing for Quality, HMSO, 1991.

Competing for Quality Policy Review, HMSO, 1996.

Market Testing

The Government's Guide to Market Testing, HMSO, 1993.

Next Steps Agencies

Improving Management in Government: The Next Steps, HMSO, 1988.⁶

Resource accounting

Better Accounting for the Taxpayer's Money: Resource Accounting and Budgeting in Government, HMSO, 1995.

Financial management

The Government's Efficiency Scrutiny on Resource Management Systems, HMSO, 1995.

Efficiency plans

Efficiency Plans: Guidance for Development and Use, HMSO, 1995.

Citizen's Charter

The Citizen's Charter, HMSO, 1991.⁷

Deregulation Unit

Checking the Cost of Regulation: A Guide to Compliance Cost Assessment, HMSO, 1996.

Regulation in the Balance: A Guide to Regulatory Appraisal Incorporating Risk Assessment, HMSO, 1996.

Thinking About Regulating: A Guide to Good Regulation, DTI Publishing, 1994.⁸

⁶ There are a number of other documents on Next Steps, including an annual Next Steps Review.

⁷ There are a number of other documents on the Citizen's Charter, including reports in 1992, 1994 and 1996.

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Central Computer and Telecommunications Agency (CCTA)

Achieving Benefits for Business Change, HMSO, 1994.

Post-Implementation Review, 1995.

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5 Steps to the Appointment of Advisors to PFI Projects: Tips on the Selection, Appointment and Management of Advisors to PFI Projects, 1996.

Risk and Reward in PFI Contracts: Practical Guidance on the Sharing of Risk and Structuring of PFI Contracts, 1996.

VAT in PFI Service Payments, Forthcoming, 1997.

■ **Joint Publications with CCTA**

The Private Finance Initiative and Government IS/IT, 1994.

The Private Finance Initiative and Government IS/IT: The Business Case and Procurement Process, 1995.

The Private Finance Initiative and Government IS/IT: Risk, 1995.

The Private Finance Initiative and Government IS/IT: Evaluation, 1996.

The Private Finance Initiative and Government IS/IT: Report on the NIRS2 project, 1995.

■ **Joint Publication with CCTA and Central IT Unit (CITU)**

The Private Finance Initiative in IT, 1997.

■ **Joint Publication with CCTA, CITU and Home Office**

Private Finance and IS/IT: case study, The IND caseworking programme, 1996.

■ **Joint Publication with CCTA, CITU and Welsh Office**

Private Finance and IS/IT: case study, OSIRIS: Office Systems Infrastructure Review and Implementation Strategy for the Welsh Office, 1996.

■ **Joint Publication with HM Prison Service**

Report on the Procurement of Custodial Services for the DCMF Prisons at Bridgend and Fazakerley, 1996.

