



HM Treasury

THE GREEN BOOK

CENTRAL GOVERNMENT
GUIDANCE ON APPRAISAL
AND EVALUATION



HM Treasury

THE GREEN BOOK

CENTRAL GOVERNMENT GUIDANCE ON APPRAISAL AND EVALUATION

2018



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Foreword

For nearly half a century the Treasury's Green Book has provided guidance to help officials develop transparent, objective, evidence-based appraisal and evaluation of proposals to inform decision making.

This Green Book is an update of the 2003 edition. It builds on the lessons learned using the 2003 edition and previous editions dating back over 40 years.

Many of the changes in this edition reflect important advances in appraisal and evaluation that government departments and agencies have made since 2003. This is especially notable in environmental appraisal, where scientific advances have transformed our understanding of environmental impacts and improved our ability to understand and value them. Greater emphasis is also placed on building monitoring and evaluation into policy development before, during and after implementation.

The policy landscape has changed since 2003, but there is a continued need to make the best use of resources. Treasury Business Case Guidance for spending proposals has been strengthened, emphasising the importance of assessing proposals on the robustness of their delivery plans alongside more traditional cost benefit analysis. The impact of regulation on business has also been brought into sharper focus with the introduction of business impact targets. Both these developments are reflected in this edition of the Green Book.

The guidance has benefited from discussions across government and with colleagues from academia and the practitioner community. Thanks are due to all that have given their time to supporting this update.

Tom Scholar

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Permanent Secretary, HM Treasury

March 2018

1

Introduction

1.1 The Green Book is guidance issued by HM Treasury on how to appraise policies, programmes and projects. It also provides guidance on the design and use of monitoring and evaluation before, during and after implementation.

1.2 The Green Book should be used alongside other HM Treasury guidance:

- [Managing Public Money](#) which provides guidance on the responsible use of public resources
- the [Aqua Book](#) which sets out standards for analytical modelling and assurance
- the [Magenta Book](#) which provides detailed guidance on evaluation methods

1.3 Green Book guidance applies to all proposals that concern public spending, taxation, changes to regulations, and changes to the use of existing public assets and resources – see [Box 1](#) below.

Box 1. Scope of Green Book Guidance

Green Book guidance covers:

- policy and programme development
- all proposals concerning public spending
- legislative or regulatory proposals
- sale or use of existing government assets – including financial assets
- appraisal of a portfolio of programmes and projects
- structural changes in government organisations
- taxation and benefit proposals
- significant public procurement proposals
- major projects
- changes to the use of existing public assets and resources

1.4 The role of appraisal and evaluation is to provide objective analysis to support decision making. Decision making processes include the scrutiny of business cases by government departments, [Treasury Approval Processes](#) and the [Regulatory Impact Assessment](#) process. The principles of the Green Book should also support options appraisal when formal decision making processes are not required. The relationship between Green Book guidance and government decision making processes is shown in [Figure 1](#).

1.5 The Green Book is not a mechanical decision making device. Rather, it provides approved guidance and methods, recommended tools for developing options and standard values for use across government. It helps officials develop transparent, objective and evidence-based advice for decision making that is consistent across government.

1.6 This guidance should be applied proportionately. The resources and effort employed should be related to the scale of the proposals under consideration.

1.7 Monitoring and evaluation of all proposals should be planned, costed and provided for as an integral part of a proposed intervention under consideration.

Figure 1. The Green Book and Appraisal in Context



1.8 This guidance has been designed to be accessible to a variety of users – from policy officials to analysts. Accordingly, it follows a tiered structure where:

- a high-level overview is provided in chapters 1 – 3
- detailed information for practitioners is provided in chapters 4 – 8
- technical information and shared valuations for use in appraisal are provided in annexes 1 – 6
- hyperlinks have been inserted to allow users to cross-reference within the Green Book and associated supplementary guidance

1.9 The Green Book’s chapters are as follows:

- [chapter 2](#) provides a non-technical introduction to appraisal and evaluation
- [chapter 3](#) provides an overview of how appraisal fits within government decision making processes
- [chapter 4](#) explains how to generate options and undertake long-list appraisal
- [chapter 5](#) explains how to undertake detailed Social Cost Benefit Analysis of a short-list of options
- [chapter 6](#) sets out the approach to valuation of costs and benefits
- [chapter 7](#) sets out how to present appraisal results
- [chapter 8](#) sets out the approach to monitoring and evaluation

- [annexes 1 – 6](#) provide further technical information and values for use in appraisal across government

Scope and relationship with other appraisal guidance

1.10 The content and boundary of all Green Book guidance is determined by HM Treasury. The content is peer reviewed by the Government Chief Economists Appraisal Group. It applies to all government departments, arm's length public bodies with responsibility derived from central government for public funds and regulatory authorities.

1.11 Departments also produce internal guidance, setting out how Green Book appraisal should be carried out for their areas of responsibility. For consistency, departmental guidance should align with the Green Book. Where departmental guidance affects other government departments, or contains significant developments in methods and approach, relevant sections should be agreed with HM Treasury and the Government Chief Economists Appraisal Group.

1.12 Throughout the guidance there are links to external supplementary guidance. These provide further detail on subjects that are relevant across government e.g. the valuation of greenhouse gas emissions. To provide background and support understanding, non-governmental research and discussion papers are referenced in the Green Book. These documents do not form part of the guidance.

2

Introduction to Appraisal and Evaluation

2.1 This chapter provides a non-technical introduction to appraisal and evaluation.

Principles of appraisal

2.2 Appraisal is the process of assessing the costs, benefits and risks of alternative ways to meet government objectives. It helps decision makers to understand the potential effects, trade-offs and overall impact of options by providing an objective evidence base for decision making.

2.3 Economic appraisal is based on the principles of welfare economics – that is, how the government can improve social welfare or wellbeing, referred to in the Green Book as social value.

Rationale for intervention

2.4 The first step in appraisal is to provide the rationale for intervention. This can be based on ensuring markets work effectively e.g. ensuring pollution is accounted for by business, or to achieve distributional objectives e.g. to promote fair access to education. Alternatively, this could involve providing goods generally not provided by market mechanisms e.g. defence.

2.5 A clear rationale for intervention should be used to identify the objectives or [outcomes](#) the government wishes to meet through intervention.

Generating options and long-list appraisal

2.6 The next step is to consider how best to meet the government’s objectives. Options might include direct government delivery, market creation, regulation, tax changes or public information initiatives. There are also a wide variety of delivery and funding options.

2.7 Generating a long-list of options at the start of the appraisal process ensures that a full range of possibilities are considered. This should be informed by stakeholder consultation or engagement, lessons learned from previous interventions, international best practice and the wider evidence base. Starting out with a narrow set of options or a pre-determined solution may miss the opportunity to explore more novel, innovative solutions that might offer better social value.

2.8 Once a long-list is developed it can then be filtered down to a set of viable short-list options ahead of detailed economic analysis. Viability can be assessed from the perspectives of strategic fit to wider policy objectives, potential Value for Money, affordability and achievability. Dependencies and constraints (e.g. legal frameworks) should also be considered.

Short-list appraisal

2.9 Analysis of short-list options is at the heart of economic appraisal. This is where the expected costs and benefits of an intervention are estimated and the trade-off between costs and benefits is considered. This is referred to as Social Cost Benefit Analysis (CBA) or, where appropriate, Social Cost-Effectiveness Analysis (CEA), which compares the costs of alternative ways of producing the same or similar [outputs](#).

Valuing relevant costs and benefits

2.10 Social CBA requires all impacts – social, economic, environmental, financial etc. – to be assessed relative to continuing with what would have taken place in the absence of intervention, referred to in the Green Book as [Business As Usual](#).

2.11 The relevant costs and benefits are those for UK society overall, not just to the public sector or originating institution. They include costs and benefits to business, households, individuals and the not-for-profit sector. Assessing the costs and benefits across all affected groups matters as a relatively low-cost public sector option, such as a new regulation, may have significant costs for businesses or households.

2.12 The costs or benefits of options should be valued and monetised where possible in order to provide a common metric. This is usually done by assessing the value which reflects the best alternative use a good or service could be put to – its opportunity cost. Market prices are the usual starting point for the valuation of costs and benefits.

2.13 For some costs and benefits there may be no market price, or the market price may not fully reflect societal costs or benefits e.g. environmental values. In these cases, valuation techniques and a range of specific standard values can be used. Where it is not possible or proportionate to monetise costs and benefits they should still be recorded and presented as part of the appraisal.

2.14 Costs and benefits should be calculated over the lifetime of the intervention or asset. For many interventions, a time horizon of 10 years is suitable. Where significant assets are involved up to 60 years may be suitable e.g. buildings and infrastructure. For interventions likely to have significant costs or benefits beyond 60 years, such as nuclear waste storage, a suitable appraisal period should be agreed at the outset.

Distributional analysis

2.15 Distributional analysis is necessary where an intervention either has a redistributive objective or where it is likely to have a significant impact on different groups, types of business, parts of the UK or Devolved Administrations. Distributional analysis can include regional, sub-national and local analysis based on geographically defined areas.

Optimism bias, risk and sensitivity analysis

2.16 When conducting appraisal consideration should also be given to:

- **optimism bias** – this is the proven tendency for appraisers to be too optimistic about key project parameters, including capital costs, operating costs, project duration and benefits delivery. Over-optimistic estimates can lock in undeliverable targets and it is therefore critical to make adjustments for this. The Green Book recommends applying specific adjustments for optimism bias. Cost estimates are increased by a set percentage to reflect evidence of underestimation from previous similar interventions. Adjustments should be based on an organisation's own evidence base for historic levels of optimism bias. In the absence of this, generic values are provided.
- **risks** – these are specific uncertainties that arise in the design, planning and implementation of an intervention. Risk costs are the costs of risks materialising, avoiding risks, sharing risks and mitigating risks, estimated on an expected likelihood basis. Policy makers need to ensure these risks are fully understood and managed, including low probability but high impact events.

- **sensitivity analysis** – involves exploring the sensitivity of expected outcomes of an intervention to potential changes in key input variables. [Switching values](#) can be estimated as part of sensitivity analysis where appropriate. These are the values an input would need to change to in order to make an option no longer viable.

Discounting

2.17 Discounting is used to compare costs and benefits occurring over different periods of time – it converts costs and benefits into present values. It is based on the concept of time preference, that generally people prefer to receive goods and services now rather than later. If Projects A and B have identical costs and benefits but Project A delivers benefits a year earlier, time preference means Project A is valued more highly.

2.18 In government appraisal costs and benefits are discounted using the social time preference rate of 3.5% (the basis for this is explained in [Annex 6](#)).

Selecting the preferred option

2.19 Comparison of each short-list option, and their advantages over Business As Usual, allows identification of the best option for the delivery of social value. The total value of discounted benefits less costs provides the Net Present Social Value (NPSV) of an intervention. The NPSV and Benefit Cost Ratio (benefits divided by relevant costs) alongside risks and any other relevant considerations, such as unmonetisable costs and benefits, help determine the preferred option.

Monitoring and Evaluation

2.20 Monitoring is the collection of data, both during and after policy implementation. This data can be fed back into implementation, current decision making and the appraisal process to improve future decision making. It requires the collection of data before implementation to act as a baseline.

2.21 Evaluation is the systematic assessment of an intervention's design, implementation and outcomes. It tests:

- if an intervention is working or worked
- if the costs and benefits were as anticipated
- whether it had any other consequences
- whether the consequences were anticipated
- how well it was implemented

2.22 Monitoring and evaluation of all proposals should be planned, costed and provided for as an integral part of the proposed intervention under consideration. This helps ensure that they will be systematically carried out. Taken together monitoring and evaluation can identify what lessons can be learned to inform the design and delivery of future interventions.

2.23 The key stages in appraisal are summarised in [Box 2](#).

Box 2. Description of Key Appraisal Steps

The key steps in the appraisal process are:

- The first step in appraisal is to provide the **rationale for intervention**. This should be used to **identify the objectives or outcomes** the government wishes to meet through intervention.
- The next step is to consider how best to meet the government's objectives by considering a **long-list of options**, including a wide range of possible approaches. These should be assessed for viability and filtered down to a short-list.
- **Short-list appraisal** follows and is at the heart of economic appraisal where expected costs and benefits are estimated and the trade-off is considered. This is done using Social Cost Benefit Analysis (CBA) or Social Cost-Effectiveness Analysis (CEA).
- **Identification of the preferred option** is based on the detailed analysis at the short-list appraisal stage. It involves determining which option provides the best balance of costs, benefits, risks and unmonetisable factors.
- **Monitoring** is the collection of data, both during and after implementation to improve current and future decision making. **Evaluation** is the systematic assessment of an intervention's design, implementation and outcomes. Both monitoring and evaluation should be considered before, during and after implementation.

3

The Overarching Policy Framework

3.1 This chapter provides an overview of how appraisal fits within government decision making processes including the Policy Cycle, the Five Case Model and Impact Assessments.

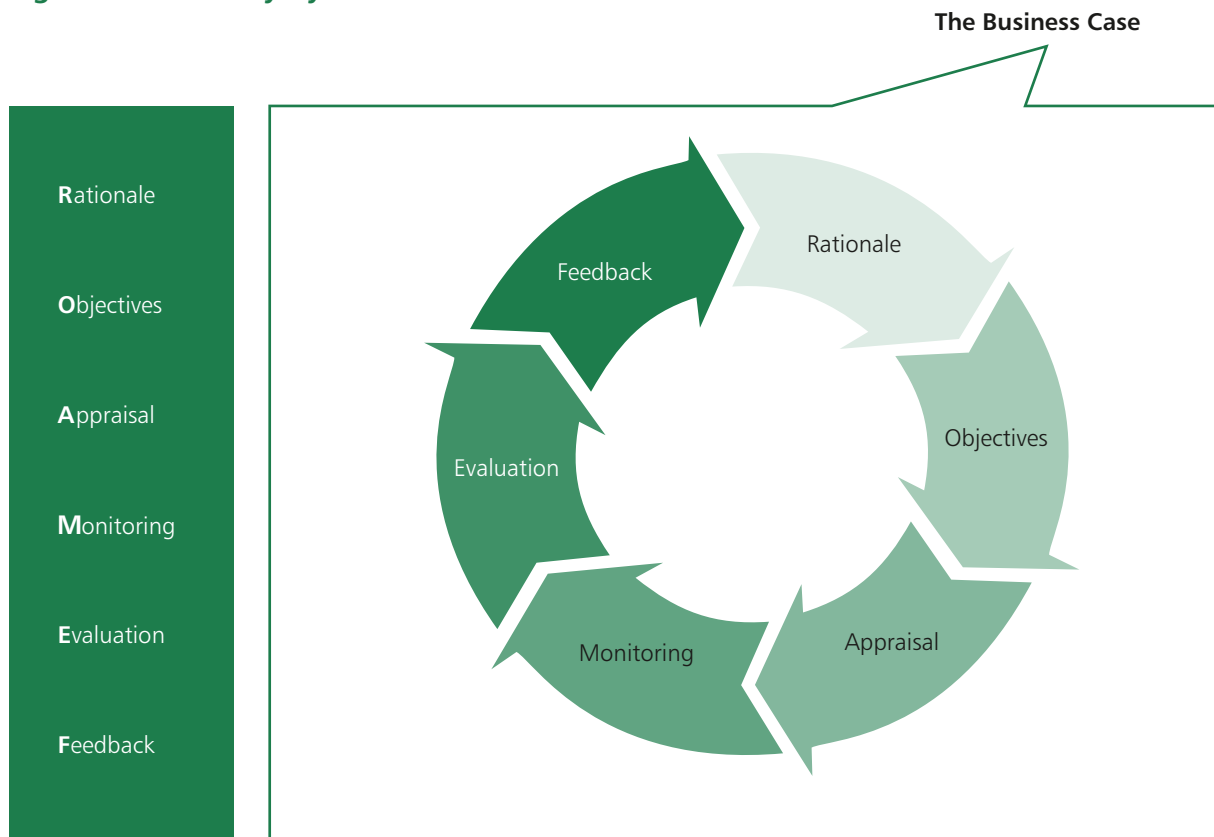
The Policy Cycle

3.2 Appraisal and evaluation are essential activities to support evidence-based decision making at all stages of the policy development cycle.

3.3 The process for policy development varies across organisations and generally incorporates a set of policy tests¹ which are used to challenge policy development and delivery. The structure of most approaches moves from developing a rationale for intervention, through identification of objectives, to option appraisal. Monitoring and evaluation play a role before, during and after implementation, with the aim of improving implementation and building the evidence for future interventions.

3.4 The elements of the policy cycle are often described as **R**ationale, **O**bjectives, **A**ppraisal, **M**onitoring, **E**valuation and **F**eedback, or ROAMEF for short, as presented in [Figure 2](#).

Figure 2. The Policy Cycle



¹ Policy tests are a set of questions used in policy development to consider a policy's expected outcomes, the reason why government is intervening, the strength of the evidence base, whether a policy is innovative and whether it can be implemented. See [Department for Education](#) for an example of policy tests.

The Five Case Model

3.5 [HM Treasury Business Case Guidance](#) provides the framework for preparing business cases for spending proposals. It puts into practice the high-level policy cycle. Business cases are prepared according to a model which views proposals from 5 interdependent dimensions – known as the Five Case Model – shown in [Box 3](#) and outlined further below.

Box 3. The Five Case Model

Strategic dimension	What is the case for change, including the rationale for intervention? What is the current situation? What is to be done? What outcomes are expected? How do these fit with wider government policies and objectives?
Economic dimension	What is the net value to society (the social value) of the intervention compared to continuing with Business As Usual? What are the risks and their costs, and how are they best managed? Which option reflects the optimal net value to society?
Commercial dimension	Can a realistic and credible commercial deal be struck? Who will manage which risks?
Financial dimension	What is the impact of the proposal on the public sector budget in terms of the total cost of both capital and revenue?
Management dimension	Are there realistic and robust delivery plans? How can the proposal be delivered?

Strategic dimension

3.6 The **strategic dimension** should set out the rationale and objectives of the proposal (as outlined in [Box 3](#)). It should describe the current situation and continuing with the current arrangements without making any changes, known as Business As Usual (BAU). BAU provides the counterfactual against which alternative options are compared.

3.7 Analysis and assumptions should have an objective basis in research. Relevant evidence can be drawn from evaluations of past interventions, evidence of “what works²”, international comparisons, academic and other literature and relevant experience. The strategic dimension should also identify where there are gaps in the evidence base.

3.8 The strategic dimension should identify the gaps between the desired outcomes and Business As Usual that an intervention sets out to address. Bridging these gaps is the key rationale for intervention. The rationale and objectives should ideally be described as outcomes, which will often be the changes experienced by people receiving a service e.g. improvements in health outcomes resulting from a change in output of health services. The objectives should not bias the choice of options towards a particular pre-determined solution.

3.9 A small set (up to 5 or 6) of **S**pecific **M**easurable **A**chievable **R**ealistic and **T**ime-limited (SMART) objectives should be identified in the strategic dimension. They will ideally include the outcomes that are the rationale for a proposal and in some cases the outputs required to deliver them.

²The [What Works Network](#) for example.

3.10 The strategic dimension ensures the strategic fit of new proposals with the existing policies and wider public sector objectives. Practical, ethical, legal and other constraints must be identified at the outset, along with any external dependencies beyond the scope and control of the proposal being considered e.g. supporting infrastructure and services. Constraints and dependencies should be understood, documented and explicitly taken into account.

3.11 Research, consultation and engagement with stakeholders and the wider public, should be conducted at an early stage. This provides understanding of the current situation and valuable insights into potential improvements.

Economic dimension

3.12 The **economic dimension** is the analytical heart of a business case where detailed appraisal takes place. It considers the value of different options to the UK and, where appropriate, the impact on different groups of people or parts of the UK. The measure of value to the UK as a whole is referred to here as social value. In the case of Official Development Assistance (ODA), social value is the net benefit to the recipient country.

3.13 Options appraisal in the economic dimension leads to the identification of a preferred option that is an optimum balance between costs, benefits and risks to society and the public sector, allowing for any unquantifiable factors which could affect a decision.

Commercial dimension

3.14 The **commercial dimension** covers procurement and commercial arrangements relating to services and assets that are required to implement a proposal. The procurement specification comes from the strategic and economic dimensions. The commercial dimension feeds information on costs, risk management and timing back into the economic and financial dimensions as a procurement process proceeds. This is part of the iterative process of developing a proposal into a mature business case. The Cabinet Office Functional programmes can provide support and advice during appraisal e.g. the Commercial Function can support assessment of procurement decisions.³

Financial dimension

3.15 The **financial dimension** is concerned with the net cost to the public sector of the adoption of a proposal, taking into account all financial costs and benefits that result. It covers affordability, whereas the economic dimension assesses whether the proposal delivers the best social value. The financial dimension is exclusively concerned with the financial impact on the public sector. It is calculated according to National Accounts rules.

Management dimension

3.16 The **management dimension** is concerned with planning the practical arrangements for implementation. It demonstrates that a preferred option can be delivered successfully. It includes the provision and management of the resources required for delivery of the proposal and arrangements for managing budgets. It identifies the organisation responsible for implementation, when agreed milestones will be achieved and when the proposal will be completed.

3.17 The management dimension should also include:

- the risk register and plans for risk management
- the benefit schedule, delivery monitoring (including factors to be monitored) and management arrangements

³ <https://www.gov.uk/government/organisations/government-commercial-function>

- the arrangements for monitoring and evaluation during and after implementation and any collection of data prior to implementation, including the provision of resources and who will be responsible

3.18 The management dimension is completed more fully during the middle and latter stages of a proposal's development into a full business case. The implications of the management dimension feed into the appraisal and must be reflected in the full versions of the economic, commercial and financial dimensions.

Impact Assessments

3.19 Impact Assessments (IAs) are used to support the appraisal of new primary or secondary legislation, or in some cases the impact of non-legislative policy change. The Green Book should be used for the appraisal required for IAs in the same way as for spending proposals. It sets out the methodology for appraisal of social value and distributional effects.

3.20 The approach to IAs follows a similar logic as for business cases. It includes the rationale for government intervention, the policy objectives and intended effects, and the costs, benefits and risks of a range of options. The calculation of costs and benefits, as well as the detailed evidence base which supports IAs, should be developed in accordance with Green Book methodology. For small regulatory changes standalone IAs may not be required, though any analysis included to support these changes should be in line with Green Book methodology.

3.21 The rules for the scrutiny and clearance processes, in England, for regulations with an impact on business above a certain value and methodology for calculating specific metrics relating to the impact on business, are set out in the [Better Regulation guidance](#). The Better Regulation guidance reflects ministerial decisions on statutory reporting duties and may be periodically updated to reflect policy change.

Option appraisal in government

3.22 The development of some policies, programmes and projects do not require the use of the formal decision making processes outlined above. For example, if they are non-regulatory in nature or below a certain value in terms of their impact. The Green Book methodology set out here should still be applied proportionately to support effective decision making and maximise social value.

4

Generating Options and Long-list Appraisal

4.1 This chapter sets out how to develop a rationale for intervention, generate a long-list of possible options to achieve objectives and filter them down to a short-list suitable for detailed cost benefit analysis.

Rationale for intervention

4.2 At the outset of the appraisal process it is important to identify clearly why change is necessary. A statement of the rationale for intervention should be developed.

4.3 Understanding Business As Usual, or the status quo, provides the basis for an effective intervention. Business As Usual is the continuation of current arrangements as if the intervention under consideration were not to be implemented. This does not mean doing nothing, although it is often referred to as the Do Nothing option, but continuing without making any changes. It is necessary to work out what the consequences of inaction would be (even if unlikely to be acceptable), as it provides the relevant counterfactual to compare alternative options.

4.4 The rationale for intervention can be based on strategic objectives, improvements to existing policy, market failure or distributional objectives that the government wishes to meet.

4.5 Market failure is where the market mechanism alone cannot achieve economic efficiency. Economic efficiency is achieved when nobody can be made better off without someone else being made worse off. Economic efficiency enhances social welfare by ensuring resources are allocated and used in the most productive manner possible. One potential cause of inefficiency is when the private returns to an individual or firm from carrying out a particular action or activity differs from the returns to society as a whole, meaning there are external costs or benefits. [Box 4](#) provides examples of possible market failure.

4.6 To provide a useful rationale which will support development of the intervention it is necessary to identify the specific market failure being addressed, rather than describing this in general terms.

4.7 Policies also need to be assessed to ensure that government actions and interventions in themselves do not lead to perverse incentives or create moral hazard. It is important to understand the effects of actions and interventions on individuals, businesses and markets. This is particularly important when assessing any form of PPP or strategic partnering arrangements with the private sector. It is critical to understand what risks are being transferred between public and private participants, that contracts are designed to ensure private sector partners are able to manage those risks and that they are held accountable for doing so.

Box 4. Market Failure

Market failure is when the market mechanism alone cannot achieve economic efficiency. Examples of the causes of market failure include:

- Public goods:** Many aspects of the environment, for example the benefits of clean air, can be described as public goods. We can all enjoy clean air. It is difficult to actively exclude anyone from enjoying it (non-excludable in supply) and once provided, it largely doesn't matter how many people enjoy it (non-rival in demand). These features mean it is difficult for businesses to provide public goods and they are often provided (or in the case of the environment, protected) by government policies. A public good will be both non-rival and non-excludable.
- Imperfect information:** Information is needed for markets to operate efficiently. Buyers need to know the quality of a good or service to judge the value it can provide. Sellers, lenders and investors need to know the reliability of a buyer, borrower or entrepreneur. This information must be available to all or there is 'asymmetry of information' which could lead to moral hazard or adverse selection. This affects markets such as life insurance, as companies may not be able to verify information (e.g. whether an individual is a smoker) and may not be willing to sell insurance to everyone willing to buy it.
- Moral hazard** occurs when individuals or businesses change their behaviour and takes risks because they are protected from negative consequences e.g. someone else bears the costs.
- Externalities:** These occur when an activity produces benefits or costs for others. Negative externalities are associated with, for example, passive or second-hand smoking. An individual may smoke tobacco indoors, in the presence of others, who inhale the tobacco smoke and damage their health. The smoker imposes an external cost on others, which would not be accounted for in the price of cigarettes without government intervention.
- Market power:** This results from insufficient actual or potential competition to ensure that a market operates efficiently. High start-up costs can deter entry by competitors and create market power. This situation may be exacerbated by organisations acting strategically to protect their market position. For example, when an organisation engages in a practice known as 'predatory pricing', where prices are set low to drive out competitors and then raised once they have left.

SMART objectives

4.8 Clear objectives are vital for successful policies, programmes and projects. Identifying objectives begins at the outset or when making the case for change (part of the **strategic dimension** in [HM Treasury Business Case guidance](#)). A lack of clear objectives limits effective appraisal, planning, monitoring and evaluation. Objectives should be SMART:

- Specific
- Measurable
- Achievable
- Realistic
- Time-limited

4.9 Up to 5 or 6 SMART objectives should be established. More than this means an intervention is likely to be poorly focussed and could under-deliver. Usually SMART objectives are expressed as changes in outcomes an intervention is designed to produce (the consequences of change in service or policy) and in some cases the expected outputs (e.g. the levels or quality of service delivered). When part of a wider programme, project objectives may need to be described as outputs.

4.10 These objectives may be described as increases in existing service levels, the delivery of new services or changes to service efficiency and effectiveness. Where cost reduction or improved efficiency are the objective, the SMART objectives also need to include the potential effects on quality of services delivered. Business needs are changes an organisation needs to make to its own operations to deliver changes in outputs required to meet the SMART objectives. SMART objectives should be objectively observable and measurable so they are suitable for monitoring and evaluation (see [Chapter 8](#)).

Generating the long-list

4.11 Generating a long-list of possible options that can achieve the SMART objectives is the recommended best practice in appraisal. The options framework in [Annex 1](#) and the [HM Treasury Business Case Guidance](#) provides a recommended approach for public spending proposals. It can also be adapted for other forms of government intervention.

4.12 It is useful to consult or engage with stakeholders or representative organisations from the outset of an appraisal.⁴ This includes at the long-list stage, where the structured approach recommended by the Green Book can support engagement with stakeholders. The use of workshops can add vital information at this stage. In addition, it may be necessary or appropriate to engage experts in certain fields.

Constructing the options

4.13 When constructing the long-list, options should not be fully specified as an end-to-end solution immediately. Instead, they should be built up by considering the choices summarised in [Box 5](#).

Box 5. Choices in the Strategic Options Framework Filter

Option choices – broad description	
1	Scope <input type="checkbox"/> coverage of the service to be delivered
2	Solution <input type="checkbox"/> how this may be done
3	Delivery <input type="checkbox"/> who is best placed to do this
4	Implementation <input type="checkbox"/> when and in what form can it be implemented
5	Funding <input type="checkbox"/> what this will cost and how it shall be paid for

4.14 Consideration of these choices should include:

- scope – what is to be delivered and where, including geographical coverage, recipient population, service quality, time limits and any other relevant factors
- solution – how the outcome is to be delivered, considering available technologies and best practice, and including:
 - the creation of new markets
 - the introduction of new or revised regulatory arrangements
 - use of “nudge techniques” based on insights from behavioural psychology and economics

⁴ General principles that apply to formal public consultations are available on the [Cabinet Office web pages](#).

- grants and subsidies
- public information initiatives
- new or changed service provision
- delivery – which organisation(s) is best placed to deliver, for example:
 - direct public sector provision
 - Public Private Partnerships (PPP)
 - not-for-profit private providers
 - private sector providers
- implementation – how the proposal is to be delivered, for example:
 - will it be an initial pilot, phased implementation or a ‘big bang’ approach?
 - is it a roll out dependent on geography, age, expiry of existing arrangements or other factors?
 - should a range of options for roll-out be considered and tested?
- funding – what is an indicative cost and how will it be funded. This may interact with the delivery option

4.15 Individual and society’s wellbeing is influenced by a number of interrelated factors including health, relationships, security and purpose. At the long-list appraisal stage, evidence on the determinants of wellbeing can help describe Business As Usual and the purpose or scope of an intervention through SMART objectives. It may help to identify interventions which have an impact on wellbeing or another outcome which is affected by wellbeing. This supports the development of a long-list of options or the most efficient way of implementing a proposed solution.

4.16 Where appropriate evaluations of previous or similar interventions, international and wellbeing evidence, should be used to design options that build on what works, to avoid repeating past mistakes. [Box 6](#) provides an example of the use of evaluation evidence and piloting. This is particularly important when considering the scope of a proposal and the service solution (the technical means of delivering the intervention). When assessing the relevance of previous evaluation, allowance should be made for differences in context, circumstances and culture.

Box 6. Use of Evaluation and Testing

The Behavioural Research Centre for Adult Skills and Knowledge wanted to understand if behavioural science could help improve educational outcomes for 16 to 19 year olds. Existing research suggested that there is a link between strong social support and student attainment. The project team adopted a ‘test, learn, adapt’ methodology, which focuses on testing what works and continually improving policy interventions in response to evaluation results.

Almost 1,500 students at 9 further education colleges were enrolled into a ‘study supporter’ trial. Students were randomly assigned into 2 different groups. An intervention group is asked to nominate one or two ‘study supporters’ (such as a parent, friend, or employer) to receive weekly text messages about their studies. Messages to supporters were a mix of notifications about key events, including upcoming exam dates, and suggested questions that supporters could ask the student to prompt a learning conversation. A second group nominates study supporters, but did not receive text messages.

Costing less than £10 per student, the trial finds that students whose supporters received weekly text messages were 27% more likely to pass their GCSEs than students who had volunteered to be part of the programme but had not been selected to receive supportive messages.

The results indicated the potential of the intervention and the team tested another iteration the following academic year, with a different cohort of 900 students. This time both the students themselves and their study supporters receive text messages. Results showed a 32% increase in the exam pass rate.

The team then decided to test whether the intervention could be effectively replicated at larger scale by running a trial across 31 further education colleges, involving approximately 4,000 students.

Source: Behavioural Insights Team Update Report 2016-17, see: www.behaviouralinsights.co.uk

4.17 The effectiveness of nudge techniques and lessons more broadly from behavioural economics should also be considered. Nudge techniques may be relevant both in creating efficient and effective options for change, and in identifying and minimising unintended effects. For example, how human behaviour may be affected by small changes in the way in which messages are communicated (see [Box 6](#)).

4.18 Options which involve the use of payment-by-results, performance targets or bonus systems require care to avoid unintended consequences resulting from gaming. Where a commissioning body (known as a principal) contracts with another organisation (known as an agent), the lessons of principal-agent theory should be considered.⁵ The more detailed and complex a reward system is, the more likely there will be unintended and potentially adverse results due to gaming. Such systems work best when the interests of the agent and the principal are completely aligned.

4.19 Public Private Partnerships (PPP) may be an appropriate option to consider in some cases. They can involve a variety of strategic partnering arrangements with the private sector and can potentially provide improved technical capability. They may also provide more cost-effective and efficient risk management through risk transfer and sharing. Where a partnership is envisaged, the interests of the commissioning or procuring body and the private partner need to be well aligned through effective, simple contract design and possible unintended consequences need to be considered at the outset (see [Annex 4](#) for more detail).

4.20 Market creation may be used to deliver objectives. To assess this, an accurate understanding of the current barriers to market provision is needed and an understanding of the market, or potential market, is required. Where relevant, competition effects need to be considered (supplementary guidance can be found on the [CMA webpages](#)). It is also necessary to take account of potential gaming and behavioural changes that may result from intervention.

⁵ Principal-agent theory here refers to the economic and organisational theory only and not to the concept of a principal or an agent in legal terms.

4.21 [Annex 1](#) provides more detail on what to consider when constructing options.

Appraising long-list options

4.22 For spending decisions the long-list can be filtered down by assessing how well they meet [Critical Success Factors \(CSFs\)](#) which cover:

- strategic fit** – how well does the option meet agreed objectives and fit with wider organisational or public-sector objectives?
- potential Value for Money** – is the option likely to deliver social value in terms of costs, benefits and risks?
- supplier capacity or capability** – if procurement is required, are there suppliers available to deliver the required services?
- potential affordability** – how will an option be financed and is it affordable within existing budgets?
- potential achievability** – how likely is it that an option can be delivered given organisational capability and skills available?

4.23 Other factors that may be relevant to assess the long-list and affect which options are feasible:

- constraints** such as legality and ethics
- dependencies** such as infrastructure
- unmonetisable and unquantifiable factors** which should be considered and it may be necessary to use a structured technique such as [Multi-Criteria Decision Analysis](#)
- collateral effects and unintended consequences** which may occur should be considered and potentially fed into the short-list analysis stage

4.24 Equalities impacts must be taken into account and the [Public Sector Equality Duty \(PSED\)](#), created under the [Equalities Act 2010](#), requires that public sector bodies have due regard to advancing equality of opportunity for persons with protected characteristics, eliminating discrimination and fostering good relations between protected groups and others. Consideration of equality issues must influence the decisions reached by public bodies and decision makers should be informed of the potential effects of intervention on groups or individuals with characteristics identified by the Act.

4.25 The PSED covers 9 protected characteristics: age, disability, gender reassignment, pregnancy and maternity, race, religion or belief, sex and sexual orientation. The need for equalities analysis will apply at the long-list stage and throughout the appraisal process, with the results visible to decision makers. In addition, since October 2014 there is also a requirement to consider the impact of decisions on [Families](#).

4.26 Distributional effects should be proportionately considered, relative to objectives, costs, benefits and risks to the whole population or any sub-group of the population. Relevant sub-groups of the population that stand to lose or gain, types of organisation or areas of the country should be identified, with quantification of the likely effects at the [short-list stage](#). Distributional effects at the long-list stage may:

- act as a constraint on the feasible options, where there are distributional objectives
- be an intended or unintended consequence

Long-list analysis for other types of intervention

4.27 The approach to long-list appraisal set out above and in [Annex 1](#) is derived from the Five Case Model and is outlined in more detail in the [HM Treasury Business Case Guidance](#). The focus of the guidance is new public spending for programmes and projects to purchase or deliver goods or services. Similar principles apply when considering interventions which do not require a business case, for example regulatory options or policy options which lead to changes in the use of existing resources. As with all the Green Book guidance, the approach to long-list analysis should be proportionate to an intervention's likely costs, benefits and risks to society and the public sector.

Short-list selection

4.28 The long-list of options should be constructed and assessed to develop a short-list of options. The short-list should include the "preferred way forward" (the combination of choices most likely to deliver the SMART objectives⁶), the Business As Usual benchmark; a viable "[do-minimum](#)" option that meets minimum core requirements to achieve the objectives identified and at least one viable alternative option.

⁶ It should not be confused with the "preferred option", which is the result of the analysis at the short-listing stage (see [Chapter 5](#)).

5

Short-list Options Appraisal

5.1 Chapter 5 sets out the principles for appraising short-list options. It covers assessment of costs and benefits, adjustments for discounting, inflation, risk and uncertainty (including optimism bias) and distributional analysis.

Social Cost Benefit and Cost Effectiveness Analysis

5.2 Social Cost Benefit Analysis (CBA) assesses the impact of different options on social welfare. All relevant costs and benefits are valued in monetary terms, unless it is not proportionate or possible to do so.⁷

5.3 Social CBA is the recommended approach for detailed comparison of the short-list of options. Social Cost-Effectiveness Analysis (CEA) is a variant of Social CBA which compares the costs of alternative ways of producing the same or similar outputs. Social CEA may sometimes be appropriate where:

- wider social costs or benefits will remain broadly unchanged or for the delivery of a public good, such as defence
- output may not be proportionately quantified

5.4 Where wider social outcomes are not affected by the decision being appraised, Social CBA and Social CEA are in effect equivalent. The assumption that there will be no change in output or welfare needs to be objectively validated before choosing the appropriate technique.

5.5 Social CBA and Social CEA are “marginal analysis” techniques. They are generally most appropriate where the broader environment (e.g. the price of goods and services in the economy) can be assumed to be unchanged by the intervention. These techniques work less well where there are potential non-marginal effects or changes in underlying relationships. This is due to the difficulties inherent in pricing such changes. It is possible to adapt Social CBA in these cases, for example when appraising the cumulative impact of interventions on [Natural Capital](#). Significant non-marginal issues which cannot be reflected in Social CBA need to be appraised and considered at the long-list stage.

Social costs and benefits

5.6 Identification and valuation of relevant costs and benefits is at the heart of economic appraisal. The principles outlined here are complemented by in-depth discussion of valuation techniques in [Chapter 6](#) and [Annex 2](#).

Scope of costs and benefits

5.7 The relevant costs and benefits are those to UK society overall. All relevant costs and benefits which may arise from an intervention should be valued and included in Social CBA unless it is not proportionate to do so. The priority costs and benefits to quantify are those likely to be decisive in

⁷ Costs to society are given a negative value and benefits a positive value. After adjusting for inflation and discounting, costs and benefits can be added together to calculate the Net Present Social Value (NPSV) for each option.

determining the differences between alternative options. The appraisal of social value involves the calculation of Benefits Cost Ratios (BCRs) – the ratio of benefits to costs – and Net Present Social Value (NPSV) – the present value of benefits less costs, as appropriate to the intervention being considered.

5.8 UK society generally includes UK residents and not potential residents or visitors. It is sometimes reasonable to include the costs and benefits for people living outside the UK e.g. service personnel posted overseas. Appraisal of Official Development Assistance (ODA) should include the costs and benefits to the recipient countries. The financial cost of ODA should be assessed in the same way as other public spending.

5.9 Appraisal of individual spending decisions is largely undertaken in the context of pre-determined budgets. Decisions concerning the overall level of public spending are macro-level decisions made separately from, and in advance of, individual spending decisions. The cost of raising public funds e.g. the cost of issuing debt or the impact of taxes, is therefore not considered in short-list appraisal.

5.10 A categorisation of potential costs and benefits that may be part of appraising social value is given in [Box 7](#). Not all appraisals involve every category.

Box 7. Classification of Costs and Benefits**Costs in the appraisal of social value**

- total direct public costs (to originating organisation):
 - capital
 - revenue
- total indirect public costs (to other public sector organisations):
 - capital
 - revenue
- wider costs to UK society:
 - monetisable including cash costs
 - quantifiable but unmonetisable costs
 - qualitative unquantifiable costs
- total risk costs (the costs of mitigating or managing risks):
 - optimism bias (decreased as estimated risk costs are included)
 - estimated or measured risk cost

Benefits in the appraisal of social value

- direct public sector benefits (to originating organisation):
 - cash releasing benefits
 - monetisable non cash releasing benefits
 - quantifiable but not monetisable benefits
 - qualitative unquantifiable benefits
- indirect public sector benefits (to other public sector organisations):
 - cash releasing benefits
 - monetisable but non cash releasing benefits
 - quantifiable but unmonetisable benefits
 - qualitative unquantifiable benefits
- wider benefits to UK society (e.g. households, individuals, businesses):
 - monetisable including cash benefits
 - quantifiable but not monetisable benefits
 - qualitative unquantifiable costs and benefits

Adjustments for inflation

5.11 Costs and benefits in appraisal of social value should be estimated in ‘real’ base year prices (i.e. the first year of the proposal). This means the effects of general inflation should be removed. The effects of converting values from nominal to real terms are shown in [Table 1](#) using a GDP deflator of 2%.

5.12 The following should be used to adjust prices from nominal to real terms:

- for short time horizons, whole economy inflation (the “GDP deflator”) from the most recent forecasts by the Office for Budget Responsibility (OBR)

- for long time horizons, forecasts of the GDP deflator published in the [OBR Fiscal Sustainability Report](#) (FSR)
- for longer time horizons, beyond the end of the OBR’s FSR, the GDP deflator should be extrapolated using the growth rate in the final year of the OBR’s projection

Table 1. Adjusting for the Effects of Inflation (Using a 2% GDP Deflator)

Year	0	1	2	3	4	5
Nominal terms	£1,000	£1,000	£1,000	£1,000	£1,000	£1,000
Real terms (year 0 prices)	£1,000	£980	£961	£942	£924	£906

5.13 For some goods or services there may be a relative price effect i.e. the movement of a specific price index (e.g. construction) may differ significantly from the general inflation (such as the GDP deflator). Where there is historical evidence and an expectation this will continue in the future, different rates of inflation can be used to reflect the relative difference. For example, Information Technology has become relatively less expensive over time and land used for development relatively more expensive. How prices change in relation to real incomes will affect this. Similarly, if supply is limited the price of the good may increase relative to inflation.

Time horizon

5.14 Costs and benefits should be calculated over the lifetime of an intervention. As a guideline, a time horizon of 10 years is a suitable working assumption for many interventions. In some cases up to 60 years may be suitable, for example for buildings and infrastructure. In all cases, the maintenance and renewal costs associated with the servicing of these assets should be included. An asset’s [residual value or liability](#) at the end of the appraisal period should also be included.

5.15 A longer appraisal period may be suitable where intervention is likely to have significant social costs or benefits beyond 60 years. This should be agreed with the approving authority. Possible examples include immunisation programmes, the safe treatment and storage of nuclear waste or interventions that reduce climate change risks.

Estimating costs

5.16 The costs of using assets and resources are defined by the value which reflects the best alternative use a good or service could be put to – its opportunity cost. Market prices are usually the starting point for estimating opportunity costs. Where market prices are not suitable or available non-market valuation techniques can be used.

5.17 Sunk costs refer to expenditure or payments already incurred and should be excluded from the appraisal of social value. What matters are costs and benefits affected by decisions still to be made. The costs of continuing to use resources that are already paid for (e.g. assets or buildings) are relevant and should be included as opportunity costs.

5.18 Private sector costs (including capital and revenue for spending proposals) should be valued on an opportunity cost basis and included in the appraisal. This is particularly important for regulatory options where the costs of regulation would fall largely on private companies.⁸ Relevant prices and costs for public and private sector options should be done on a comparable basis.

⁸ Such additional costs should be recorded at the point they will be incurred and should be discounted by the Social Time Preference rate (STPR).

5.19 Cost and benefit estimation will normally involve input from accountants, economists or other specialists. Consultation with stakeholders, particularly those who will potentially incur costs, is an important part of this.

5.20 Distinguishing between fixed, variable and other costs can be helpful to aid sensitivity analysis (see [Box 8](#)). A step change in the cost of one input factor may not apply to others. Costs and cost drivers need to be fully understood and each cost requires its own relevant set of governing assumptions.

Box 8. Definitions of Costs

Costs can be defined as:

- fixed costs or overheads remain constant over wide ranges of activity for a specified time period (e.g. a building)
- variable costs vary according to the volume of activity (e.g. external training costs vary with the number of trainees)
- semi-variable costs include both a fixed and variable component (e.g. maintenance where there is usually a planned programme and a responsive regime such as call-outs, where costs vary with activity)
- semi-fixed, or step costs, are fixed for a given level of activity and eventually increase at a critical point (e.g. after telephone call volumes reach a certain level, a new call centre may be required)

5.21 Other ways of categorising costs may be relevant to support full consideration of opportunity costs and sensitivity analysis:

- capital and resource costs should be accounted for separately, and built up from their fixed, variable, semi-variable and stepped elements
- direct values relate to the originating public sector organisation, while indirect values fall to the wider public sector

Public sector financial cost

5.22 Public sector financial costs are the estimated resource and capital costs for a spending proposal over its expected lifetime. They include all costs and receipts to the public sector but do not include wider social costs. As set out in the [HM Treasury Business Case Guidance](#), public sector costs and benefits appear differently in economic and financial cases. In economic analysis they are recorded in real terms whereas in financial analysis they are recorded in current, nominal terms (on the same basis as organisational budgets) and adhere to different accounting rules. Discounting is applied in economic analysis, but not to analysis of public sector financial costs.

5.23 Public sector financial costs should be calculated using the international National Accounts statistical framework produced for the UK by the Office of National Statistics. Public sector financial costs are recorded on an accruals basis consistent with departmental budgets, as per the [Consolidated Budgeting Guidance](#). These distinctions apply to any intervention with financial impacts on the public sector.

5.24 For new public spending proposals the financial dimension of a business case would usually require 3 major financial statements, which are the source of public sector financial costs when calculating NPSV:

- a *budget* statement based on accounting principles as per the [Consolidated Budgeting Guidance](#). This shows the resource and capital costs over the lifetime of the proposal. For strategic initiatives, the budget will often include forecast financial statements of a whole organisation over a number of years.
- a *cashflow* statement showing the costs that will be spent on the preferred option if it goes ahead.
- a *funding* statement showing the sources of funds and other resources required i.e. which internal departments, partners and external organisations would provide the resources and funding required.

5.25 Contingency is an allowance made for the cost of known risk and any unforeseen outcomes. Contingency provision and arrangements should be included in financial projections, based on the risk analysis completed during appraisal of social value (see [Uncertainty, Risk and Optimism Bias](#) below). The contingency provision should reflect the sum of measured risk (costs of risks avoided, shared and mitigated on an expected likelihood basis) and the optimism bias adjustment estimated in nominal prices. Contingency provision should be allocated to the reserves of the overseeing or approving body, not the project or programme.

5.26 Monitoring of costs and benefits during and after implementation is necessary for management, control and transparent accountability. Longer running programmes and larger projects over several years should maintain regular monitoring against and updates of original projections. This is vital to managing the delivery of social value through benefit realisation and cost control, providing information that supports the design of future interventions.

5.27 Public sector organisations responsible for public expenditure need to undertake cost monitoring, cost modelling and risk monitoring. Forecasting error and associated risks can be reduced by maintaining active cost monitoring systems and improving unit cost estimates by employing cost modelling techniques.

Estimating benefits

5.28 Estimating benefits means they can be compared with costs and net benefit can be calculated i.e. benefits once costs have been taken into account or netted off.

5.29 Real or estimated market prices provide a first point of reference for estimating the value of benefits. As with cost estimation, where no market price or market exists non-market valuation techniques should be used.

5.30 Expected benefits of an intervention and how these will be measured and realised should be set out in a benefits register. This is a key strand of implementation, operational management and a key part of the management dimension of a business case. A benefits register can be used to support the [assurance of benefits realisation](#) as a project or programme is implemented. [Box 9](#) below provides a template for the benefits register.

Box 9. Benefits Register Template

Benefit number	Unique within the register
Benefit category & class	Categories e.g. public sector benefits (direct/indirect), wider social benefits. Classes such as: cash/non cash releasing, quantitative/qualitative etc. (see Box 7)
Description	Including enabling programme, project or activity
Service feature	What aspect of the proposal will give rise to the benefit – to facilitate monitoring
Potential costs	Incurred during delivery
Activities required	To secure benefit
Responsible officer	Senior responsible officer for project or programme
Performance measure	Key performance indicators (KPIs) and relationship to SMART objectives
Target improvement	Expected level of change
Full-year value	Value of benefits (£m)
Timescale	Number of years

Unquantified costs and benefits

5.31 It may be disproportionate to quantify some costs and benefits or there may be insufficient evidence to provide reliable estimates. Where this is the case, these effects should be clearly described and visible as part of the results of the appraisal (see [Chapter 7](#) and [Annex 2](#)).

Discounting and Social Time Preference

5.32 Discounting is a technique used to compare costs and benefits occurring over different periods of time on a consistent basis. Discounting should be applied to all future costs and benefits. Discounting in appraisal of social value is based on the concept of time preference – that generally people prefer to receive goods and services now rather than later.

5.33 For individuals, time preference can be measured by the real interest rate on money lent or borrowed. Amongst other investments, people invest at fixed, low risk rates, hoping to receive more in the future to compensate for the deferral of consumption now. These real rates of return give some indication of their individual pure time preference rate. Society as a whole, also prefers to receive goods and services sooner rather than later. This is known as ‘social time preference’. The discount rate used in the Green Book is known as the ‘social time preference rate’ (STPR). It is the rate at which society values the present compared to the future.

5.34 The STPR has two components:⁹

- ‘time preference’ – the rate at which consumption and public spending are discounted over time, assuming no change in per capita consumption. This captures the preference for value now rather than later.
- ‘wealth effect’ – this reflects expected growth in per capita consumption over time, where future consumption will be higher relative to current consumption and is expected to have a lower utility.

⁹ Based on Ramsey F.P. (1928) “A Mathematical Theory of Saving” *Economic Journal*, Vol. 38, No 152, pp. 543-559.

5.35 The STPR used in the Green Book is set at 3.5% in real terms, with exception for risk to life values which use a lower rate of 1.5%. The derivation of the discount rate can be found in [Annex 6](#). [Table 2](#) shows the present value of £1,000 declines in future years with a discount rate of 3.5%.

Table 2. Present Values and Discount Rate

Year	0	1	2	3	4	5	6	7	8	9	10
Value	£1,000	£966	£934	£902	£871	£842	£814	£786	£759	£734	£709

5.36 The main role of discounting is to put interventions with different time spans and benefit cost profiles on to a common “present value” basis. In the longer term (over 30 years), the STPR declines in a series of steps to allow for future uncertainty in the value of its constituent parts, as explained in [Annex 6](#). The approach to discounting where there are inter-generational wealth transfers is also described in [Annex 6](#). The accompanying tables in [Annex 6](#) and associated tables on the [Green Book web pages](#) show both the discount rate and discount factors that can be used to calculate a present value.

5.37 Discounting is solely concerned with adjusting for social time preference and is separate from adjusting for inflation. The recommended Green Book discount rate applies to real values, with the effects of general inflation already removed. To promote transparency the best practice approach is to first convert costs or benefits to a real price basis, and then perform the discounting adjustment. The inflation rate and discount rate should not be added and applied to costs and benefits.¹⁰

5.38 In appraisal, discounting should never be applied retrospectively to costs and benefits that have already occurred. Values do not increase simply because activities took place in the past (although of course the value of some assets may tend to increase over time). Discounting and the calculation of NPSV are illustrated further in [Box 10](#).

5.39 Costs to government of raising funds (either through taxation or borrowing) are not a decision variable when considering whether to go ahead with a project or not. The STPR is therefore not linked to the costs of raising funds (either through taxes or borrowing).

¹⁰ Some automated systems to calculate costs and benefits are not set up in line with this approach. As long as the calculation provides the same result this is acceptable on grounds of proportionality for this to continue until established data systems are redeveloped.

Box 10. NPSV and Discounting Worked Example

Alternative options, A and B, are both expected to improve the quality of a department's work and reduce staff costs.

Option A requires £10 million in initial capital expenditure to realise benefits of £2.5 million per annum for the following four years (£2 million in reduced staff costs and £0.5 million in quality improvements).

Option B requires £5 million in initial capital expenditure to realise benefits of £1.5 million per annum for the following four years (£1 million reduced staff costs and £0.5 million in quality improvements).

Year	0	1	2	3	4
Option A (£m)					
Costs	-10.00	0	0	0	0
Benefits	0	2.50	2.50	2.50	2.50
Net Benefit	-10.00	2.50	2.50	2.50	2.50
Discounted net benefits	-10.00	2.42	2.33	2.25	2.18
Net Present Social Value -0.82					
Option B (£m)					
Costs	-5.00	0	0	0	0
Benefits	0	1.50	1.50	1.50	1.50
Net Benefit	-5.00	1.50	1.50	1.50	1.50
Discounted net benefits	-5.00	1.45	1.40	1.35	1.31
Net Present Social Value 0.51					
Discount factor	1	0.9662	0.9335	0.9019	0.8714

Option B has positive NPSV of £0.51m compared to -£0.82m for Option A.

Unintended consequences

5.40 Appraisal of the short-list should consider any likely beneficial or adverse collateral effects and unintended consequences. This may include:

- effects on particular groups in society
- possible changes in behaviour as a result of an intervention
- claims made for efficiency gains from payment-by-results, performance targets or bonus systems, which should be supported by robust evidence ideally from a similar setting, rather than simple assumptions.
- the potential for gaming and unexpected results

Uncertainty, risk, optimism bias

5.41 There is a wide range of uncertainty that affects interventions, but in appraisal it is often due to lack of evidence or understanding of the likely impact of new interventions. Research and evidence from evaluations of previous interventions, pilot studies and experience of “what works” can help to reduce this uncertainty. The following paragraphs set out a range of techniques for dealing with uncertainty in appraisal.

5.42 As used in the Green Book, risk and optimism bias are closely linked but distinct concepts, for more detail on methods see [Annex 5](#).

Optimism bias

5.43 Optimism bias is the demonstrated systematic tendency for appraisers to be over-optimistic about key project parameters, including capital costs, operating costs, project duration and benefits delivery. Over-optimistic estimates can lock in undeliverable targets.

5.44 To reduce this tendency appraisals should make explicit adjustment for optimism bias. The Green Book recommends applying overall percentage adjustments at the outset of an appraisal. The initial optimism bias estimate should not be “locked in” but can be reduced as an appraisal develops and the cost of specific risks are identified.

5.45 Ideally adjustments should be based on an organisation’s own evidence base for historic levels of optimism bias. In the absence of robust organisation-specific estimates generic values are provided in [Annex 5](#). There are currently no generic values available to be applied to benefits, however an adjustment should be applied based on an organisation’s own evidence base.¹¹

5.46 Optimism bias is a form of reference class forecasting which predicts future outcomes based on the outcomes for a group of similar past projects. It is important to note that adjustments for optimism bias are not the same as financial contingency (a concept [explained above](#)).

Risk

5.47 Risk management is defined as a structured approach to managing risks that are identified and assessed when designing an intervention or that materialise later in its lifecycle.

5.48 The public sector’s risk exposure arises as a consequence of public policy decisions. Public sector organisations responsible for an intervention cannot opt out of certain risks and achieve risk reduction through ‘cherry picking’ (as insurance companies may choose to do when refusing cover). The option of managing a balanced risk portfolio is also not usually available (as investment funds may do).

5.49 To optimise social value, risk must consciously and proportionately be managed. Good risk-management practice in appraisal, monitoring and evaluation involves:

- identifying possible risks in advance and putting mechanisms in place to minimise the likelihood they materialise with adverse effects. The appraisal should include an assessment of how specific risks may be avoided, minimised or managed.
- including the costs of risk avoidance, transfer and mitigation. A risk register should be created during the development of an intervention (see [Annex 5](#)) and maintained through implementation. It should be owned by those responsible for operational delivery.
- considering how and by whom key risks might be managed. This is this an important part of assessing the long-list and provides important inputs into the design of a procurement process, risk allocation and risk sharing in commercial contractual arrangements. If a procurement process is involved this should be re-examined as a proposal develops, including when contract bids are assessed.
- ensuring risk is borne by the organisation that is best placed to monitor and manage it, and that this responsibility is clearly agreed with appropriate controls to mitigate adverse consequences if risks materialise.

¹¹ An example of adjusting benefits for optimism bias at a local level can be found in [Supporting public service transformation: cost benefit analysis for local partnerships](#).

- monitoring of risk and optimism bias which should be undertaken by all public bodies as part of their monitoring and evaluation processes.
- having decision making processes supported by a framework of risk analysis and evaluation, ensuring they are underpinned by good oversight and accountability.

5.50 As the short-list appraisal is developed, risks and risk costs should be identified and the optimism bias allowance included at the outset of the appraisal should be reduced in accordance with the Green Book guidance (see [Annex 5](#)). [Box 11](#) shows an example of applying optimism bias.

5.51 Risk costs are the costs if risks materialise and of avoiding, transferring or mitigating risks. If risks materialise, there will be associated costs and these should be quantified on an expected value basis. Multiplying the expected likelihood of a risk materialising by its estimated cost can be used to derive an expected value. This requires objectively-based estimates of the percentage likelihood of a risk occurring. Low probability high impact risks should be noted in the risk register to make the decision maker aware. Effective risk costing will be supported if organisations put in place sophisticated risk assessment processes.

5.52 Risks with low probability but high impact need to be considered seriously by policy makers. In addition to ensuring these risks are part of the risk register, Senior Responsible Officers (SROs) need to actively manage and minimise these risks both before and during implementation. Real options analysis (see [Annex 5](#) for a worked example) provides a technique to explore whether additional flexibility can be added in the project design phase and utilised later when further information becomes available. It is particularly useful for projects that exhibit significant uncertainty or are difficult to reverse following initial investment (eg. where future climate change impacts are uncertain).

Box 11. Optimism Bias Case Study

The capital costs of a non-standard civil engineering project within a major change programme are estimated to be £50 million on a present value basis. No detailed risk analysis work has taken place at this stage, although significant costing work has been undertaken.

The project team applies an optimism bias adjustment of 66% showing that, for the scope of the work required, the total cost may increase to £83m. This adjustment was based on evidence and experience from comparable civil engineering projects at a similar stage in the appraisal process.

As the project progresses, more accurate costs and quantified risks are identified. The adjustment for optimism bias can then be reduced to reflect this. When reduced, there will only be a general contingency left for unspecified risks.

Without applying optimism bias adjustments, a false expectation would have been created that a larger project could be delivered at a lower cost.

Preferred option selection

5.53 Preferred option selection starts from a comparison of the alternative options in the short-list relative to Business As Usual (BAU). The short-list should include at least BAU, the preferred way forward, a do-minimum option and at least one other viable alternative.

Summary measures of social welfare

5.54 A variety of measures can be used to summarise Social CBA. Estimates of Net Present Social Value (NPSV) and Benefit Cost Ratios (BCR) are commonly used:

- NPSV is defined as the present value of benefits less the present value of costs. It provides a measure of the overall *impact* of an option.
- BCR is defined as the ratio of the present value of benefits to the present value of costs. It provides a measure of the benefits *relative* to costs.

5.55 When calculating the NPSV or BCR:

- future costs and benefits should be adjusted for inflation to 'real' base year prices. The base year should be the first year of the proposal.
- future costs and benefits should be discounted by the Social Time Preference Rate (STPR) to provide the present value.

5.56 The most appropriate summary measures and their construction will depend on the context in which the decision is being made:

- Where optimising over a constrained budget, as is usually the case for government spending, the BCR can be constructed as a measure of social value divided by the relevant public spending constraint (e.g. NPSV/£ or the Present Value of Benefits/£). This assesses the benefits bought per £ of public spending. It can be used to allocate across a portfolio of spending to maximise Value for Money.¹²
- For Regulatory Impact Assessments, where the constraint is based on cost targets for business regulation, an indicator of the cost to business (or deregulatory benefits) of options will be relevant.
- Where departments or types of spend with a constrained budget operate on thresholds, the relevant measures may be framed accordingly. For example 'cost per QALY measure' is commonly used in the health sector to assess Value for Money with a pre-defined threshold that should be met to be considered Value for Money.
- When comparing a range of options a consistent formulation should be used to calculate the BCR of all options. Ideally organisations should use a consistent approach to formulating BCRs for similar types of decision and across time.

5.57 Where non-monetised costs or benefits are significant summary measures alone will not capture the full impact of an option. Similarly, a single measure may fail to adequately reflect the full range of potential costs and benefits to society if there are significant risks attached to an option that have proved challenging to quantify. It may be unrealistic to produce a single number that adequately captures the full impact of an option.

5.58 Appraisal is iterative and involves checks and reworking of steps in the analysis and planning stages of an intervention. If additional evidence is identified at a late stage it may be necessary to reconsider:

- the selection of the short-list, repeating Social CBA and Social CEA

¹² Public sector budgets are nearly always constrained so it is generally impossible to undertake all projects that would provide benefits that exceed their public-sector costs. This means public spending has an opportunity cost that needs to be considered when assessing options. Considering options in terms of the benefits per £ of the relevant budget constraint allows the opportunity cost to be taken into account.

- the preferred way forward (i.e. the option identified at the long-list stage which is most likely to deliver SMART objectives)
- the choice of preferred option (the chosen option at the short-list stage)

Sensitivity analysis

5.59 Sensitivity analysis explores the sensitivity of the expected outcomes of an intervention to potential variations in key input variables. It can demonstrate, for example, the changes in key assumptions required to change the preferred option on an NPSV or BCR basis or to turn the NPSV of an option positive.

5.60 A switching value refers to the value a key input variable would need to take for a proposed intervention to switch from a recommended option to another option or for a proposal not to receive funding approval (see [Box 12](#) for a worked example).

5.61 At a minimum sensitivity analysis and the identification of switching values should be carried out on the preferred option from the short-list appraisal. These results must form part of the presentation of results. If the costs and benefits of the preferred option are highly sensitive to certain values or input variables, sensitivity analysis will probably be required for other options in the short-list.

Box 12. Switching Values – Worked Example

Officials are appraising the remediation (treatment) of a 39 acre contaminated land site, to be funded by a public sector grant. The remediation of the land would enable new businesses to move close to an existing cluster of businesses in a highly productive sector. The benefits of the intervention can be estimated by the change in the land value of the site (land value uplift). There is data on the current value and likely value of the land post remediation. For simplicity, it is assumed all values are already appropriately discounted.

Variable	Value
Site area	39 acre
Existing use land value estimate	£30,659 per acre
Future use land value estimate	£200,000 per acre
Land value uplift per acre	£169,341 per acre
Total land value uplift	£6.6m
Wider social benefits	£1.4m
Present Value Benefits (PVB) – including land uplift, health and environmental effects)	£8m
Present Value Cost (PVC)	£10m
Benefit Cost Ratio (BCR = PVB / PVC)	0.8
Net Present Social Value (NPSV)	-£2m

The total benefits are £8m when wider social benefits are added to the increase in land value as a result of the remediation. The costs of the remediation exceed the benefits so the BCR is less than 1 and the NPSV is negative. The switching value to turn the NPSV positive, so benefits outweigh costs, would be an approximate future land use value of £251,000 per acre equal to a land value uplift of approximately £221,000 per acre.

Source: Ministry of Housing, Communities and Local Government

5.62 Scenario analysis is a form of ‘what if’ analysis that is useful where there are significant future uncertainties. Scenarios may be chosen to explore significant technical, economic and political uncertainties which will affect the success of an intervention. Scenario analysis must always be proportionate to the costs and risks involved.

5.63 Low cost, low risk proposals may look at simple ‘what if’ questions. Major policies and more expensive, higher risk options may require modelling exercises which test the impact of different states of the world on expected costs and benefits.

5.64 Monte Carlo analysis is a simulation-based risk modelling technique that can be used when there are a number of variables with significant uncertainty. Further explanation can be found in [Annex 5](#).

5.65 Decision trees and real options analysis are alternative approaches to dealing with uncertainty in appraisal. They illustrate more complex alternative options and risks over time, especially when decisions are sequential. They can be used to illustrate alternative scenarios where key external risks are likely. They can also be used to clarify alternatives where decisions taken are either irrevocable or expensive to reverse. More detail can be found in [Annex 5](#) along with an [example](#) of real options analysis.

Equalities analysis at the short-list stage

5.66 As outlined in [Chapter 4](#) the Public Sector Equality Duty (PSED) requires that public sector bodies have due regard to advancing equality, for groups of individuals with protected characteristics identified in the Equalities Act. The need for equalities analysis will apply when considering a short-list of options and the results must be visible to decision makers. [Public Sector Equality Duty Guidance](#) is available from the Equality and Human Rights Commission. Separately there is a need to consider the impact on [Families](#).

Distributional analysis at the short-list stage

5.67 Where distributional effects (e.g. on income) are relevant, they should be appraised. Assessment of distributional impacts could range from a simple quantitative or descriptive approach where the scale of the effect is relatively low, to an in-depth appraisal and detailed calculation of distributional effects where the scale is relatively high. Depending on the scope and type of intervention distributional analysis may involve considering the impact on businesses of different size, for example focussing on small and micro businesses.

5.68 Where effects are significant for a group concerned, a clearly presented analysis identifying gaining and losing groups and estimating the effects on their welfare should be carried out. Presentation alongside the overall UK effects improves visibility and transparency of distributional impacts, so that the effects of decisions are properly understood and, where necessary, options for mitigation may be considered.

5.69 Distributional weights are factors that increase the monetary value of benefits or costs that accrue to lower income individuals or households. They are based on the principle that the value of an additional pound of income may be higher for a low-income recipient than a high-income recipient.

5.70 Distributional weights can be used as part of the distributional analysis where there is understood to be a social value that differs from simple additionality due to who gains or loses. To account for the uncertainties, sensitivity analysis is recommended and it may be useful to estimate switching values i.e. the distributional weights required to change the preferred option. This provides an estimate of the certainty of the results based on the weights used.

5.71 In practice the use of distributional weighting is challenging. This is due to uncertainty in the assumptions relating to the groups between whom redistribution is measured and uncertainty in estimation of distributional weights.

5.72 Distributional results should be presented transparently. For example, if distributional weightings are used to adjust estimated costs or benefits depending on which groups in society they fall on, the analysis with weightings should be presented alongside the analysis without weightings.

5.73 It may be necessary to undertake additional distributional analysis for interventions with sub-national or regional distributional effects (e.g. those that involve redistribution of welfare to different parts of the UK), those which are targeted at one or more types of geographic area (e.g. rural areas) or those which are targeted at one or more geographic area (e.g. a specific city or town). Results should be shown separately alongside the calculation of UK-wide NPSV, which allows the local effects to be clearly identified. It may also be necessary to assess the differential impact of new interventions in devolved administrations, due to differences in existing policies.

5.74 This type of appraisal must include, as far as possible, the effects on other areas affected by the proposal. It cannot be assumed that resources are diverted from other parts of the UK 'on average'. Interventions will often divert resources from areas that are nearby and/or have very similar characteristics to the areas receiving an intervention. The effects of deadweight, displacement, transfers, substitution and leakage must be estimated based on credible, objective evidence that relates to the areas or issues of concern (See [Annex 3](#) for more detail).

5.75 Distributional issues should also be considered when conducting research to calculate generic reference values for appraisal. For example, the income distribution of a sample population may be taken into account in order to adjust a generic value to represent the total population.

Appraising projects and programmes

5.76 Programmes usually form part of a wider organisational strategy and contribute to organisational objectives. The key differences between projects and programmes which should be reflected in the way they are appraised are:¹³

- programmes focus on the delivery of outcomes and projects usually focus on the delivery of outputs
- programmes are usually made up of enabling projects and activities
- programmes usually have a longer life span, involving a series of projects or stages and take a number of years to deliver
- programmes are usually more complex, with a wider scope and provide an umbrella for enabling projects to be co-ordinated and delivered

5.77 Individual projects within a programme are subject to the usual approval, development and processes set out in the [HM Treasury Business Case guidance](#). The existence of a programme business case should shorten and simplify the business case for the constituent projects. In some cases the business case process can be shortened with agreement of the approving authority. Guidance is available to support planning and approval of [Agile](#) digital and IT projects.

¹³ The differences affect the way they are appraised, approved and evaluated as further explained in [HM Treasury Business Case Guidance](#) and the [Treasury Approvals Process](#).

Portfolio appraisal

5.78 Portfolio appraisal involves the optimisation of a portfolio of programmes and projects within a limited budget. The objective is to optimise the social value of the portfolio taking account of total whole life cost of projects, when subject to a budget constraint.

5.79 Public capital spending is a readily controlled form of expenditure. This is because proposals that are not yet started or fully implemented can be more easily delayed, reduced in scope, re-phased or abandoned. When a decision is made to go ahead with capital expenditure it usually creates substantial whole of life costs e.g. maintenance and running costs for infrastructure or service provision for schools or hospitals. As a result, public sector capital spending is usually a relatively small percentage of the total cost of project. When ranking a set of projects with substantial capital spending, the BCR including whole life costs should be used. However, the cut-off or budget constraint for considering which options are affordable should be the capital budget.

5.80 All capital spending proposals may be ranked according to their BCR and the ranking then adjusted to reflect unquantifiable and unmonetised factors and risks. Future spending commitments should be taken into account in approval of individual spending decisions and when strategically reviewing a portfolio.

Steps in the appraisal process

5.81 This chapter has outlined key steps in short-list appraisal and selecting the preferred option. This is summarised in the [Box 13](#) and shown in the context of the overall appraisal process.

Box 13. An Outline of the Key Stages in Appraisal**The Appraisal Framework:**

- **Rationale for intervention**
 - a. research and understand the current position – Business As Usual
 - b. establish rationale for intervention
 - c. identify SMART objectives (outcomes and outputs) for intervention

- **Long-list appraisal**
 - a. generate a long-list of options
 - b. identify constraints and dependencies
 - c. consider distributional objectives or effects
 - d. identify Critical Success Factors (CSFs)
 - e. consider unmonetisable factors
 - f. consider and filter long-list against CSFs to generate a viable short-list and preferred way forward

- **Short-list appraisal**
 - a. select Social Cost Benefit Analysis or Social Cost Effectiveness Analysis
 - b. identify and value costs and benefits of all options
 - c. qualitatively assess non-monetisable costs and benefits
 - d. estimate the financial cost to the public sector in nominal prices
 - e. adjust all costs and benefits for inflation for economic analysis
 - f. apply appropriate optimism bias
 - g. maintain risk and benefits registers
 - h. assess avoidable, transferable and retained risk, build in additional costs and reduce optimism bias accordingly
 - i. discount costs and benefits over time
 - j. sum discounted values to produce Net Present Social Value (NPSV) and BCRs as appropriate
 - k. consider affordability, comparing financial costs to a budget constraint
 - l. if required, conduct a separate distributional or sub-national analysis

- **Identification of the preferred option**
 - a. identify preferred option considering NPSV, BCR, risks and non-monetisable factors
 - b. conduct sensitivity analysis, including switching values, for preferred choice

- **Monitoring and evaluation**
 - a. before – bring together the existing evidence base and establish a baseline
 - b. during – allow emerging evidence to inform ongoing adjustments to the intervention, implementation and operational delivery
 - c. after – assess the outcome and lessons learned

6

Valuation of Costs and Benefits

6.1 Chapter 6 sets out the approach to the valuation of costs and benefits in more detail. This includes further explanation of opportunity costs, which costs and benefits to include and approaches to non-market valuation. It covers land use valuation, assets and infrastructure, valuation of risks to life and health, natural capital and travel time.

Opportunity cost

6.2 The costs of using assets and resources are defined by the value which reflects the best alternative use a good or service could be put to, or opportunity cost. The starting point for estimating opportunity costs is usually market prices. It is important to understand the best alternative use of an asset being valued, since better alternatives may exist. The opportunity cost of labour should include the total value of the output produced by employees. This is the cost of employees' time, based on Full Time Equivalent (FTE) costs and includes pension costs, National Insurance, allowances, benefits and basic salary.

Employment and productivity effects

6.3 Productivity effects should be included in the calculation of UK costs and benefits where they can be objectively demonstrated. Productivity effects may arise from movement to more or less productive jobs, changes in the structure of the economy, benefits from dynamic clustering or agglomeration (benefits that arise through close location of businesses and/or people), private investment, product market competition or the generation and flow of ideas. Productivity effects will typically lead to higher wages, rather than higher employment. The benefits can be calculated from the different levels of total employment costs under different options.

6.4 Interventions which increase human capital, job-search activity or provide better access to jobs can have positive labour supply and macroeconomic effects. Provided they can be supported by clear, objective evidence labour supply effects can be included in appraisal.

6.5 Any macro level effects not resulting from productivity or labour supply effects only contribute to temporary deviations from trend growth. For example, any differences in labour demand between individual types of spending within a portfolio of programmes and projects, or between individual options within a proposed intervention, cannot generally be reliably observed or measured from a UK perspective. As a result, they should not be counted in the overall appraisal of UK social value unless they can be demonstrated to have supply side effects. [Annex 3](#) sets out the approach to labour demand effects for the appraisal of distributional effects at a sub-national level and appraisal of Official Development Assistance.

6.6 Multiplier effects are further economic activities which result from either labour supply or direct labour demand effects. They are likely to have limited additionality and the effects are generally already accounted for at a macro level by aggregate decisions to spend at a particular level. If multiplier effects do occur it is usually not possible to reliably observe or measure differences between individual programmes and options within projects at a UK level. It is therefore

recommended that they should not be included in estimates of social value. With robust, objective evidence supply chain effects may be used for local level analysis (see [Annex 3](#) for the approach to local level effects in distributional analysis).

Economic transfers

6.7 Transfers of resources between people (e.g. gifts, taxes, grants, subsidies or social security payments) should be excluded from the overall estimate of Net Present Social Value (NPSV). Transfers pass purchasing power from one person to another and do not involve the consumption of resources. Transfers benefit the recipient and are a cost to the donor and therefore do not make society as a whole better or worse off.

6.8 Where transfers may have a distributional impact it may be appropriate to quantify and show these effects alongside the estimate of UK NPSV. This could involve showing the transfer of equivalent costs or benefits from one group in society to another, particularly when relevant to distributional objectives. It may be appropriate in those circumstances to undertake distributional analysis as set out in [Annex 3](#).

6.9 Redundancy payments are a transfer payment and should not be part of the estimate of UK NPSV. Redundancy costs (or potential costs) should be included in the calculation of the financial costs to the public sector. In addition, where there are significant wider social effects of redundancy these should be calculated and included.

6.10 Payments of tax and national insurance made from an employee's gross earnings are part of the output or value produced by the workforce. They are therefore not a transfer payment and should be included where relevant in calculations of social value. HM Treasury should be contacted if there is uncertainty about whether costs or benefits in appraisal represent a transfer payment.

Residual values and other adjustments

6.11 An asset's residual value or liability at the end of the appraisal period should be included to reflect its opportunity cost. Residual values do not depend on the actual sale of an asset. The market price at the end of the asset's lifetime – the best value obtainable from its sale, lease or alternative use – is part of the value created as a result of the cost to the public sector of creating the asset.

6.12 Contingent liabilities – potential future expenditure if certain events occur – should be appraised and included as part of the expected cost of risk. They sometimes result from decisions that do not involve direct public expenditure. One example of a contingent liability is the cancellation costs if a public sector organisation terminates a contract prematurely. The [HM Treasury contingent liability approval framework](#) provides further discussion on calculating expected costs.

6.13 Depreciation is not included in the estimate of NPSV, although it is included in the estimate of public sector costs in financial analysis. Depreciation is used in accounting to spread an allowance for loss in value of an asset over its lifetime. In calculating NPSV, costs are not spread over time but register when total costs are reflected in the accounts.

Non-market valuation

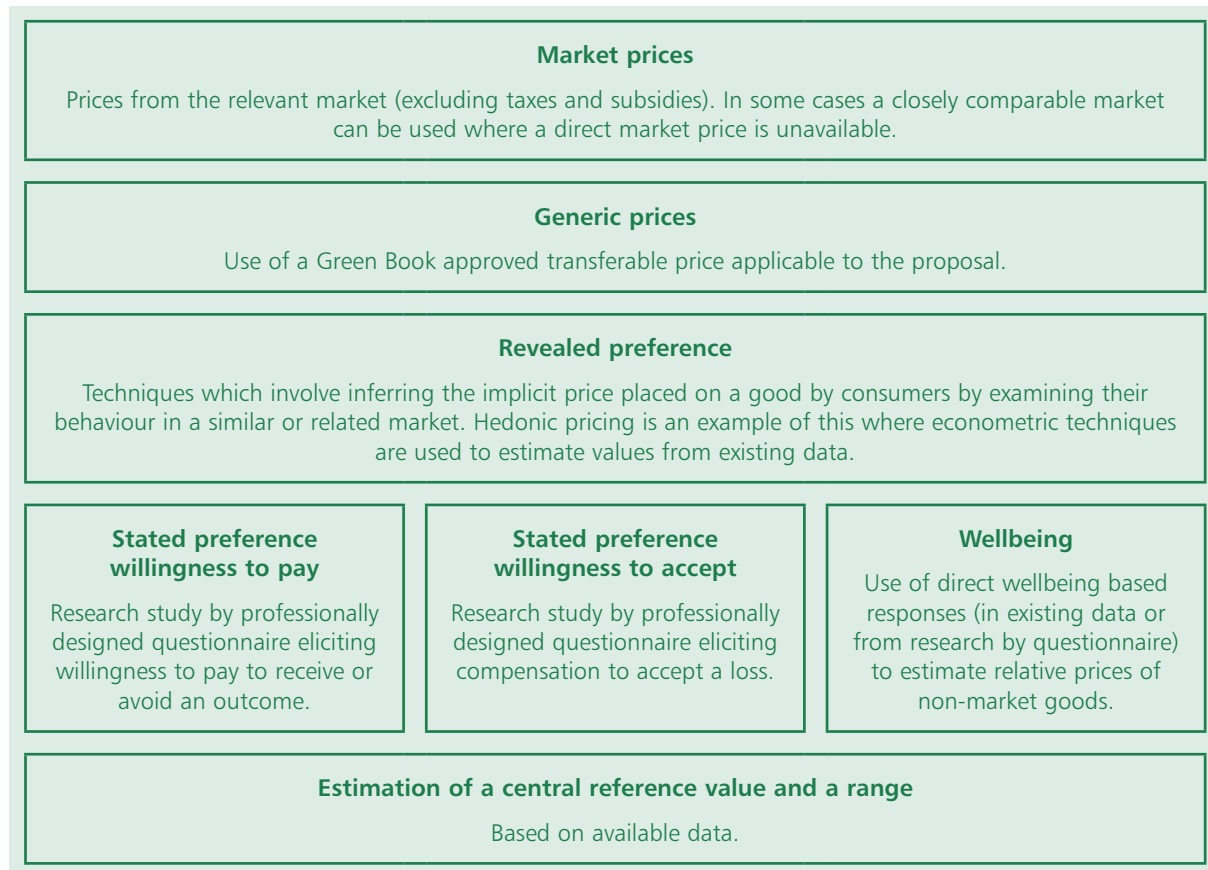
6.14 When there is no market price for costs and benefits to society they need to be estimated and are known as shadow prices. This is particularly important for environmental, social and health effects. Some have generic values generated, for example, through surveys of a sample of the population. These are included, with information on how to use them, in [Annex 2](#) and the [Green Book](#)

[webpages](#). To ensure appropriate use it is important to understand the difference between the characteristics of the sample population and an intervention's intended target population. The advice of professional economists is required when dealing with non-market valuation.

Non-market price calculation and estimation

6.15 Social costs and benefits without a market price can be estimated using a range of techniques. [Box 14](#) summarises a hierarchy of the main techniques that can be used. These approaches have strengths and weaknesses that need to be considered when they are used for Social CBA.¹⁴

Box 14. Valuation Methods for Non-Market Prices



6.16 Market prices will not represent total costs and benefits where a market is distorted because of restricted competition, such as a monopoly in supply (only one seller), or monopsony in purchasing (only one buyer). If this is the case valuation may be required and discussion is advised between the responsible organisation and their approving authority, or HM Treasury in the case of major expenditure.

6.17 For non-market valuation in general, research studies may be commissioned where there are no reliable values and it is justified by the size of the cost, benefit or risks. Where a research study is not feasible and transferable values are not available, desk-based research and other data sources may shed light on the likely range of values. In these cases a range of estimates should be used. The basis should be made clear, and they must be included in the sensitivity analysis, to test whether the benefit valuation is critical to the decision to be made.

6.18 Sometimes it is possible to identify the implied value of non-market goods from other decisions people make where prices are available. This gives a revealed preference – the value revealed as a result of people's actions. Hedonic pricing is an example of this approach. For example, the relationship between house prices and levels of environmental amenity, such as

¹⁴ [Fujiwara and Campbell \(2011\)](#) discuss the strengths and weaknesses of revealed and stated preference techniques and use of subjective wellbeing evidence.

peace and quiet, may be analysed in order to assign a monetary value to the environmental benefit. Another example is the travel cost method, which involves estimating the costs people incur in order to consume a non-market good such as a recreational site.

6.19 If robust revealed preference data is not available, surveys that use willingness to pay and willingness to accept are an established alternative method known as stated preference techniques.

6.20 Revealed and stated preference techniques are commonly used to elicit estimates of what individuals are willing to pay or accept for a specific outcome. They underpin many of the valuation techniques outlined in [Annex 2](#), for example stated preference techniques are used to value health outcomes using Quality Adjusted Life Years (QALYs).

Subjective wellbeing approaches

6.21 Subjective wellbeing evidence aims to capture the direct impact of a policy on wellbeing. The evidence can challenge decision makers to think carefully about the full range of an intervention's impacts and to consider a wider range of interventions. The evidence can also help challenge implicit values placed on impacts by providing a better idea of the relative value of non-market goods.

6.22 The use of subjective wellbeing approaches in assessing the long-list of options is explained in [Chapter 4](#). For use in short-list appraisal it may be appropriate to use subjective wellbeing as the outcome variable for Social CEA in certain circumstances.¹⁵ It is recognised that the methodology continues to evolve¹⁶ and it may be particularly useful in certain policy areas, for example community cohesion, children and families. Where valuations are considered robust enough for inclusion in Social CBA, benefits or costs must not be double counted, which could occur if a benefit or cost arising from a policy were counted by different valuation methods.

Specific approaches to valuation

Land use values

6.23 The value of land is determined by factors such as use, location, nearby infrastructure and the cost of development for an alternative use. The potential net benefits of new land used can be assessed using values arising from a change. The change in value is defined as the value of the land in its new use (e.g. commercial or residential) minus the value of the land in its existing use.

6.24 Any increase in land value as a result of a change in its use reflects the economic benefits of conversion to a more productive use. The value to society of a development can therefore be derived from the land value. This estimate should be adjusted for any change likely without the development, displacement from the original land use and wider effects of the resulting development, e.g. any change in amenity value, environmental or health outcomes. Any double counting should be adjusted for. See [Annex 2](#) for more detail.

Asset maintenance

6.25 Asset maintenance costs may be substantial, occur over long time periods and need to be accounted for over an asset's likely lifetime. These estimates should be based on an organisation's asset maintenance policies. In the absence of policy any assumption should be based on maintaining the service level and quality at the outset for the asset's lifetime.

¹⁵ Where there is evidence that wellbeing fully captures all the outcomes affected by a proposal and there is sufficient evidence available for different options being considered.

¹⁶ The What Works Centre for Wellbeing have published a guide on the use of wellbeing evidence in cost-effectiveness analysis, available on the analyst web page: <https://www.whatworkswellbeing.org/appraisal>.

Asset sales

6.26 The design of an asset sale is subject to the Green Book and [HM Treasury Business Case Guidance](#). Estimates of social value should include wider social costs and benefits that may be affected by a sale.

6.27 The value of existing assets is their opportunity cost. For asset sales this is usually the value in the market and must be estimated where no comparable market value exists. Where there is a known stream of income arising from an asset's ownership (e.g. interest, repayment of a debt, or rental/lease income) the value should be estimated based on a discounted value of the future income stream (using Social Time Preference Rate, STPR). Where there is no income stream, market value can be estimated using comparable sale values or comparable potential income streams. The asset value used should inform the estimate of social value and public sector income.

6.28 Where an asset is unused, there may still be positive benefit of an alternative use if transferred to the private sector or a wider social cost of disposal. These costs and benefits may be affected by the method and timing of the sale and any provisions attached. There may also be public sector or social costs associated with ongoing ownership of an asset which will need to be considered as part of any assessment to hold or dispose of an asset.

6.29 Social CBA and Social CEA are not relevant when the benefit of an asset sale is only public sector revenue, with no change in public service output. If there is no change in the output of public or other services, there is simply a saving in the overall public sector. The focus should then be on ensuring an efficient sale to deliver best value to public sector finances and should be registered in the financial dimension of a business case.

6.30 Valuation of financial asset sales is covered by the Green Book, except for the sale of government debt which is exempt. Financial assets are generally priced according to a valuation of their discounted income stream, using the STPR. The composition of the STPR means it excludes project or programme specific risks, so the cost of risks should be explicitly included in an intervention's cost.

6.31 A market risk premium must be estimated to price a financial asset for sale and should be added to the risk-free component of the STPR, which is 2.5%. The STPR is 3.5% and includes a 1 percentage point allowance for catastrophic risk which is excluded to give the risk-free component of 2.5% ([Annex 6](#) provides a breakdown of the STPR). A projection of the future stream of income from the asset is also required. The variability of this income stream and the reliability of the projections will directly affect the size of the risk premium.

6.32 Potential purchasers may have other reasons for finding a financial asset attractive, such as its risk profile. This can be irrelevant to the public sector but of material value to a financial institution seeking to balance risk in a portfolio. This may increase the price that potential purchasers are willing to pay. More information on valuing financial assets can be found in [Green Book supplementary guidance: asset valuation](#).

Infrastructure

6.33 Infrastructure interventions should be appraised and valued in the same way as all other interventions. Infrastructure is a broad term relating to the assets, networks and systems that support the operation of a modern society and economy. In the UK, the term economic infrastructure refers to businesses and their assets that are concerned with transportation, water and sewage, waste management, energy, communications, and flood and coastal erosion. Economic infrastructure has particular characteristics that need to be recognised and taken into account.

6.34 Economic infrastructure can be geographically extensive and involve significant investment in physical assets. Many of these assets have grown organically over time and are often highly interdependent. Because of their size, and in certain cases complexity, some decisions may have effects on future flexibility of an organisation or industry affected and other infrastructure service providers. Productivity benefits should be considered as part of appraisal, including agglomeration effects or changes in the structure of the economy that may result from infrastructure investment.

6.35 Infrastructure, long term planning and high interdependence levels need to be taken into account at the long-listing stage and when selecting the optimum short-list ([Chapter 4](#)). It is vital that this is supported by sufficient good quality research and evidence, for example on previous similar interventions.

Valuing risks to life and health

6.36 Changes in risks to life or health as a result of government interventions should be valued as part of appraisal and will usually require non-market valuation techniques. The choice of technique will depend on the nature of the specific intervention being appraised.

6.37 The Value of a Prevented Fatality (VPF) measures the social value of changes in risk to life. It is used to value small changes in fatality risks, where levels of human safety vary between options. This is not the value of a life, it is the value of a small change in the risk or probability of losing a statistical life. Not to value this in appraisal would effectively value human safety at zero.

6.38 In cases where alternative levels of fatality risk are involved in option design, VPF allows this to be taken into account. The value concerned is known as the value of the risk of “a statistically prevented fatality.” It has been widely used for many years, particularly in transport. The current value and how it may be applied is discussed in [Annex 2](#).

6.39 Valuation can also involve estimating the impact of risks to the length of life, measured using Statistical Life Years (SLYs), and risks to health related quality of life (QoL) measured using Quality-Adjusted Life Years (QALYs). In practice, particularly in the health sector, QoL can be thought of as different dimensions of health (e.g. the capacities for mobility, self-care, usual activities, pain or discomfort and anxiety or depression).¹⁷ Observations used will be based on self-reported health and provide equal weight to whatever full health means to each respondent.

6.40 The value of a SLY is derived from the social value of a small change in the probability (the risk) of losing or gaining a year of life expectancy. This value can be of use when appraising options that involve different changes to life expectancy. These risks may involve regulation or provision of goods and services that affect or directly relate to human life and health.

6.41 The gain or loss of a QALY can represent the social value of an improvement in life expectancy and QoL in a way that is comparable to the gain or loss of a SLY. The QALY is two dimensional, combining both longevity and level of health in a single measure. This is useful when appraising options that result in different effects on both longevity and QoL. The current values of a SLY and a QALY, how they can be applied, and background information is contained in [Annex 2](#).

6.42 On grounds of equity in appraisal, the VPF, QALY and SLY values are based on average values from representative samples of the population. For the avoidance of doubt VPF, QALYs and SLYs are used when analysing and planning the provision of assets, goods and services at a population or sub-population level. They are not designed for contexts such as situations of emergency or rescue.

¹⁷ These are dimensions of health as measured using the [EQ-5D](#) instrument. This is a tool that individuals complete to show changes in self-reported health over time or before/after receiving health care treatment.

Greenhouse gas emissions and energy efficiency values

6.43 Greenhouse gas (GHG) emissions occur as a result of many decisions to create assets or provide public services, particularly where direct energy consumption is required. They may also result from the energy required to produce basic input materials used in construction. The creation of GHGs has a social cost based on its contribution to climate change.

6.44 To estimate the social cost of an intervention it is necessary to include the costs of emitting GHGs. Energy efficiency has a direct social value, in addition to the value of a reduction in GHGs, as the energy saved itself has a direct benefit to society (similarly, activities that create extra demand for energy have a direct energy cost). The approach and values to quantify GHGs and energy efficiency can be found in [Annex 2](#).

Assessing and valuing effects on the natural environment

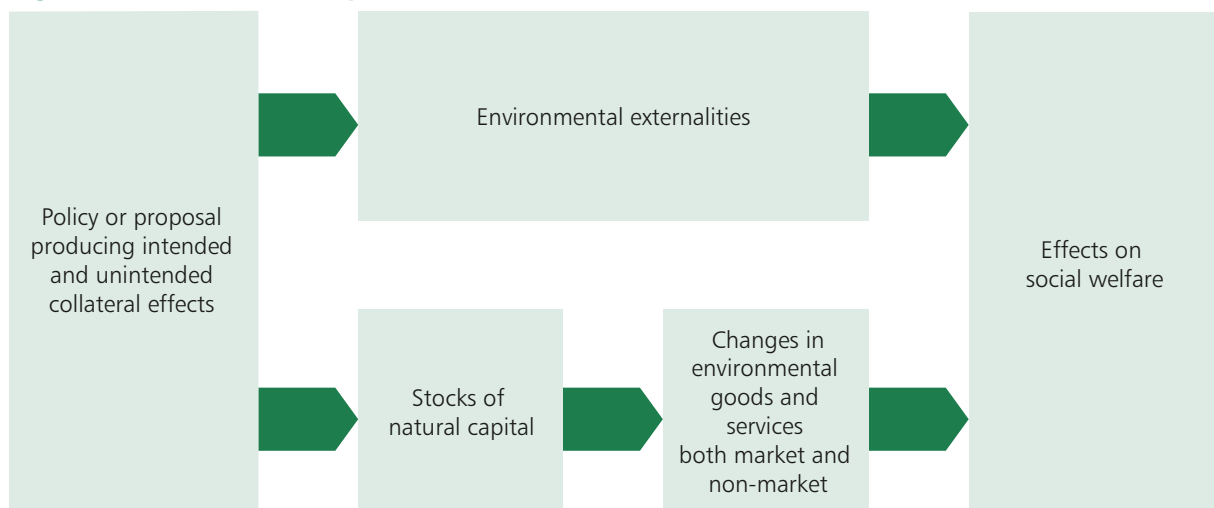
6.45 Natural capital includes certain stocks of the elements of nature that have value to society, such as forests, fisheries, rivers, biodiversity, land and minerals. Natural capital includes both the living and non-living aspects of ecosystems.

6.46 Stocks of natural capital provide flows of environmental or ‘ecosystem’ services over time. These services, often in combination with other forms of capital (human, produced and social) produce a wide range of benefits. These include use values that involve interaction with the resource and which can have a market value (e.g. minerals, timber, fresh water) or non-market value (e.g. outdoor recreation, landscape amenity). They also include non-use values, such as the value people place on the existence of particular habitats or species. Where service flows are not marketed, or market prices do not include their full value to society, non-market values may be estimated using the range of non-market valuation techniques or tools.

6.47 Understanding natural capital provides a framework for improved appraisal of a range of environmental effects alongside potentially harmful externalities such as air pollution, noise, waste and GHGs.

6.48 Natural capital stock levels should be systematically measured and monitored for the social costs and benefits of their use to be understood and controlled (see report to the [Natural Capital Committee](#)). A focus solely on the marginal valuation of a loss in services may overlook the potential for large reductions in stocks. This could then lead to dramatic reductions in present or future services. Similarly, the cumulative effects of multiple decisions on natural capital stocks need to be considered. Where appropriate therefore, and particularly for major impacts, assessments should consider whether affected natural assets are being used sustainably.

Figure 3. The Natural Capital Framework



6.49 [Figure 3](#) shows the natural capital framework. This does not replace existing approaches to appraising and valuing environmental effects. Rather, by providing a more comprehensive framework within which to develop and appraise policy, it suggests additional options to meet policy goals and enables all options to be assessed more accurately for potential improvements and/or damage to the environment.

6.50 As a first step, the following questions can be used to consider the impact on natural capital. Is the option likely to affect, directly or indirectly:

- the use or management of land, or landscape?
- the atmosphere, including air quality, GHG emissions, noise levels or tranquillity?
- an inland, coastal or marine water body?¹⁸
- wildlife and/or wild vegetation, which are indicators of biodiversity?¹⁹
- the supply of natural raw materials, renewable and non-renewable, or the natural environment from which they are extracted?
- opportunities for recreation in the natural environment, including in urban areas?

6.51 If the answer to one or more of these questions is “yes” or “maybe”, further assessment is recommended as outlined in [Annex 2](#).

Travel time

6.52 The value of a change in travel time is the change in welfare expressed in monetary terms. The values of travel time savings represent the opportunity costs of time spent by travellers during their journeys. For example, the opportunity cost of travel time for a visiting care worker during working hours is the social value of the time which would otherwise be spent caring for service users. More detail on travel time valuation can be found in [Annex 2](#).

PPP, tax and other adjustments

6.53 Comparison of Public Private Partnerships (PPP) options with a comparable public sector option is required. A suitable public sector option should be created to provide a benchmark for comparison of direct public provision and partnership options, costs and value on a level playing field. This requires the comparable public sector option to be based on the same provision of services in terms of quantity and quality and provide the same level and length of asset maintenance as the partnership option. It is therefore necessary for adjustments to be made for tax (see [Annex 4](#)).

6.54 A choice involving PPP options should not be reduced to a binary choice between public and private. Having a partnership option and public sector comparator on the short-list does not rule out other options. There may be more than one partnership option and where this is the case each one requires its own public sector comparator. There may also be other directly provided public sector options not comparable to the PPP options (e.g. different in terms of scope or benefits offered) in addition to the public sector comparator.

6.55 Payments of tax on foreign procurements are included in market prices in the social value calculations, in the same way as they are for UK purchases. Manufacturing and supply chains are generally global in nature, meaning all procurements on average are likely to have elements of

¹⁸ The water cycle cuts across natural assets, and includes non-tidal rivers, lakes, ponds, wetlands, floodplains as well as groundwater, coastal estuaries, the marine environment.

¹⁹ Wildlife can be affected by direct changes to protected sites and by disrupting or creating connections between sites.

foreign origin, manufacture and taxation applied to their production. It would not be proportionate, or likely to add value to the decision process, to attempt an analysis of each procurement's degree of embedded foreign taxation and then to make an adjustment.

6.56 The existence of a UK supply chain or the location of companies involved in maintenance and repair may be important for policy or wider social objectives. When this is the case this should be considered at the long-list stage and in selection of the short-list. Such priorities should be used when developing the economic dimension of a business case, and should feed through into the specification of the procurement process in the commercial dimension.

6.57 If competition effects resulting from a proposal are deemed likely during consideration at the long-listing stage ([Chapter 4](#)), further in-depth assessment of these impacts should be undertaken and incorporated into any Social CBA or Social CEA. Guidance on quantifying competition effects can be found at the [CMA webpages](#).

Unmonetisable and unquantifiable costs and benefits

6.58 If there are significant unmonetisable effects associated with an intervention, efforts should be made (where it is possible and meaningful) to quantify them in some other way. Significant benefits and risks that are beyond direct monetisation should be considered at the long-list stage and in selection of the short-list. Options with and without their inclusion provide alternative scenarios, which can be used to reveal their costs. This informs choice by considering whether these cost differences are a price worth paying. For example, Bateman et al. (2013)²⁰ apply this when examining the costs of changing policy on land use when faced with unmonetisable impacts on biodiversity.

6.59 The focus of appraisal should be on benefits and costs important to the decision being considered. The treatment of unmonetisable and unquantifiable benefits is discussed further in [Annex 2](#).

²⁰ Bateman et al. (2013) "Bringing ecosystem services into economic decision making: Land use in the UK" *Science*, Vol 341, No. 6141: 45-50, 5th July 2013. DOI: 10.1126/science.1234379.

7

Presentation of Results

7.1 Chapter 7 outlines how to present appraisal results.

7.2 The role of appraisal and evaluation is to provide objective evidence and analysis that feeds information into the design, scrutiny and approval processes that support government decision making. Accordingly appraisal results should be presented transparently to show clearly the social value of alternative options in a consistent way.

7.3 The Green Book recommends:

- presenting results in summary form, supported by more detailed tables and written analysis. The summary should include key measures such as Net Present Social Value (NPSV), Benefit Cost Ratio (BCR), risks and significant unmonetised costs and benefits or other unquantifiable factors. It should clearly state the choice of time horizon for the appraisal and rationale for that choice.
- listing key assumptions used alongside the results of the quantitative analysis and providing a statement on any unquantified values. Assumptions which have a big effect should be made clear alongside the results of Social Cost Benefit Analysis.
- providing clear references and justifications, with links to sources. Sensitivity analysis of the preferred option should be presented and may be required for other options.
- that Business As Usual should be quantified in absolute terms where possible and presented alongside the results of appraisal which show the incremental effect of options.
- clearly presenting uncertainty in the estimates of BCRs or NPSVs and where possible graphical presentation should be used.

Appraisal Summary Tables

7.4 A generic, core Appraisal Summary Table (AST) is shown in [Table 3](#). It can be used as a starting point for summarising results. Some government departments already use standard ASTs to bring together key information that is tailored to their needs.

Table 3. Generic Appraisal Summary Table Template

		Do-minimum Option	Option 1 Preferred (if not do-minimum)	Options 2→to→N
A	Net Present Social Value			
B	Public sector cost (or appropriate value for cost)			
C	Appropriate BCR			
D	Significant unmonetisable costs/benefits			
E	Significant unquantifiable factors			
F	Risk costs by type and residual optimism bias			
G	Switching values (for the preferred option only)			
H	Time horizon and reason			

7.5 The AST is intended to be spread across two facing A4 pages to provide an at a glance summary of the key factors in a public spending and non-regulatory decisions.

7.6 Regulatory decisions with impacts on business are subject to the [Impact Assessment \(IA\) guidance](#) issued by the Better Regulation Executive. In some circumstances specific requirements may apply (e.g. use of an IA toolkit and template). The AST here does not replace the summary sheet on the front of the [IA template](#) but it may form part of the evidence base for IAs. For example, it may provide a useful summary of social value calculations that feed into any regulatory decisions.

7.7 The AST should also record any significant unmonetisable and unquantifiable effects that are important for a decision. Extensions to this template and supporting tables setting out costs and benefits over time are downloadable from the [Green Book web pages](#).

7.8 The AST should be supported by a set of tables (one for each option) in spreadsheet format. These should show the net benefit, total costs and benefits and budgetary impact over time. There should also be a column providing references, including a link to the sources. This allows for quick reference to indicate whether the line is an assumption or calculated on an objective basis. Where sale, purchase or significant reallocation of public resources are involved, the [HM Treasury Business Case guidance](#) applies and should be followed. This contains further [templates](#) for completion of the business case to be used.

8

Monitoring and Evaluation

8.1 Chapter 8 sets out the approach to monitoring and evaluation including different types of evaluation and uses before, during and after implementation.

8.2 Monitoring and evaluation should be part of the development and planning of an intervention from the start. They are important to ensure successful implementation and the responsible, transparent management of public resources. Guidance on conducting evaluation is contained in the [Magenta Book](#).

8.3 Evaluation is a systematic assessment of an intervention's design, implementation and outcomes. It involves:

- understanding how a government intervention is being or has been implemented, what effects it had, for whom and why
- comparing what happens with what was expected under Business As Usual (the appropriate counterfactual)
- identifying what can be improved, estimating overall impacts and cost-effectiveness

8.4 When used properly, evaluation can inform thinking before, during and after implementation as set out in [Box 15](#).

8.5 It is important to incorporate monitoring and evaluation into the development and appraisal stage of a policy, programme or project. Pilots can be used to test policy effectiveness of what works. Policies can also be designed with inbuilt variation to test the effectiveness of different approaches in real time.

Box 15. Uses of Evaluation

<p>Before – brings together the existing evidence base, identifies uncertainties (and so where a future evaluation might focus), and helps reduce risk associated with an intervention prior to full implementation.</p>	<ul style="list-style-type: none"> <input type="checkbox"/> How is the intervention expected to work? <input type="checkbox"/> Is it likely to work? <input type="checkbox"/> How is it expected to be delivered? <input type="checkbox"/> What can we learn from previous monitoring and evaluation work? <input type="checkbox"/> Can the intervention be piloted and tested before full roll-out?
<p>During – allowing emerging evidence to inform ongoing adjustments to the intervention and informs implementation. It can also inform subsequent operational delivery.</p>	<ul style="list-style-type: none"> <input type="checkbox"/> Is the intervention working as intended? <input type="checkbox"/> Is it being delivered as intended? <input type="checkbox"/> Why is this? <input type="checkbox"/> How can it be improved? <input type="checkbox"/> What are the early impacts?
<p>After – involves an assessment of the outcome of the intervention and provides a summative assessment of the learning gained throughout its design and delivery.</p>	<ul style="list-style-type: none"> <input type="checkbox"/> Did the intervention work? <input type="checkbox"/> Were there unexpected outputs and outcomes or were they as expected? <input type="checkbox"/> What was the size of the impact? <input type="checkbox"/> What was the cost to deliver the benefits and did the intervention achieve Benefit Cost Ratios estimated at appraisal? <input type="checkbox"/> What can we learn to inform future interventions?

8.6 Evaluation is often broken down as follows:

- Process Evaluation – involves assessing whether an intervention is being implemented as intended within its cost envelope, whether the design is working, what is working more or less well and why. It supports understanding of internal processes used to deliver outputs, alongside what was actually delivered and when.
- Impact Evaluation – involves an objective test of what changes have occurred, the extent of those changes, an assessment of whether they can be attributed to the intervention and a comparison of benefits to costs. It supports understanding of the intended and unintended effects of outputs, as well as how well SMART objectives were achieved.

8.7 Regulations may require post-implementation reviews (PIRs) which are closely related to policy evaluations. The aim is to review regulations at timely intervals to assess whether they are still necessary, whether they are having the intended effects and what the costs to business are. PIRs will generally focus on measures with significant impacts on business and should be conducted proportionately, supported by appropriate monitoring and evaluation. [Better Regulation guidance](#) provides more information on conducting PIRs.

8.8 The planning of monitoring and evaluation for spending proposals should follow the [HM Treasury Business Case guidance](#) for both programmes and projects. This allows a wide range of analytical and logical thinking tools to be used when initially considering the objectives and

potential solutions. Planning and provision of resources for monitoring and evaluation should be proportionate when judged against the costs, benefits and risks of a proposal both to society and the public sector.

8.9 Monitoring and evaluation typically use a mixture of qualitative and quantitative methodologies to gather evidence and understand different aspects of an intervention's operation. Surveys, interviews and focus groups may be needed to understand the views of a wide range of stakeholders, evaluation questions should reflect immediate needs to manage and assess the success an intervention. Evaluation is important as:

- it facilitates transparency, accountability and development of the evidence base
- it can be used to improve current interventions
- it expands learning of 'what works and why' to inform the design and planning of future interventions

8.10 Building monitoring and evaluation into the design of a proposal, and building resources into a proposal, has the following benefits:

- it ensures timely, accurate and comprehensive data can be collected. Data collection should be done alongside the monitoring of costs; either within the intervention itself, or as part of the organisation's wider cost monitoring
- it ensures monitoring and evaluation can take place
- it allows for relatively minor adjustments to be made to the implementation design which can greatly improve the delivery of benefits
- it means high-quality evaluation evidence can be obtained and reduces the likelihood of having to retrospectively ask for information on what was delivered and when
- it means it can be possible to implement in a way that creates a natural comparison group, which can greatly improve the quality of the evidence around 'what works'
- it means evaluation can be used during implementation to address significant issues or threats to delivery of planned outcomes to maximise delivery of benefits

8.11 Monitoring and evaluation objectives should be aligned with the proposal's intended outputs, outcomes and the internal processes, although they may also be wider. Policies and programmes that involve a series of related sub-programmes must also be subject to monitoring and evaluation in programme terms during and after implementation.

8.12 SMART objectives should be objectively observable and measurable. Their design should take into account monitoring and evaluation processes. Their suitability for use in monitoring and evaluation is a necessary condition for inclusion as SMART objectives ([Chapter 4](#)). Without verifiable and measurable objectives success cannot be measured, proposals will lack focus and be less likely to achieve Value for Money.

8.13 Data on Business As Usual, along with ongoing data collection, is vital to manage delivery and monitor the impact during and after implementation. Monitoring and evaluation should examine what happens compared to:

- the impacts expected at the outset, in the business case or impact assessment if available
- the situation at the start of implementation

- what would have happened if Business As Usual had continued without the proposed intervention

8.14 In terms of the Five Case Model, a core set of questions to consider are set out in [Box 16](#). A more detailed set of evaluation questions can be found in the [Magenta Book](#).

Box 16. Core Evaluation Questions

To what extent were the SMART objectives achieved and by when, in particular:

- to what extent were outputs delivered and when?
- to what extent were the anticipated outcomes produced and by when?
- what continuing change is expected as a result of the above?
- how well did the process of delivering the outputs and outcomes work?
- were there significant unintended effects?
- what social value was created as defined in the economic dimension?
- what level of confidence can be attributed to the estimates of impact, including social value?
- what was the cost to the public sector as defined in the financial dimension?

8.15 Monitoring and evaluation evidence and reports should be actively owned by the Senior Responsible Officer and the team responsible for an intervention's delivery. Data and findings should be reported regularly, and reports should be timed to correspond to decision points where they can be of maximum use. Major findings should also be reported to the organisation's Accounting Officer and to the relevant external approving organisation.

8.16 Evaluation reports, and the research that informs them, should be placed in the public domain in line with government transparency standards and [Government Social Research: Publication Protocol](#), subject to appropriate exemptions.

A1. Long-list Appraisal

A1.1 This Annex provides more detail on long-list appraisal, introduced in [Chapter 4](#).

A1.2 Generating a broad long-list of possible options at the outset is recommended best practice in appraisal. This is where the full range of possible scope, delivery and funding options that could achieve the [SMART objectives](#) are considered.

A1.3 The 'options framework' introduced below provides a structured approach to generate and appraise a long-list. The framework is recommended for public spending proposals and is explained further in the [HM Treasury Business Case guidance](#). Without a structured approach, an initial, superficially attractive solution may be put forward for detailed analysis without sufficiently testing viable alternatives. In such cases, no amount of detailed Social Cost Benefit Analysis (CBA) results in an optimum proposal.

A1.4 It is useful to consult or engage with stakeholders or representative organisations from the outset and throughout the development of an intervention. Different types and scale of intervention will require different approaches. For example, in cases where specialist knowledge is important, it might be appropriate to engage experts or representative organisations. The approach set out below can support structured discussions with stakeholders by identifying potential issues and focusing on the key decisions needed to achieve optimum social value.²¹

A1.5 This Annex sets out the recommended approach for public spending proposals, however the principle of using criteria to assess a long-list of options applies proportionately to all forms of government intervention. This includes those that require impact assessments and options appraisal falling outside formal processes. A form of long-list appraisal should come before detailed Social CBA.

Options framework and filter

A1.6 The options framework breaks a proposal down into a sequence of choices. These choices are presented as questions around the proposed scope, solution, delivery, implementation and funding (see [Box 17](#)).

A1.7 The options framework considers these choices from the perspective of the public services an intervention is intended to deliver. The social value of assets are appraised according to how well they enable delivery of a service, as the public sector is generally concerned with the provision of goods and services, not asset ownership.

²¹ General principles that apply to formal public consultations are available on the [Cabinet Office web pages](#).

Box 17. Choices in the Strategic Options Framework Filter

Option choices – broad description	
1	Scope <input type="checkbox"/> coverage of the service to be delivered
2	Solution <input type="checkbox"/> how this may be done
3	Delivery <input type="checkbox"/> who is best placed to do this
4	Implementation <input type="checkbox"/> when and in what form can it be implemented
5	Funding <input type="checkbox"/> what this will cost and how it shall be paid for

Assessing the options – Critical Success Factors

A1.8 Critical Success Factors (CSFs) are a small number of criteria used at the long-list stage to make strategic choices about options. They support an assessment of how well an option is likely to succeed across the 5 dimensions of a business case and deliver SMART objectives.

A1.9 Key CSFs which should be used to appraise new public spending interventions are given in [Box 18](#). Up to 2 or 3 intervention-specific factors may need to be added. Having too many CSFs can result in a loss of focus. Further changes may be required for non-public spending options. Supplier capacity and capability will not, for example, be relevant for a regulatory intervention.

Box 18. Critical Success Factors

Key Critical Success Factors	Description
Strategic fit and meets business needs	How well the option: <ul style="list-style-type: none"> <input type="checkbox"/> meets the agreed spending objectives, related business needs and service requirements <input type="checkbox"/> provides holistic fit and synergy with other strategies, programmes and projects
Potential Value for Money	How well the option: <ul style="list-style-type: none"> <input type="checkbox"/> optimises social value (social, economic and environmental), in terms of the potential costs, benefits and risks
Supplier capacity and capability	How well the option: <ul style="list-style-type: none"> <input type="checkbox"/> matches the ability of potential suppliers to deliver the required services <input type="checkbox"/> appeals to the supply side
Potential affordability	How well the option: <ul style="list-style-type: none"> <input type="checkbox"/> can be financed from available funds <input type="checkbox"/> aligns with sourcing constraints
Potential achievability	How well the option: <ul style="list-style-type: none"> <input type="checkbox"/> is likely to be delivered given an organisation's ability to respond to the changes required <input type="checkbox"/> matches the level of available skills required for successful delivery

Constraints and dependencies

A1.10 Constraints and dependencies will affect which options are feasible. They should be identified and understood at the earliest possible stage and taken into account when developing a long-list. Constraints might include legality, ethics, social acceptability, practicality and coherence with wider public policies and strategy. Dependencies are factors that an option relies on to be successful. They are external and outside of direct control, but the successful delivery of objectives depends on them (for example, infrastructure).

Unmonetisable and unquantifiable factors

A1.11 Unmonetisable and unquantifiable factors should be accounted for at the long-list stage. Estimates of social costs or benefits cannot be made based purely on subjective judgement. If it is likely to be difficult to value social benefits, it may still be possible to have an idea of their potential costs. This could involve estimating what the additional costs of an option to deliver greater benefits would be and then consider whether that is a price worth paying. Multi Criteria Decision Analysis (MCDA) should be considered where appropriate (see [Annex 2](#)).

Collateral effects and unintended consequences

A1.12 Collateral effects and unintended consequences may occur as a result of an intervention, for example on particular groups in society. It is important to think about these when developing and appraising the long-list of options. This is especially true where the changes may create new opportunities, obligations or incentives. It is necessary to consider possible beneficial and adverse effects of changes in behaviour that may result from the intervention.

Equalities analysis at the long-list stage

A1.13 Equalities impacts should be taken into account and the [Public Sector Equality Duty \(PSED\)](#), created under the [Equalities Act 2010](#), requires that public sector bodies have due regard to advancing equality. Consideration of equality issues must influence the decisions reached by public bodies and decision makers should be informed of the potential effects of intervention on groups or individuals with characteristics identified by the Act.

A1.14 The need for equalities analysis will apply at the long-list stage and throughout the appraisal process. The results should be visible to decision makers. The PSED covers 9 protected characteristics: age, disability, gender reassignment, pregnancy and maternity, race, religion or belief, sex and sexual orientation. In addition, since October 2014 there is also a requirement to consider the impact of decisions on [Families](#).

Distributional effects at the long-list stage

A1.15 Where appropriate, potential distributional effects (e.g. on different income groups or types of business) should be taken into account at the long-list stage. Distributional effects at the long-list stage may:

- act as a constraint on the feasible options, where there are distributional objectives
- be an intended or unintended consequence of an option

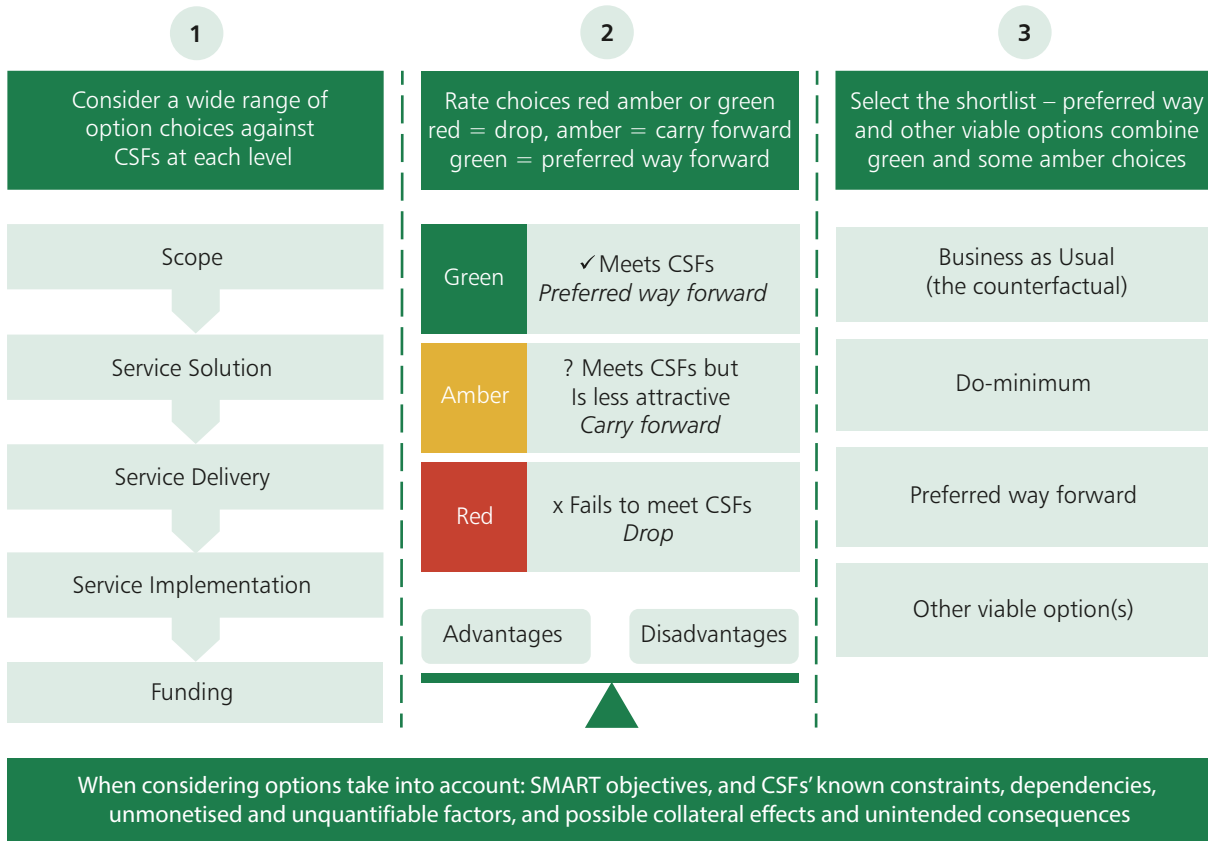
A1.16 When appraising a long-list and selecting a short-list any sub-groups of the population, types of organisation or areas of the country that might stand to lose or gain should be identified. Interventions targeting a specific area will often divert resources from areas nearby and/or with similar characteristics. If this is the case the analysis at the long-list stage should separately identify these areas in addition to the target areas of the intervention. Further analysis and quantification may be required at the short-list stage (See [Chapter 5](#) and [Annex 3](#)).

A1.17 The analysis should be proportionate to the issue being considered in terms of its objective, costs and risks nationally and any group(s) affected. The results of distributional analysis should be made visible by separate presentation alongside the UK wide or aggregated analysis. This ensures clear information to support decision making.

Optimum short-list selection

A1.18 When a long-list has been generated and assessed a small number of viable options known as the short-list can be identified. Within each category (e.g. scope), a number of alternative options should be considered and challenged according to how well they meet the CSFs. This can be done by considering their strengths, weaknesses, opportunities and threats (SWOT). These are high level assessments made on the basis of existing knowledge and research, to allow identification of a viable short-list for detailed Social CBA or Social CEA (see [Chapter 5](#)). The process is summarised below in [Figure 4](#).

Figure 4. Summarising the Options Framework



A1.19 Affordability is an important CSF and should be considered early on in the strategic analysis of the long-list. Before finalising the short-list, estimated indicative costs should be considered to see whether options are affordable given budget constraints. This will stop unaffordable (and therefore non-viable) options moving to the short-list stage. If an option fails this test, the long-list appraisal should be revisited to develop a more realistic alternative.

A1.20 The options framework identifies preferred choices and viable alternatives, and rules out non-viable alternatives. The reasons for each decision should be documented to support engagement with stakeholders on alternatives and appraisal of the long list of options should clearly identify any trade-offs between CSFs. This approach has been found to improve the speed, effectiveness and efficiency of strategic analysis through a clear focus on key issues. All implicit and explicit assumptions should be recorded and challenged as being realistic with an objective basis.

A1.21 The short-list should include the preferred way forward (the combination of choices taken through the options filter most likely to deliver the SMART objectives²²), the Business As Usual benchmark, a viable do-minimum option, that meets minimum core business requirements to achieve the objectives identified and at least one alternative viable option (usually the next best choices to deliver the SMART objectives).

A1.22 The short-list is taken forward to the next stage of appraisal which involves detailed Social CBA or Social CEA of all options. The do-minimum option means it is possible to see whether other options are “gold-plated”, where low value features are added to an alternative option at high cost.

²² It should not be confused with the “preferred option”, which is the result of the analysis at the short-listing stage (see [Chapter 5](#)).

A2 ■ Non-market Valuation and Unmonetisable Values

A2.1 This Annex provides detail on specific approaches to non-market valuation techniques and generic values for use in appraisal. It covers:

- a range of environmental techniques
- land values
- energy efficiency and Greenhouse Gases
- life and health
- travel time

Environmental and natural capital

A2.2 Where potential effects on natural capital are identified by the screening questions in [Chapter 6](#), the 4-step approach in [Box 19](#) can be used to identify whether and how an intervention may affect stocks of natural capital and the benefits they provide. Further guidance can be provided by Department for Environment Food and Rural Affairs (DEFRA) at EnvironmentAnalysis@defra.gsi.gov.uk.

A2.3 In addition to the process in [Box 19](#), further points relevant to the natural capital approach include:

- an understanding of biological and physical changes in natural assets is the starting point of the appraisal and associated economic valuation (for example, understanding the impacts of a woodland creation and carbon sequestration project).
- environmental effects and associated values are often geographically specific. The recreational value of new or destroyed woodlands, publicly accessible green space or changes in air quality may be greater in or near densely populated locations than more remote areas. Recreational values may be greater where there are fewer alternative sites.
- the sustainable use of natural assets should also be considered. In addition to the marginal valuation of a loss in services, the degradation of a renewable asset should be assessed, such as the exploitation of a fishery or a loss in condition of the underlying biodiversity. Non-marginal effects such as reaching ecological tipping points might lead to dramatic or irreversible loss in the asset under consideration. This would result in a loss of environmental services and welfare. Cumulative effects of multiple investment decisions upon the underpinning stocks of natural capital should also be considered.
- future scarcity values for goods and services are likely to rise over time. This is due to the rising demand for goods and services which depend on natural capital and the services it provides, combined with limited, and in some cases diminishing, underlying stocks. This is not a problem easily addressed through the appraisal of individual interventions, as diminishing underlying stocks may involve [non-marginal effects](#). In addition, if assumptions about future prices exceed the long term growth of per-capita real income, this must be agreed with HM Treasury.

Box 19. Identifying whether an intervention may affect Natural Capital

The four steps to consider whether and how an intervention may affect stocks of natural capital are:

- **Step 1** – identify the environmental context of the proposal (“what and where?”):
 - identify scale, location, outputs and spatial reach of the intervention.
 - what types of land cover and natural system will the proposal affect, directly or indirectly (e.g. farmland, urban green space, woodland, freshwaters, moorland, coastal margins)?
- **Step 2** – consider bio-physical effects on natural assets (“how?”):
 - which natural assets (such as land use, water bodies, species, wildlife habitats and soils) are specifically likely to be affected?
 - this step facilitates the assessment of relevant welfare effects in Step 3, as well as informing on the physical sustainability of natural stocks.
- **Step 3** – consider the social welfare implications of the bio-physical effects identified in Step 2 (“what consequences?”):
 - how are environmental goods and services to society affected by the changes to the assets? These goods and services may be classified as:
 - i **“provisioning”** services such as supply of food, fuel, fibre and water which typically have market values.
 - ii **“regulating”** services such as water quality and quantity regulation, climate regulation, pollination, air quality regulation.
 - iii **“cultural”** services such as landscape and environmental spaces for recreation amenity, and cultural heritage.
 - “regulating” and “cultural” services do not typically have direct market values. The effects should be identified as far as possible and proportionately quantified and monetised. Unmonetised factors should be treated as recommended for all interventions.
- **Step 4** – consider uncertainties and implementation:
 - environmental effects may be uncertain. Therefore, consideration needs to be given to quantifying these uncertainties as risks that must be costed and managed, so that they can be minimised, mitigated or where possible avoided.
 - critical factors should be identified and arrangements for monitoring included as part of intervention proposals in order to manage risks and optimise outcomes. See Annex 5 on risk management.
 - identification of mitigating measures is particularly important so that risks to natural assets can be minimised and benefits maximised.

A2.4 Multiple impacts may need to be measured and valued. For example, the costs of a proposal that would destroy woodland could include the loss of the following: timber value, carbon sequestration, recreational value, biodiversity and “non-use” values, as well as direct externalities such as noise and air quality. Care should be taken to avoid double-counting where impacts overlap.

Approaches to environmental valuation

A2.5 For initial estimates of environmental impacts, or valuing secondary impacts, Defra's [Environmental Valuation Look-up Tool](#) provides access to environmental valuation evidence. These indicative values should be combined with changes in the physical quantity of the environmental good or impact under consideration.

A2.6 The Look-up Tool provides a starting point for scoping the requirements for more robust valuation, such as appropriate Value Transfer methods or commissioning bespoke economic valuation studies. Value Transfer refers to the use of existing economic valuation evidence in a new appraisal context.²³ Other sources for Value Transfer include:

- the international [Environmental Valuation Reference Inventory](#) which contains over 400 UK environmental valuation studies
- the Forestry Commission's searchable [Woodland Valuation Tool](#) which collates all valuation studies relevant to the various services provided by woodland

A2.7 The following sections summarise valuation approaches and provide indicative estimates for specific environmental services and effects. A primary valuation study may be justified where there is no relevant valuation evidence and environmental benefits are critical to decision making.

Effects on air quality

A2.8 Atmospheric pollution can have significant effects on health, quality of life, economic activity and the functioning of ecosystems. Three approaches can be used for valuation:²⁴

1. if impacts are likely to be less than £50 million and do not affect compliance with legal limits then a "damage cost" approach is appropriate. This involves multiplying emissions changes by pre-calculated unit costs, described further below. This is often used to value the consequences of changes in pollution e.g. on health, crops and buildings.
2. if impacts are greater than £50 million then the "impact pathway" approach should be considered. This involves bespoke modelling specific to the intervention.
3. an "abatement cost" approach should be used in the limited instances where a proposal could affect compliance with legal limits. This involves estimating the least costly way of mitigating the impact of the proposal to ensure continued compliance with legal obligations.

A2.9 Damage costs are a relatively simple way to value changes in air pollution, as full modelling can be resource intensive. Damage costs are estimates of the societal cost of a change in emissions of different pollutants. This approach is appropriate for small air quality impacts (below £50 million) provided the proposal does not affect areas likely to breach legal air quality limits. Damage costs are calculated per year and should be multiplied by the number of years to which they apply. Full guidance and the latest damage cost estimates are available from [DEFRA](#).

Noise

A2.10 Noise has a social cost. It can affect health, wellbeing, productivity and the natural environment. Generic appraisal values are shown in [Table 4](#) and [Table 5](#). These are marginal annual values for changes in total road, rail and aircraft noise exposure. These values can be added for changes of more than one decibel and should be multiplied by the number of years and households to which they apply. Where the effect of noise is likely to be a substantial or a decisive

²³ Further information on Value Transfer methods is available on the [DEFRA web pages](#).

²⁴ Please contact IGCB@defra.gsi.gov.uk to discuss the most appropriate approach.

factor for an intervention, a detailed assessment may be justified. Full tables, more information on how the values in the table below are calculated and further guidance can be found on the [DEFRA webpages](#).

Table 4. Change in Noise Metric by Decibel (dBA) – Daytime per Household per Decibel Change, Central Values (2014 Prices)

Change in noise metric by decibel (dBA) – daytime		Road	Rail	Aircraft
45.0	46.0	£11.28	£3.90	£15.61
55.0	56.0	£51.22	£16.98	£49.01
65.0	66.0	£103.96	£46.34	£79.82
75.0	76.0	£175.04	£93.31	£114.75

Table 5. Change in Noise Metric by Decibel (dBA) – Night Time per Household per Decibel Change, Central Values (2014 Prices)

Change in noise metric by decibel (dBA) – night time		Road	Rail	Aircraft
45.0	46.0	£29.20	£13.59	£37.93
55.0	56.0	£57.91	£28.25	£66.56
65.0	66.0	£86.62	£42.92	£95.19
75.0	76.0	£86.62	£42.92	£95.19

Waste

A2.11 Where a proposal affects the flow of materials or waste it may be possible to access data on environmental externalities from Life Cycle Assessment (LCA) studies.²⁵ LCA is the compilation and evaluation of the inputs, outputs and the potential environmental impacts of a product system throughout its life cycle. LCA studies and databases cover air pollution, greenhouse gas emissions, resource depletion, aquatic eco-toxicity, human toxicity and other issues. These are expressed either as mid-point indicators (e.g. tonnes of CO₂ equivalent emissions) or end-point indicators (e.g. human health measured in Disability Adjusted Life Years).

A2.12 European data to feed into LCAs are publicised via the EU, although a range of other databases are in common use. When using published studies, it is important to ensure that the study is representative of the situation to which the data is being applied.

Recreation

A2.13 The recreational value of the natural environment varies with the type of habitat, location, population density and the availability of substitute recreational opportunities. The University of Exeter has developed a map-based web interface which captures these complexities. The [Outdoor Recreation Valuation \(ORVal\) Tool](#) uses a range of spatial data layers to model the visitation rates and recreational welfare benefits that are provided by accessible green space in England and Wales. The ORVal Tool allows users to explore existing recreational values of individual or multiple sites as well as the welfare effects of creating or altering sites. It is relevant for national and local appraisals where outdoor recreational opportunities are likely to be affected.

²⁵ Government analysis on carbon emissions for multiple sectors, including material use and waste disposal, are based on multiple LCA studies that estimate greenhouse gas reporting conversion factors. The latest data are available online on the [Department for Business, Energy and Industrial Strategy web pages](#).

Effects on amenity value

A2.14 Activities such as waste disposal and quarrying of minerals and aggregates have social costs such as noise, congestion, dust, odours and visual intrusion. These can undermine public enjoyment of an area and generate adverse health impacts. Land contaminated from past industrial activity and pollution can also result in costs to society. Interventions that address these problems can generate benefits to residents, visitors and businesses.

A2.15 Hedonic pricing studies use econometric techniques to estimate a value for a good or service from a related market. The technique has been used to estimate the value of a wide range of environmental costs and benefits as they are reflected in local property prices. For example, analysis of house prices suggests that proximity to habitats, designated areas, heritage sites, domestic gardens and other natural amenities can add as much as £68,000 to the price of a £200,000 house in the UK, a premium of one-third.²⁶

A2.16 Hedonic valuation techniques using property price data help estimate relevant amenity values.²⁷ [Research for Defra](#) on the value of remediating contaminated land identified statistically significant differences in local property prices from remediation in a number of case study sites. More generally, changes in amenity value will depend on many factors including local circumstances, population density and the environmental change in question. Therefore, care needs to be taken in using or transferring values from existing studies. Amenity value can potentially overlap with local recreational values so where both are being used, care should be taken not to double count. In addition, property value effects reflect capitalised rather than annual changes in value.

Landscape

A2.17 Landscape provides the setting for people's day-to-day lives. It does not only refer to special or designated landscapes or the countryside. In the context of appraisal of environmental impacts, landscape benefits can relate to opportunities for recreational activities including nature viewing (e.g. bird watching), hiking, and the opportunities to experience views, sounds and scents. It can include aesthetic experience and visual amenity. Since landscape incorporates values for recreation, aesthetic values and cultural heritage, care is needed in order not to double count impacts.

Water quality and water resources

A2.18 Water use, water quality and flood risk are likely to be affected where land use is changed, development or infrastructure is promoted or certain technological change is facilitated. For example, transport schemes may lead to social costs where polluted water runs off from new roads into local watercourses, a housing development may place pressure on local water supplies and new types of power station may increase freshwater abstraction to the detriment of local natural assets. Water or flooding impacts should be considered and valued as part of options appraisal.

Valuation of water resources

A2.19 Valuation evidence is publicly available from Water Resources Management Plans developed by water companies in England and Wales. These include marginal costs (known as "average incremental social costs") of providing extra water output which may be used as a proxy for the economic value of water resource impacts. In the 2014 round of Management Plans, the industry average incremental social cost of provision of an additional million litres (a marginal mega litre) per day was around £1.5 million. This can be interpreted as the typical economic cost of replacing a marginal mega litre of water and may be suitable for high-level assessment of the value of water

²⁶ Gibbons et al. (2014) "The amenity value of English nature: a hedonic price approach" *Environmental Resource Economics*, 57: pp. 175-196.

²⁷ For example, see Ham et al. (2013) "The valuation of landfill disamenities in Birmingham" *Ecological Economics*, 85: pp. 116-129.

resource impacts. However regional variation can be significant, because options to augment resources are constrained to varying degrees, in part reflecting wider water scarcity. Care should therefore be taken in using these figures. For significant interventions, the relevant local Water Resource Management Plan should be consulted and Defra can advise at watereconomics@defra.gsi.gov.uk.

A2.20 The quality of water in the environment has an effect on biodiversity, amenity and recreation and was the subject of a major study in 2007, updated in 2013, called the National Water Environment Benefits Survey.²⁸ Estimates²⁹ of the average benefits of improvements in the quality of water in rivers, lakes, canals & coastal waters are:

- £17,400/km/year – value of improving water quality from bad to poor
- £20,100/km/year – value of improving water quality from poor to moderate
- £23,300/km/year – value of improving water quality from moderate to good

A2.21 For river basins with higher population densities, benefits are above these averages. Economic valuation of ecosystem services provided by the water environment, particularly in urban areas, is an active area of research. For additional information Defra can be contacted at watereconomics@defra.gsi.gov.uk.

Flood risk and coastal erosion

A2.22 Flooding and coastal erosion can lead to social costs (e.g. harm to people and damage to property, infrastructure and the environment). Typical damage per property, per flood event varies from around £7,000 to £10,000 for a flood of less than 0.1 metres in depth, to between £37,000 and £42,000 for a flood in excess of 1.2 metres in depth.

A2.23 To estimate the changing risk of flooding and coastal erosion over time, risk is generally measured in terms of changes to Annual Average Damages (AAD). This is the probability-weighted resource cost of flood damage to property and infrastructure, plus adverse health impacts and the resource costs of disruption. Estimating AADs for large scale flood and coastal erosion requires complex hydraulic modelling to estimate the probability and severity of flooding and/or coastal erosion, and its likely impact on people and assets in a defined spatial area.

A2.24 Generic national Weighted Annual Average Damage (WAAD) estimates are available for broader-scale, high-level scoping analysis. These are national average, per property, annual damage estimates and have been developed for residential properties across flood events with different probabilities and levels of flood warning service. The estimates for an average house in 2017 prices range from the following:

- a property with no flood protection and no flood warning service – £5,054 per property, per annum
- a property with existing protection against a “1 in 200 chance” (0.5% annual probability) and a flood warning service of more than 8 hours – £39 per property, per annum

²⁸ For a summary of values see [the Environment Agency web pages](#). In addition, the water companies run customer surveys ahead of each five-yearly business planning round (most recently in 2013) which include stated preference elements to determine customers’ local willingness to pay for various improvements in water services, often including the quality of the local water environment.

²⁹ Based on estimates for each river basin and catchment in England and Wales.

A2.25 Local economic output and employment impacts of flooding can be material, though as with other local impacts, the potential for displacement at the national level should be recognised. Defra provides a toolkit for assessing such impacts.³⁰ For further guidance see the Environment Agency's [Flood and Coastal Erosion Risk Management Appraisal Guidance \(Environment Agency 2010\)](#) and the online [Flood and Coastal Erosion Risk Management Handbook and Data for Economic Appraisal 2017](#).

Vulnerability to climate change

A2.26 The [Climate Change Risk Assessment \(CCRA\)](#) should be used to consider current and potential future climate risks and vulnerability to risks of an intervention. The CCRA provides a framework that quantifies interactions with climate risk. It enables a consideration of the role of climate in altering the scale and distribution of costs and benefits over the lifetime of the proposal. Supplementary guidance, [Accounting for the effects of Climate Change](#) provides steps to determine whether climate risks are relevant in relation to the appraisal of an intervention.

Biodiversity

A2.27 Biodiversity can be thought of as a core component of natural capital that supports the provision of environmental goods and services to people. It is defined by the [Convention on Biological Diversity](#) as 'the variability among living organisms from all sources including terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and ecosystems'.

A2.28 Valuation is typically estimated per hectare or per household, using stated preference methods. Biodiversity may be reflected by, or associated with other benefits e.g. recreation, pollination, water quality and amenity. To avoid double counting, biodiversity should only be valued where it directly impacts human wellbeing and where it is additional to other benefits. For example, non-use value for biodiversity represents a legitimate additional category of value that can be added to direct and indirect use values for final goods and services.

A2.29 Defra have published a [discussion paper](#) which presents a broad discussion on valuing diversity in the appraisal context and specific guidance on biodiversity values. In cases where available stated preference estimates of biodiversity value are insufficiently robust for use, an alternative is to use quantitative metrics of biodiversity change as objectives and calculate the costs of delivering those objectives.³¹

Land values

A2.30 Land value changes arising from a change in land use may be used to derive a social value for use in appraisal. This can provide a convenient way of estimating the impact of an intervention rather than valuing the underlying factors that caused the value to change.

A2.31 Land prices reflect different attributes of the land's use including planning permission, amenity value, proximity to urban centres and transport connectivity. Land values increased by transport improvements may rise due both to the change in planning status that facilitates development and the benefits from the transport scheme.

³⁰ "Flood and Coastal Erosion Risk Management (FCERM) and the Wider Economy" Frontier Economics for Defra, 2014. Available at <http://randd.defra.gov.uk> by searching on "FD2662".

³¹ For an example see Bateman et al (2013) "Bringing ecosystem services into economic decision making: Land use in the UK" Science, Vol 341, No. 6141: 45-50, 5th July 2013. DOI: 10.1126/science.1234379.

A2.32 The value of an intervention that enables a change in use and subsequent new development may include:

- the private benefit associated with the change in land use, as represented by the uplift in land value due to a more productive use. This is defined as the value of the land in its new use (e.g. commercial or residential) minus the value of the land in its existing use and it typically accrues to landowners.
- the net external effects of the resulting development on society, such as loss or gain in amenity value, transport costs, health or environmental effects and land use value changes etc.

A2.33 To understand how land values can help in the appraisal of a potential development, it is important to understand the factors that determine the land's price. The private benefit or Gross Development Value (GDV) is the estimated total revenue that could be obtained from a development, for housing it would be:

$$GDV = \text{house prices} \times \text{number of dwellings}$$

A2.34 The residual method of land valuation stipulates the maximum price that will be paid for the land (commercially) after accounting for development costs and a minimum level of profit:

$$\text{Land price} = GDV - (\text{development costs} + \text{fees} + \text{profit})$$

A2.35 Therefore the land price reflects the value of the land in its new use (the GDV) less the expected development costs and minimum required profit. In a well-functioning market, competition for the right to develop the land drives the price of land up to a point where a normal level of profit is achieved, where the change is equal to the economic rent extracted from the land.

A2.36 In appraisal terms, the difference between this new land value and its previous land value represents the net private benefits of the development. This is the final value of the site, less development costs, less the value of the land in its "old" use. Any increase as a result of a change in use reflects the economic efficiency benefits of converting this land into a more productive use.

A2.37 To estimate the full value to society of the change in use wider effects need to be accounted for. The Net Present Social Value (NPSV) of a development is the discounted sum of the land value uplift and the net value of wider effects, taking into account potential deadweight and displacement. The range of wider effects associated with a development includes the amenity cost or benefit associated with a development, potential health effects and any transportation effects arising from the development. Further details of potential external effects and appraisal values are given in the [MHCLG Appraisal Guide](#). When considering the wide range of positive and negative effects, double counting of benefits needs to be avoided. For transport appraisal the [Department for Transport's \(DfT\) Web-Tag guidance](#) should be used.

A2.38 Land value data is derived from market data which is dependent on individuals' and firms' valuation of a specific piece of land. Where local land value data is available, this information can be used to appraise the net impact of a development. However, where this data is not readily available, illustrative land value data from the Valuation Office Agency (VOA) is available. This is included in the [MHCLG Appraisal Guide](#) and the MHCLG publication [Land value estimates for policy appraisal](#). It provides estimates for the average prices of residential, greenfield and brownfield land in England from 2014, with residential land split by local authority. Further guidance on the appraisal of transport dependent land developments can be found in [WebTAG Unit A2.3](#).

Energy efficiency and Greenhouse Gas (GHG) values

A2.39 This is a high-level guide to valuing Greenhouse Gas (GHG) emissions and energy use for appraisal purposes. [BEIS publish](#) more extensive guidance, background, rationale and relevant data tables that should be used.

A2.40 The steps given below are based on a change in fuel or energy use. Most interventions will have other objectives and will involve energy use as part of a wider effect. In both cases, total energy use and total GHG emissions should be quantified and costed, using the data tables referred to above and included with other costs.

A2.41 Multiplying the fuel use in each year by the Long Run Variable Cost (LRVC) for that fuel will give the societal value in fuel usage for that period (excluding GHG emissions, which are calculated separately):

Social cost of energy = fuel consumption x Long Run Variable Cost (LRVC)

- **Step 1 – quantify energy use or efficiency.** Identify the fuel or electricity consumption for each year, distinguished by type of fuel and the sector in which the changes are incurred (e.g. residential, commercial, industry). Changes should be measured in megawatt hours (MWh).³²
- **Step 2 – value energy or fuel use.** The LRVC reflects the production and supply costs of energy which vary according to the amount of energy supplied. They will vary according to the type of fuel, sector being supplied and prevailing fuel prices. Low, central and high LRVC assumptions for different fuels and sectors are published on the BEIS webpages in [data tables](#).
- **Step 3 – convert energy use into GHG emissions.** The formula below shows how to quantify GHG emissions for a given energy use. This uses the energy changes estimated in 'Step 1', converted into a GHG measure. An emission factor is used to estimate the amount of GHG emissions from burning a unit of fuel. These vary by fuel type and reflect the mix of fuels required for electricity. The global warming potential of GHG emissions is measured as the equivalent amount of carbon dioxide (CO₂) that would give this warming. The standard unit of account is equivalent tonnes (tCO₂e) or kilograms (kgCO₂e) of carbon dioxide. Various emission factors can be found in the [data tables](#). For electricity, the consumption-based long-run marginal emission factor should be used for changes in energy demand. The generation-based emission factors are only used for energy production rather than energy demand. Energy production is generally greater than energy demand to account for losses during the transport of energy to final consumers.

GHG = fuel use x emissions factor

Cost of GHG = GHG (kgCO₂e) x value of carbon

³² Conversion factors for converting between calorific units of measurement (i.e. tonnes of oil equivalent, calories, therms, joules, or watt hours) are available in Annex B of the online guidance "Valuation of energy use and greenhouse gas emissions for appraisal" available on the [Business, Energy and Industrial Strategy webpages](#). Conversion factors for converting volume-based or weight-based measurements into calorific units of measurement (which will vary according to the fuel) can be found in Table A1, Annex A, of the Digest of UK Energy Statistics.

- **Step 4 – value to society of emissions.** GHG values are based on the economic cost of mitigating a unit of carbon. The carbon value will vary depending on the sector from which the emissions occur:
 - **the traded sector** is defined as those activities covered by the EU Emissions Trading System (EU ETS) which sets a market price for carbon. It generally covers all power generation, many energy-intensive industries, and intra-EU aviation. Therefore, all electricity consumption is covered by the EU ETS and is in the traded sector.
 - **the non-traded sector** – includes all other energy consumption, including all household and non-aviation transport fuel use (excluding electricity).

A2.42 Carbon value assumptions for the traded and non-traded sectors are available for 3 different scenarios (low, central, and high) to enable sensitivity analysis. The values can be found in the [data tables](#). Further detail on how to map energy use to the traded and non-traded sectors is available in the [BEIS online guidance](#).

Life and health

Risks to life and health

A2.43 This section outlines some approaches to the measurement and valuation of risks to life and health. In addition to valuing changes to the risk of a statistically prevented fatality, other methods most often used in appraisal are statistical life-years (SLYs), quality-adjusted life-years (QALYs) and sometimes disability-adjusted life-years (DALYs) which are explained further below. The choice will depend on the appraisal and should be agreed with the approving authority.

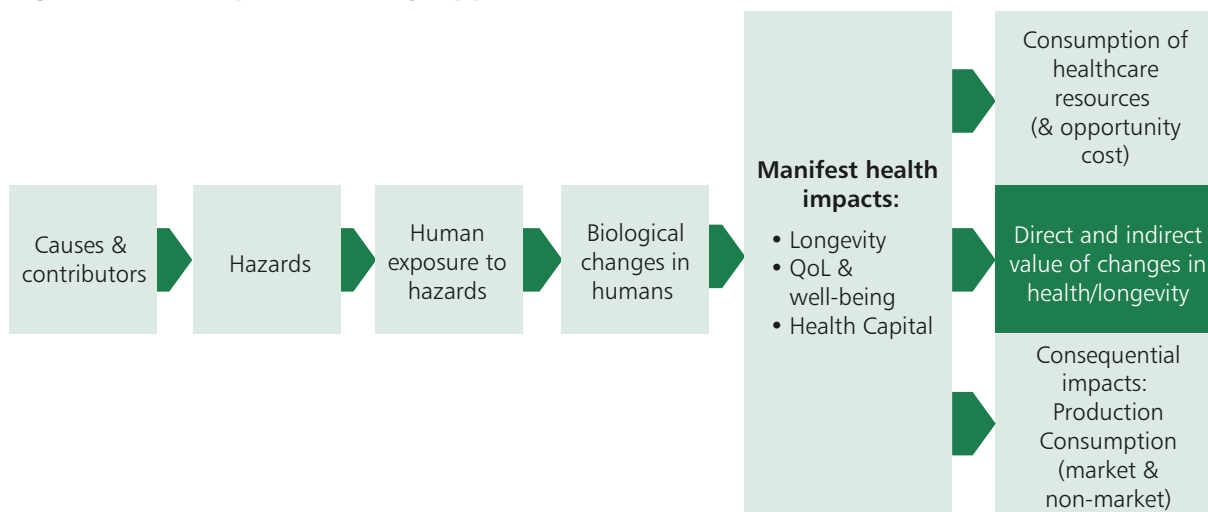
A2.44 Measurement of health impact may be expressed in the two dimensions of length of life (longevity), and health-related quality of life (QoL). Different risks, and interventions to reduce those risks, may affect different dimensions. Some risks entail significant loss of longevity, some QoL rather than longevity and some both. Measurements using numbers of fatalities or SLYs reflect the longevity dimension only, while QALYs reflect both longevity and QoL dimensions.

A2.45 On grounds of equity in appraisal QALY values, SLY values and the valuation of a statistically prevented fatality (VPF) are based on average values from representative samples of the population (who differ in their incomes, preferences, age, states of health and other circumstances). These values are used when analysing and planning the provision of assets, goods and services at a population or sub-population level. They are not designed for use in contexts such as situations of emergency or rescue.

Life and health effects

A2.46 Health affects the ability to produce and consume goods or services and the ability to derive welfare and well-being directly. The impact pathway approach is a way of structuring analysis of the effects of external factors from causes to consequences for health and life. A general model which, is used to structure this approach, is shown in [Figure 5](#).

Figure 5. The Impact Pathway Approach



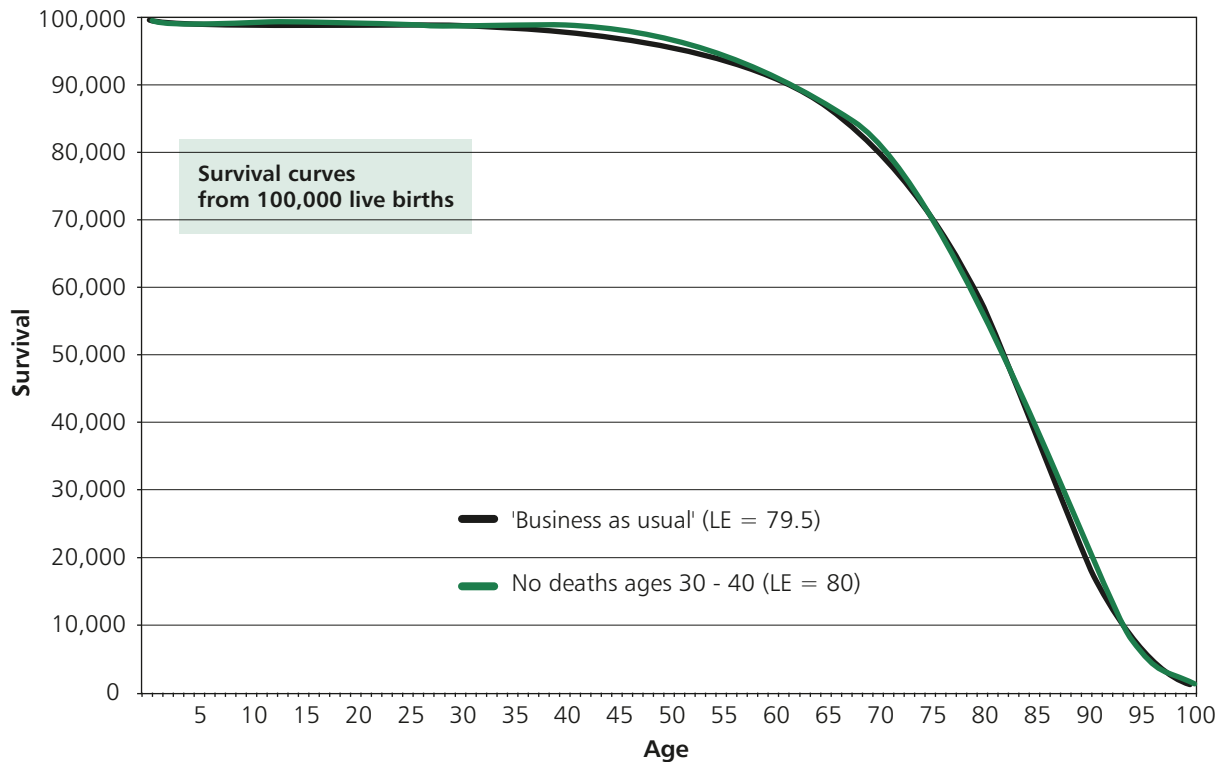
A2.47 An example of a biological change could be hypertension (high blood pressure). This can be caused by human exposure to hazards such as lead in petrol, sustained environmental noise, salty food, high consumption of alcohol, smoking, and lack of exercise. Hypertension is a cause of angina, heart attacks and stroke, typically affecting life expectancy, QoL and the consumption of healthcare resources. These then affect participation in paid and unpaid production, paid for consumption and not paid for consumption (such as informal care), and the health or welfare of others (e.g. family members). Interventions at any point in the pathway may have health and longevity consequences. At whatever stage the intervention occurs, consequential impacts along the pathway should be considered, including:

- the opportunity cost (or benefit) of shifts in the consumption of healthcare resources alongside other costs of the intervention
- the direct value of the change in health or longevity
- indirect and consequential impacts

Measuring and valuing risks to longevity

A2.48 For Social Cost Benefit Analysis involving risks to longevity, clarity is required concerning how length of life is affected by the risk or intervention. Longevity can be measured as life expectancy. This can be expressed as the area under a survival curve, which shows the likelihood of surviving to any given age, as illustrated in [Figure 6](#). Life expectancy is a statistical expectation of the risk of dying at any given age, rather than a specific number of years. If for example a cohort of 100,000 people faced a 1% risk of dying aged 30 to 40, and an intervention could eliminate this risk, the intervention could be described as preventing 1,000 fatalities.

A2.49 The black line in [Figure 6](#) represents the survival profile without the intervention and the green line with elimination of all 1,000 deaths between the ages of 30 and 40. The cohort collectively would live an extra 45,000 statistical life-years (SLYs), compared with Business As Usual. The cohort's life expectancy would increase by 0.45 years per person; and the unknown 1,000 people whose early deaths are prevented would each gain, on average, 45 years of life expectancy. They are not certain to live an extra 45 years, this is their average statistical expectation of life. This valuation method does not relate to "life-or-death" circumstances affecting specific individuals. It is unknown which members of the cohort would be the prevented fatalities.

Figure 6. Illustration of longevity effects

Source: Illustrative analysis provided by the Department of Health and Social Care

A2.50 Monetary valuations of a VPF have been used in transport appraisals for several decades. They derive from research conducted on behalf of DfT. The current value and references to the research on which it is based can be found [on the DfT webpages](#).

A2.51 The value of a SLY is derived from the same empirical evidence as a VPF. SLYs help with the appraisal of options where the number of years of life expectancy at risk differs between options; valuing impacts in terms of SLYs offers a way of allowing for this difference. The current monetary value for a SLY is £60,000 and is updated annually (see [DfT web pages](#) for further information).

Measuring health-related quality of life and QALYs

A2.52 QoL is the other key dimension used in health-related appraisal. The two dimensions of longevity and QoL are aggregated in the concept of a QALY. As risks, and interventions to reduce them, can affect QoL as well as longevity, QALYs can reflect this additional dimension. QALYs are calculated by multiplying the change in QoL by the duration (in years) – for example a reduction in QoL from 1.0 to 0.5 for 6 months equals the loss of 0.25 QALYs. While not necessarily as straightforward as measuring length of life, measuring QoL can be undertaken with simple instruments such as questionnaires. The most widely used of these in the UK is the EQ-5D. This measures QoL in 5 dimensions:

- mobility
- ability to self-care
- ability to carry out usual activities
- pain/discomfort
- anxiety/depression

A2.53 Each dimension is rated at one of 5 levels: no problems / slight problems / moderate problems / severe problems / extreme problems or unable. With 5 levels on 5 dimensions, EQ-5D is able to describe 3,125 (i.e. 5⁵) “health states”. Cardinal ratings for these health states – on a scale where 1 is equivalent to the best of health, and 0 to being dead – are available for the UK, based on the preferences of the population.

- Ratings between 0 and 1 for different health states described by the EQ-5D tool are available from the [EuroQol website](#)
- ideally the QoL ratings under the options being considered should, if possible, be sourced from people like those who would be affected (as commonly happens in clinical trials). However, if that is not feasible, QoL ratings for some common health states are available.³³
- monetary valuations of QALYs are available for the UK. The current monetary WTP value for a QALY is £60,000. Further information on the basis for the value of a QALY can be obtained by contacting the Department of Health and Social Care.

A2.54 Discounting of resources relating to health and life issues is carried out using the appropriate standard discount rate of 3.5% declining after 30 years. The value of VPFs, SLYs and QALY effects should be discounted at the health rate of 1.5%, declining after 30 years. See [Annex 6](#) for further information on the discount rate.

A2.55 DALYs are a measure of life-years adjusted for loss of quality of life and loss of life expectancy for people living with a health condition or its consequences. Unlike life expectancy, which is measured by the area below profiles such as the survival curves illustrated above, DALYs measure a loss of longevity aggregated with loss of quality of life (the area above a curve). Appraisal of an intervention is concerned with estimating the difference that it makes – hence the intervention’s impacts could be described in terms of QALYs gained or DALYs prevented. However, in practice, DALYs differ in some subtler ways and are used less often in the UK.

Travel Time

A2.56 Values of Travel Time Savings (VTTS) vary according to journey purposes, the characteristics of the journeys being made and the preferences of individual travellers. In the context of transport appraisal, it is standard practice to disaggregate VTTS by 3 journey purpose types:

- commuting – often to/from a usual place of work
- employer’s business – journeys made in the course of work
- other non-work – all other trips (such as shopping, leisure and personal trips)

A2.57 The VTTS for employer’s business trips represents the opportunity cost to the employer of time spent travelling by their employee. Businesses benefit from reduced travel times include improved access to suppliers or customers, which increase productivity by lowering the cost or raising the quality of inputs and widening the market a business can serve. It is these benefits that form the basis of values of employer’s business VTTS.

A2.58 For non-work (commuting and other non-work trips) the VTTS represents the value travellers place on the preferable activities they can undertake in the saved time. For instance, in response to a quicker commute a traveller could choose to spend more time at home with their families or move to a bigger house further away from work.

³³ See for example Stouthard, M. E. A., et al (1997) “Disability weights for diseases in the Netherlands” Amsterdam: Inst. Sociale Geneeskunde.

A2.59 VTTS differs by travelling conditions, for example:

- a higher value is placed on saving walking or waiting time than on saving time spent in a vehicle
- time spent in overcrowded conditions on public transport also carries a higher weight, the value being determined by the severity of the overcrowding
- reliability can also carry a premium and is commonly measured in terms of the standard deviation of journey time or average lateness in the case of public transport

A2.60 Values for use in VTTS are available in the [WebTAG data book](#) which is maintained and updated annually by DfT. Further, more detailed guidance on the use of VTTS in transport appraisal and information on the derivation of DfT's recommended VTTS can be found on the [DfT webpages](#).

Value transfer considerations for VTTS

A2.61 The DfT's published VTTS represent the typical values of time savings resulting from transport interventions. Therefore, the recommended standard VTTS may not be appropriate if the characteristics of the affected group are not similar transport users, or differ significantly from those of a typical transport scheme. In these circumstances the DfT values may still be used as an indication of the order of magnitude of impacts.

Unmonetisable values

A2.62 As part of short-list appraisal proportionate effort should be made to monetise all costs and benefits of each option (as set out in [Chapter 5](#)). The resources and effort should be related to the scale of the proposals under consideration. The scale may be judged in terms of financial costs or savings, social welfare costs or benefits and risks involved to society and the public sector.

A2.63 Where it is not possible to monetise certain costs or benefits they should be recorded and presented as part of the appraisal. Where possible these unmonetisable values should be assessed in another way, providing an understanding of their magnitude.

Straightforward unmonetisable values

A2.64 Significant unmonetisable values that are important enough to affect key choices about options should be considered at the long-list stage. Strategic examination of the long-list of options can deal with many factors that are likely to be unmonetisable when framing the analysis (as set out in [Chapter 4](#)). If valuing social benefits is likely to be difficult, it may still be possible to have an idea of potential costs. As part of indicative costing at the long-list stage this could involve estimating the additional costs of an option which delivers these greater benefits and considering whether the additional costs are worthwhile.

A2.65 At the short-list stage unmonetisable values should form part of the consideration for determining the preferred option. This will involve presenting an assessment of unmonetisable effects alongside estimates of NPSV and describing the potential impacts on a decision.

Complex unmonetisable values

A2.66 Complex, unmonetisable trade-offs occur where there are a number of important unmonetisable costs or benefits in different options that need to be balanced. Such trade-offs are often strategic in nature and involve the design of solutions based around alternative benefits against a limited budget.

A2.67 Multi-Criteria Decision Analysis (MCDA) using swing weighting is a technique that can be employed, in certain circumstances, at the long-listing stage to consider unmonetised trade-offs. MCDA should not be confused with simple weighting and scoring, which is sometimes referred to as Multi Criteria Analysis (MCA)³⁴ which is not a recommended Green Book approach. MCDA should not be used as a substitute for cost benefit analysis in appraising the short-list. Supplementary Green Book guidance, the [Multi-Criteria Analysis Manual](#), provides detailed guidance on how to undertake MCDA.

³⁴ Although MCA can sometimes go beyond simple weighting and scoring.

A3 ■ Sub-national and Distributional Analysis

A3.1 Distributional analysis is a term used to describe the assessment of the impact of interventions on different groups in society. Interventions may have different effects on individuals according to their characteristics (e.g. income level or geographical location). These effects could be a deliberate government objective or the unintended consequences of an intervention. These concepts are introduced in Chapters 3, 4 and 5.

A3.2 This annex provides more detail on:

- sub-national and local appraisal
- distributional analysis by income group

Sub-national and local appraisal

A3.3 Interventions can have distributional objectives or consequences which need to be assessed as part of appraisal. Regional, sub-national and local effects are distributional effects relating to geographically defined areas. This section covers the appraisal of interventions:

- with sub-national or regional distributional effects (e.g. those that involve some form of redistribution of welfare to different parts of the UK)
- which are targeted at one or more types of geographic area (e.g. interventions targeted at rural areas³⁵)
- which are targeted at one or more geographic area (e.g. a specific town or city)

A3.4 These interventions require additional analysis to UK level analysis. They require appraisal of the effects on both the target locations and other areas that may experience positive and negative spillover effects. The results should be presented alongside and separately from UK level analysis.

Leakage, displacement, substitution and deadweight

A3.5 The effects of these types of intervention should be appraised for:

- leakage** which is the extent to which effects “leak out” of a target area into others e.g. workers commuting into other areas to take up new employment opportunities
- displacement and diversion** which is the extent to which an increase in economic activity promoted by an intervention is offset by reductions in economic activity elsewhere. This may be relevant if the objective of an intervention is to create new employment but it leads to existing businesses from other areas moving to a target area
- substitution** where firms or consumers substitute one activity for another as a result of intervention
- deadweight** which refers to outcomes that would have occurred without the intervention

³⁵ Further information on the appraisal of effects in rural areas is available from Defra at <https://www.gov.uk/government/publications/rural-proofing>.

Employment and productivity effects

A3.6 [Chapter 6](#) sets out the treatment of productivity, labour supply and demand effects and multiplier effects. As part of a sub-national distributional analysis, in contrast to UK level appraisal of social value, first round labour demand effects can be included as an element of the appraisal. In addition supply chain effects for specific geographic areas may be included. This requires sound, objective evidence on which to estimate likely additionality after accounting for deadweight, substitution and displacement.

A3.7 The sub-national analysis which includes these effects in Net Present Social Value (NPSV) and Benefit Cost Ratios (BCRs) should be presented alongside the UK-wide results. In a similar way, the analysis of the impact of Official Development Assistance (ODA) on recipient countries' first round labour demand effects can also be included because the macro effects which rule out their inclusion in UK level analysis, do not apply in these cases.

A3.8 All other social costs and benefits should be treated the same in the calculation of local and UK-wide social value and proportionality should be judged in the same way.

A3.9 Data on these effects provided by beneficiaries of an intervention should be independently verified. Variability in data should be clearly stated and the results tested through sensitivity analysis. Ranges should be presented where there are high levels of uncertainty.

A3.10 Organisations routinely involved with these types of intervention should develop an objective, well researched evidence base to support decision making. The use of monitoring and evaluation for these types of intervention is very important, due to the relative scarcity of well supported objective data. From the outset, research and use of previous evaluation evidence is vital. This should be taken when setting SMART objectives and evaluating results. This will avoid the difficulty of retrospectively estimate impact without the appropriate information.

Distributional analysis by income group

A3.11 Appraisal may consider other sub-groups of the population in addition to those required under the [Public Sector Equality Duty](#). This section covers the assessment of welfare when an intervention has different impacts on individuals or households in different income groups. At a minimum, all significant potential gaining and losing groups of a policy should be identified.

Distributional weighting

A3.12 When assessing costs and benefits of different options it may be necessary or desirable to "weight" these costs and benefits, depending on which groups in society they fall on. This is in addition to estimating the "unweighted" costs and benefits, which is the minimum requirement of Social CBA. In weighted analysis, financial benefits for lower income households are given a higher social value than the equivalent benefits for higher income households. Weighted estimates should be presented alongside unweighted estimates to demonstrate the impact of the weighting process.

A3.13 The basis for distributional weights is the economic principle of the diminishing marginal utility of income. It states that the value of an additional pound of income is higher for a low-income recipient and lower for a high-income recipient. Broadly a value of 1 for the marginal utility of income would indicate that the utility of an additional pound is inversely proportional to the income of the recipient. An additional £1 of consumption received by someone earning £20,000 per year would be worth twice as much than to a person earning £40,000. Higher estimates of the marginal utility of income will mean the value of an additional pound declines more quickly relative to increases in income.

A3.14 A review of international evidence provides an estimate of the marginal utility of income at 1.3.³⁶ This is used by DWP in distributional analysis. The estimate of the marginal utility of income can be used to calculate welfare weights to adjust costs and benefits.

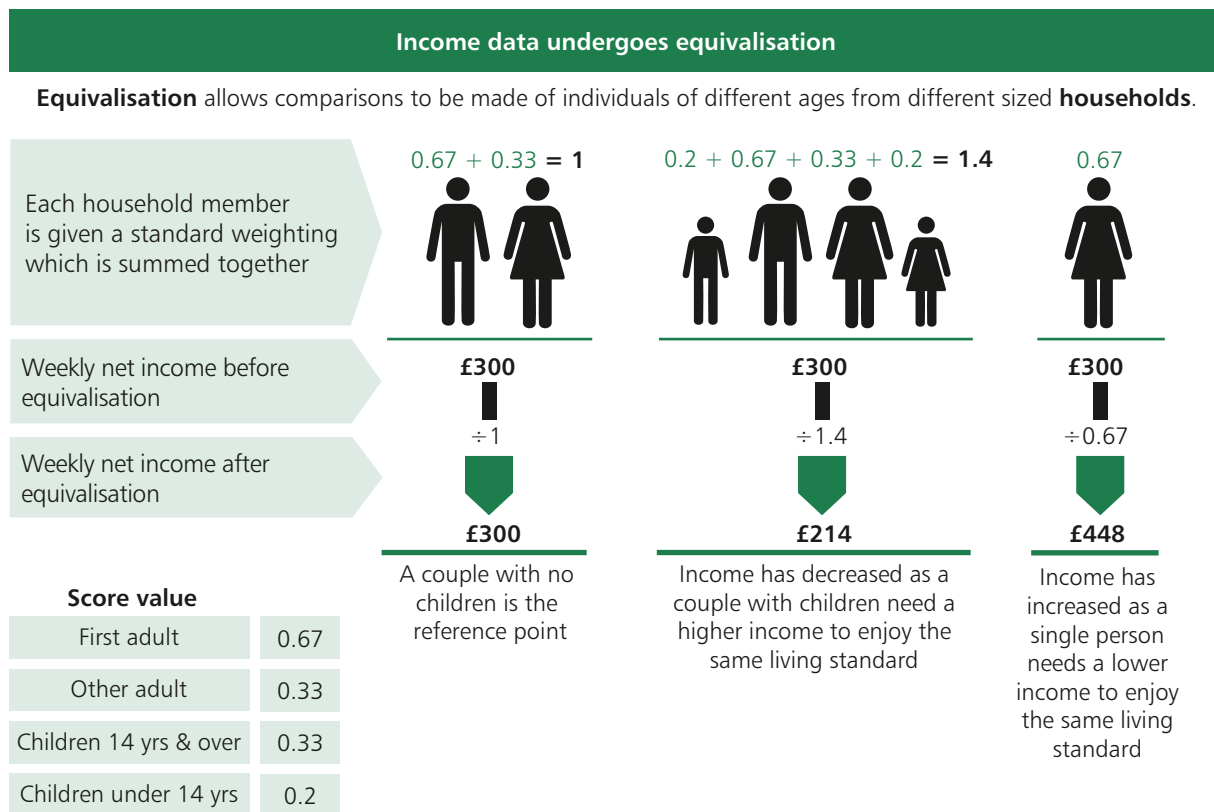
Equivalisation

A3.15 Where distributional effects are quantified by applying weights, it may also be necessary to apply “equivalisation” techniques. Often the distributional impact of policy will be estimated by household, however households can have different structures.

A3.16 Equivalisation applies a scaling factor to household income to adjust for composition (factors such as age, income and size) to standardise the welfare impact. This allows a consistent comparison in welfare terms between households of different structures. For example, where a single person would have a higher standard of living than a couple with the same household income, equivalisation produces a higher “equivalised income” for the single person to reflect this.

A3.17 An example of equivalisation is set out in [Figure 7](#), which DWP use in the annual statistical publication on poverty at the UK level, entitled [Households Below Average Income \(HBAI\)](#). The government commonly bases analyses on the household as this is the level at which budgeting decisions and benefit incomes are considered. In some circumstances, however, it may be appropriate to consider relative incomes at an individual level.

Figure 7. Methodology for Income Equivalisation



A3.18 If specific data is not available for an intervention’s target population, then data on incomes by quintile may be used. This is provided by the ONS and HBAI and summarised in [Table 6](#) below. [HBAI \(2017\)](#) presents weekly equivalised income (£) by quintile in 2015/16 prices and is updated annually. Ensuring this is representative of the income for the group concerned in a particular proposal is important and affects the accuracy of any estimates produced.

³⁶ Layard et al. (2008) “The marginal utility of income” *Journal of Public Economics*, Vol. 92, pp. 1846-1857.

Table 6. Quintile Groups of all Households Ranked by Equivalised Disposable Income (Based on Weekly Income Before Housing Costs 2015/16)

	Bottom	2nd	3rd (Median)	4th	Top	Mean of All Households
Final income (£)	244	363	481	638	946	593

Calculating welfare weights: practical steps

A3.19 To appraise the impact of policies using distributional weights, the equivalised income for two groups is estimated:

- taxpayers as funders of policies (group **t**) – who are assumed to have an average income (using median equivalised income)
- programme participants who benefit from the policies (group **p**) – who are assumed to be in the lowest equivalised income group, given DWP’s overall objectives. For other departments applying this approach, interventions may be targeted at groups with higher incomes. If that is the case a higher income estimate should be used.

A3.20 Using the “taxpayer” and “programme participant” approach welfare weights can be estimated as follows:

- divide median equivalised income of average taxpayers (proxied by median of all households) by the median equivalised income of programme participants (proxied by the quintile that matches the target for distributive effects)
- raise this number by the power of 1.3 (the estimate of elasticity of marginal utility of income as [set out above](#))
- the result is the redistributive effect for an individual member of the group being affected by a policy change
- [Fujiwara \(2010\)](#) uses this methodology to estimate a welfare weight of 2.5, based on income figures from the Office for National Statistics. Using more recent [2015 data](#)³⁷ yields a slightly lower welfare weight of 2.4.

A3.21 The weighted impact resulting from any redistribution is as follows:

$$\text{impact on society} = \text{change in income, group } p * \text{welfare} + \text{change in income, group } t$$

A3.22 There is uncertainty in both weighting and equivalisation methods. Presenting unweighted and weighted costs and benefits side-by-side shows the impact of the weightings. Testing the estimated weights through sensitivity analysis, including switching values where appropriate, is recommended. Switching values estimate the value that a key input variable (in this case the income weights) would need to take for a proposed intervention to switch from a recommended option to another option (see [Chapter 5](#)).

A3.23 Not all distributional effects can be or need to be quantified or monetised. To decide whether the intervention’s distributional effects are of a scale necessary to monetise or quantify them, the underlying rationale or potential consequences of the intervention should be considered.

A3.24 When considering how to apply the guidance above consider the following steps:

- does the policy have different financial impacts across income groups, or is redistribution a consequence? If yes, then consider applying [welfare weights](#).

³⁷ With median equivalised income per week for the bottom and middle quintile, respectively £244 and £481.

- is the analysis targeted at individuals or a mixture of households of different size and composition? If the latter then [equivalisation](#) may be required, prior to applying weights.
- is the income of the intervention group known? If known it should be used to calculate the welfare weight. If not, then the [HBAI income groups](#) can be used.

A4 ■ Public Private Partnerships

A4.1 This Annex provides further detail on how Public Private Partnership (PPP) options should be considered in appraisal. PPP options include PF2, a revised approach to PPPs as described in [A New Approach to Public Private Partnerships](#). More detail is available in the [HM Treasury Business Case Guidance](#).

A4.2 PPP options may be relevant to consider alongside other options as part of public service provision in options appraisal. PPP options can offer alternative funding models for public schemes. They can also offer strategic partnering arrangements for the cost-effective delivery and operation of public services. These include different possibilities for construction, operation, delivery and risk sharing, all of which have the potential for different costs, benefits and degrees of complexity relative to public sector provision or funding. There are also different risks and specific issues to consider in an assessment of a PPP option.

Overview of PPP options

A4.3 PPPs can be included as an option in long-list appraisal (set out in [Chapter 4](#)) alongside delivery alternatives such as direct public provision, outsourcing, market creation, not-for-profit solutions, changes to regulation, the use of nudge techniques and grant giving. The choice for how an option is delivered should be closely linked to the nature of the intervention and some interventions will be more amenable to PPP options than others.

PPP appraisal at the long-list stage

A4.4 When considering PPP at the long-list stage, qualitative questions help to identify whether PPP should be the “preferred way forward” or form part of the short-list. In addition to assessing a PPP option against critical success factors set out in [Chapter 4](#), the issues in [Box 20](#) should also be considered.

A4.5 Public sector organisations putting forward PPP proposals (the responsible organisation) will need to secure as much evidence as possible against the questions in [Box 20](#) as part of the long-list process. In particular, they need to consider the lifetime costs and risks involved in the project, including those arising from early termination. The risk assessment should also consider any major financial and operational risks that could affect the private partner over the life of the project.

Box 20. Qualitative Issues when Considering PPP Options

Issues to Consider	
Ability of the public sector to define and measure objectives and outputs	<input type="checkbox"/> Is the responsible organisation satisfied that long term contracts could be constructed for projects in the sector and that any contractual outputs could be objectively measured and assessed?
Risk allocation and management of risk by the private sector	<input type="checkbox"/> Is the responsible organisation sure that optimal risk allocation and service delivery is achieved through a PPP delivery model (including practical risk transfer to the private sector for better management)? <input type="checkbox"/> Is the private sector able to manage the risks associated with the programme more effectively than the responsible organisation? <input type="checkbox"/> Have service demand and income risks been fully assessed in the context of proposed contract length for the PPP option?
Operational flexibility	<input type="checkbox"/> Is the responsible organisation sure that there is an appropriate balance between the degree of operational flexibility desired and long term contracting based on up-front capital investment? <input type="checkbox"/> The responsible organisation should assess the likelihood and nature of variations during the life of the contract. <input type="checkbox"/> Can the service be implemented without unacceptably constraining the responsible organisation in Value for Money delivery of future operational objectives?
Equity, efficiency and accountability	<input type="checkbox"/> Is the responsible organisation sure there are no factors that mean direct service delivery is required, rather than a PPP contract?
Innovation by the private sector	<input type="checkbox"/> Is there scope for innovation in the design of the solution or the provision of services, including the need for removal of constraints by the public sector organisation?
Contract duration and residual value	<input type="checkbox"/> Is the responsible organisation sure that the advantages and disadvantages of the proposed contract length are understood? <input type="checkbox"/> This consideration should include how far into the future service demand can reasonably be predicted, the expected life of any assets, what the expected use of any asset or service could be post-contract, the residual value of any assets and the affordability of the contract.
Incentives and monitoring	<input type="checkbox"/> Can the contracts be drafted to avoid perverse incentives for the private sector? Are private sector partners actively able to manage the risks they will hold and be held accountable for doing so? <input type="checkbox"/> The responsible organisation should assess whether incentives for delivery or service levels can be enhanced through the proposed PPP payment mechanism. They should also be satisfied that the service can be independently assessed against an agreed standard.
The Market	<input type="checkbox"/> Is the private sector capable of delivering the required outcome? <input type="checkbox"/> The responsible organisation should assess whether a significant market with sufficient capacity for these services exists in the private sector. <input type="checkbox"/> They should also assess whether there is sufficient market appetite and whether other similar projects have been tendered to market. <input type="checkbox"/> Do potential private partners have the financial and managerial resources to manage the risks it is taking on?

Issues to Consider	
Timescale	<input type="checkbox"/> The responsible organisation should ensure that the procurement is feasible within the required timescale and that there is enough time for the resolution of key procurement issues.
Skills and resources	<input type="checkbox"/> The responsible organisation should ensure that it has the management expertise and capacity to define, deliver and support the service throughout the procurement and the subsequent delivery period.

PPP appraisal at the short-list stage

A4.6 Short-list appraisal of PPP options should take place in the same way as other options. This includes calculation of social value, valuation of wider social costs and benefits, consideration of unmonetisable benefits, application of optimism bias, risk costing and sensitivity analysis.

A4.7 The Green Book recommends that Business As Usual, a do-minimum option, the preferred way forward and at least one other viable alternative are included in the short-list. Where a PPP option is the preferred way forward at the long-list stage, at least one of the viable alternatives should be direct public provision. This is the required public sector comparator, which acts as a benchmark, and should be comparable in service output terms and asset maintenance. Additionally, if plausible, there should be an additional PPP version of the do-minimum to check for gold plating of the PPP option.

A4.8 When part of a business case changes through the process which alters cost, distribution of risk across different points in time or the transfer of risk between participants, this should be included and updated as part of Net Present Social Value (NPSV) and budget calculations. Changes to costs and risk which occur during contract negotiations, should be fed into the NPSV and public sector cost calculations. This means the appraisal of the preferred option is properly informed before a final contract is agreed.

Benefits and risks of PPP options

A4.9 In PPP contracts the quality of service provided and performance of the contractor are central to the delivery of VfM. Complexity and change hinder effective risk management. To be successful partnership arrangements need to be thoughtfully designed. Principal-agent theory explains that if the interests of an agent (in this case a private partner) employed by a principal (in this case a public sector organisation) are not aligned, then the agent is likely to act in their own interest. Therefore, from the principal's viewpoint, unintended and undesirable results may occur.³⁸

A4.10 The need to align the interests of agents and principals with minimum complexity means shared objectives need to be high level rather than minutely complex. The need to build in flexibility for future change should be considered. In the longer term, unforeseen changes in the wider environment are likely e.g. the demand or funding for a service may change. Being committed to an inflexible long term contract, that cannot be altered at a realistic cost, should be avoided. It is important to take account of previous evidence and the value of flexibility in longer term commercial arrangements.

A4.11 PPP options are about more than financial issues, although these are important. For example PPPs are cited as potentially offering higher levels of specialist and operational management expertise, greater management flexibility and focus and improved risk management. These issues should be considered on a case-by-case basis to produce realistic and objective estimates of

³⁸ Principal-agent theory here refers to the economic and organisational theory only and not to the concept of a principal or an agent in legal terms.

costs and benefits arising from an option involving PPP, to compare against alternative options. The bundling of design, build and maintenance activities can create better value in the right circumstances, by creating an incentive for high quality design and build.

Treatment of costs in PPP options

A4.12 A PPP option will still register as part of total public sector debt, but in certain circumstances may make capital available at an earlier date than other options. Costs may be brought forward in time and will also impact on future spending. The costs should be counted at the point at which they will accrue to the accounts of the organisation responsible. To reflect the true cost of the PPP option, appropriate provision for the full cost of the additional capital should be included in Cost Benefit calculations. This involves including private finance charges as a cost to the public sector. Additional costs of privately financed options need to be fully offset by additional benefits before a PPP option demonstrates a favourable Benefit Cost Ratio comparable with a directly financed option.

A4.13 A “comparable” public sector option is required to provide a benchmark for comparison of direct public provision and partnership options on a level playing field. This requires that the comparable public sector option is based on the same quantity and quality of service provision and the same levels of asset maintenance. It is therefore necessary to make adjustments for effective tax rates rather than a theoretical maximum. If uncertain, please contact the relevant HM Treasury spending team in the first instance to discuss the correct approach.

A4.14 National Accounts treatment of PPP should not be a reason for project approval. However, as recording in departmental budgets follows the National Accounts then it is necessary to ensure the correct treatment of costs. The classification of PPP projects and other procurement options in the National Accounts have different budgeting implications and this should be reflected in the methodology used to assess affordability.

A4.15 It is the responsibility of the organisation to come to a view on the expected classification of a proposal in the National Accounts. It should take an informed view on classification from the outset, keep this under review as the proposal and contract negotiation develops and reflect this in any business case. The features of the proposal may change during its development, which could change its classification. The responsible organisation should retain the budget flexibility necessary to deal with any such change. If the organisation requires advice contact HM Treasury as per the [Consolidated Budgeting Guidance](#).

A4.16 The UK National Accounting rules follow from the [European Standard of Regional and National Accounts \(ESA 2010\)](#) and the latest version of [Eurostat's Guide to the Statistical Treatment of PPPs](#). The Manual on Government Deficit and Debt (MGDD) sets out the rules that classification of a programme or project depends upon.³⁹ A project may be classified to the public sector in the National Accounts for various reasons, even where significant risk transfer is involved. The value of risk transferred should be included in the calculation of public sector costs and benefits and be included in the calculation of NPSV and sensitivity analysis.

Treatment of PPP options classified to the private sector

A4.17 For PPP options where costs are classified to the private sector in the National Accounts, the financial costs of the proposal are spread over the course of the contract. This is because they are part of the unitary payments made by the public sector to the private sector and public sector

³⁹ The Manual on Government Deficit and Debt (MGDD) has been updated annually for several years, please ensure that the most up to date version is used.

costs are charged to the year in which they accrue in accounts. See [Chapter 5](#) of the main Green Book text for the treatment of costs in economic analysis (estimates of social value) and financial analysis (estimates of public sector financial costs).

Treatment of PPP options classified to the public sector

A4.18 For PPP options where costs are classified to the public sector, capital costs are not spread over a scheme's lifetime. They instead occur relatively early in its implementation. As is the case for all other public capital spending, the costs accrue to the National Accounts (and therefore to the procuring public body's accounts) during the creation of the asset.

A4.19 The overall fiscal envelope is centrally determined in the Budget, as are departmental and other public sector bodies' budget allocations. Capital used should therefore be accounted for in the spending body's capital budgets in accordance with accounting rules. Payments that account for provision of services as part of a scheme and other costs to the PPP partner, including their cost of capital required to fund the scheme, are accrued to the accounts as they are charged during the life of the scheme.

A5 ■ Uncertainty, Optimism Bias and Risk

A5.1 This Annex covers the Green Book approach to uncertainty, optimism bias and risk, covering:

- definitions
- adjusting for optimism bias
- risk quantification
- risk management and categories of risk
- the interaction between risk and optimism bias
- reducing optimism bias
- project or programme contingency and optimism bias
- presentation of optimism bias in appraisal results

A5.2 The focus is on the application of optimism bias and quantification of risk, in the context of uncertainty about costs, benefits and time taken to deliver interventions. The approach set out here primarily applies to the appraisal and management of projects and programmes, usually associated with new public spending, but the principles are applicable to government appraisal more widely. [Green Book supplementary guidance](#) provides more information on the treatment of uncertainty and risk when valuing infrastructure.

Definitions

A5.3 In appraisal, uncertainty is often due to lack of evidence or understanding of the likely impact of new interventions. Research and previous evaluation evidence, pilot studies and evidence of what works can help to reduce this uncertainty.

A5.4 Optimism bias is the demonstrated systematic tendency for appraisers to be over-optimistic about key project parameters, including capital costs, operating costs, project duration and benefits delivery. The Green Book recommends applying specific adjustments for this at the outset of an appraisal. Optimism bias estimates are a form of reference class forecasting, which predicts future outcomes based on the outcomes for a group of similar past projects.

A5.5 Risks are specific uncertainties that arise from activities such as forecasting or implementation, the costs of which have been estimated. They are specific to an intervention and may be quantified and managed.

Adjusting for optimism bias

A5.6 The aim of adjusting for optimism bias is to provide a more realistic assessment of the initial estimates of costs, benefits and time taken to implement a project. As the appraisal develops, more accurate costing of project or programme specific risk management should be undertaken.

Accordingly, adjustments for optimism bias may be reduced as more reliable estimates of specific risks are made. Any reductions should be presented transparently and tested with sensitivity analysis where appropriate.

A5.7 Optimism bias adjustments are applied to reflect the level of risk identification and management that has taken place. In options where a higher level of risk has been factored into the calculation of costs at the outset, a lower optimism bias adjustment is appropriate. Steps 1 to 4 below explain how optimism bias adjustments should be applied:

□ **Step 1 – decide which category of adjustment it is most appropriate to use.**
Categories of generic spending are as follows:

- **standard building projects** involve construction of buildings that do not require special design, e.g. most accommodation projects including offices, living accommodation, general hospitals, prisons and airport terminal buildings.
- **non-standard building projects** involve construction of buildings that do require special design e.g. specialist innovative buildings, unusual output specifications, building with space constraints or complicated site characteristics. Specialist/innovative buildings could include specialist hospitals, innovative prisons, high technology facilities and other unique buildings or refurbishment projects.
- **standard civil engineering projects** involve construction of standard facilities or infrastructure e.g. most new roads and some utility projects.
- **non-standard civil engineering projects** involve construction of specialist facilities or infrastructure e.g. innovative rail, road, utility projects, or upgrade and extension projects.
- **equipment and development projects** involve provision of equipment and/or development of software and systems e.g. manufactured equipment, Information and Communication Technology (ICT) development projects or cutting-edge technology projects.
- **outsourcing projects** involve provision of hard and soft facilities or management services e.g. ICT services, facilities management or maintenance projects.

[Table 7](#) below provides adjustment percentages for these generic categories that should be used in the absence of more robust, organisation and project specific evidence. It is based on a [study by Mott MacDonald](#) into the size and causes of cost and time over-runs in past projects.

A project which includes several category types should be considered as a 'programme' with a number of 'projects' for assessment purposes. Each 'project' should be separately rated for optimism bias and risk. Where alternative options being considered involve different spending types this could result in different assumptions regarding optimism bias. If the effect is significant it should be clearly set out and justified within the presentation of results.

Table 7. Generic Optimism Bias Adjustment Percentages

Spending Type	Optimism Bias Adjustment (%)			
	Works Duration		Capital Expenditure	
	Lower	Upper	Lower	Upper
Standard buildings	1	4	2	24
Non-standard buildings	2	39	4	51
Standard civil engineering	1	20	3	44
Non-standard civil engineering	3	25	6	66
Equipment/development	10	54	10	200
Outsourcing	n/a	n/a	0	41

- **Step 2 – consider if the optimism bias adjustment can be reduced.** Reduce the upper bound adjustment to the extent risk has been identified and included in cost estimates. If appropriate consider the extent to which the remaining contributory factors are mitigated and apply a mitigating factor. The mitigation factor has a value between 0, which means that contributory factors are not mitigated at all, and 1, which means all contributory factors are fully mitigated. The value selected between 0 and 1 will be an evidence-based judgement of the extent to which risk has been mitigated at the outset, and needs to be justified. In practice this will mean reducing the optimism bias adjustment from the upper bound to the extent that risk has been costed.
- **Step 3 – apply the optimism bias adjustment determined in steps 1 and 2.** The present value of costs should be increased by the appropriate optimism bias factor. For example, if costs are -£10 million and the optimism bias factor is 40%, this would lead to optimism bias adjusted costs of -£14 million (i.e. $-\text{£}10 \text{ million} \times (1 + 0.4)$). If an appropriate optimism bias factor is available the present value of the benefits should also be adjusted (which would lead to a lower level of estimated benefits). The results should be added to estimate the total Net Present Social Value (NPSV) adjusted for optimism bias. This is the best estimate of the social value of an option, allowing for risk and optimism bias.
- **Step 4 – review the optimism bias adjustment at different stages of appraisal.** Optimism bias adjustment should be reduced in proportion to risk avoidance or risk mitigation measures taken. Objective and transparent evidence of the mitigation of contributory factors should be observed and verified independently before reductions are made. Procedures for this include the Gateway Review process. Further information can be found on the [Infrastructure and Projects Authority's assurance review toolkit webpages](#).

A5.8 Closer to implementation the optimism bias adjustment for a project can be reduced to its lower bound provided mitigating evidence is robust. This assumes that the cost of mitigation is less than the cost of managing any residual risks. The costs of risk avoidance should be built into the proposal in their entirety since they will be incurred irrespective of whether the risks materialise. The costs of mitigation are included as expected costs, which is cost of mitigation multiplied by likelihood of the risk occurring.

A5.9 Optimism bias should be applied to operating costs and benefits, as well as capital costs. Where there is no appropriate measurement of typical bias, the confidence intervals of key input variables can be used.

Monitoring and Sensitivity Analysis

A5.10 The time taken to complete policies, programmes or projects and the benefits achieved relative to expectations should be monitored and recorded. Monitoring costs in public organisations is an important factor in delivering Value for Money. Quantitative evaluation of schemes after implementation is vital for producing realistic estimates of optimism bias to be used in future. Monitoring and evaluation will also support improvements in costs, benefits and timing for use in appraisal.

A5.11 Switching values should also be checked to explore the following questions:

- by how much can benefits fall short of expectations if a proposal is to remain Value for Money? How likely is this?
- by how much can costs increase if the proposal is to remain worthwhile? How likely is this to happen?
- what will be the impact on benefits if costs are constrained?

Risk quantification

A5.12 Risk should be quantified and costed in a proportionate way. Where relevant this should include the costs of mitigation and the expected costs if risks materialise. The extent to which risk is identified allows the initial estimates of optimism bias to be reduced (as set out in [Step 4](#) above). As an appraisal develops the cost of risk should be estimated and included in the estimated costs of an intervention. This is not a mechanistic relationship and will be a judgement of the extent to which relevant risks have been identified and quantified. There are various techniques set out in the next sections that can be used to calculate risk costs.

Single point probability analysis

A5.13 An 'expected value' can be calculated by multiplying the probability of a risk occurring by the costs associated with a risk materialising – see [Box 21](#) below.

Box 21. Example of Single Point Probability

Case study: Single point analysis	
Annual cost of service	£2 million
Estimated additional cost of project overrun	£200,000
Estimated probability of risk occurring	10%
Estimated value of risk = £200,000 x 10%	£20,000

Multi-point probability analysis

A5.14 There are a range of possible values for any risk. A probability distribution recognises some are more likely than others. An example is given below in [Box 22](#). While some risks have low probability, they may have significant impacts on project outcomes and need to be closely managed by Senior Responsible Officers (SROs).

Box 22. Example of Multi-Point Probability**Case study: Expected costs of a construction project using multi-point analysis**

A facility is estimated to cost £50m to build. The expected costs associated with construction uncertainties are:

Possible cost (£m)	Difference from estimated cost (£m)	Estimated probability of the event occurring	Risk value (£m)
45	-5	0.1	-0.5
50	0	0.6	0
55	+5	0.3	+1.5

The most likely result is no extra cost (probability 60%). However, the expected additional cost (the sum of each possible result multiplied by its probability) is £1 million.

Decision trees and real options analysis

A5.15 Decision trees and real options analysis illustrate more complex alternative options and risks over time, especially when decisions are sequential. They can be used to illustrate alternative scenarios where key external risks are likely. They can also be used to clarify alternatives where decisions taken are either irrevocable or expensive to reverse. Where information is likely to increase over time this can illustrate the value of delaying decisions or leaving options open by making smaller decisions now that allow for larger decisions later.

A5.16 Decision trees provide a structure for calculating expected values in complex situations. They can be used to map out and understand the sequence of actions, decision points and events along an activity's path. Decision trees require that probabilities are either known or can be reasonably estimated. They can also be populated with information on costs and benefits.

Real Options Analysis

A5.17 A 'real option' is a choice that becomes available through an action or an investment opportunity. Real options analysis recognises information about uncertainty can change over time through research and learning, and initial decisions can be changed as a result. If the value of this flexibility is not accounted for, the social value of an option will be systematically underestimated.

A5.18 Real options analysis is particularly applicable to proposals that exhibit significant uncertainty following initial investment, but where learning opportunities and flexibility in future decisions can help mitigate this. It is most useful where knowledge that is relevant to the choice of options is growing. If there is limited flexibility in the future, the benefits of new information are unlikely to be realised.

A5.19 Decisions should be taken with the best available information, recognising that this may change in future and flexibility to respond should not be used to justify delay. In addition to considering the range of options available, describing how information is likely to be acquired through monitoring and evaluation should be incorporated into appraisal. In practice, a decision will only have value if it can be enforced. The length of time before exercising a decision will also affect its value. The greater the time for useful information to become available, the greater the scope for the value of a decision to vary.

A5.20 An example of real options analysis can be found in [Box 23](#) below.

Box 23. Example of Real Options Analysis

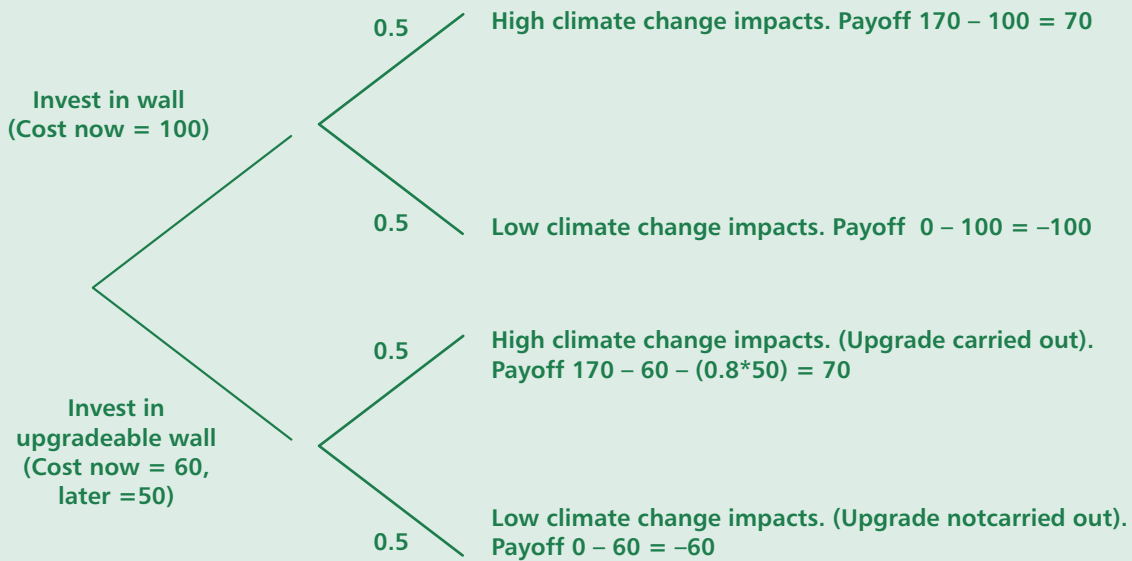
Case Study: Appraisal using a real options approach

Consider a proposal for investing in infrastructure protecting against the impacts of river flooding due to climate change. Because of time required to build the infrastructure, this is best done in advance but there is uncertainty about future impacts.

There are two options: invest in a wall, or invest in groundworks for a wall which has the option to be fully upgraded quickly in the future. There is an equal probability of high or low climate change impacts in the future.

The standard wall costs 100, and has benefits of 170 from avoided flooding if high climate change impacts occur (zero otherwise). The groundworks for the upgradeable wall cost 60, the future upgrade costs 50 and the benefit is also 170 if high climate change impacts occur. The upgrade can however be put off until there is more certainty about climate change.

The information can be set out in a decision tree:



Simplifying assumptions: residual damages under the “do not invest” strategies have been ignored; the discount factor for the future decision to upgrade or not is 0.8.

The expected value of investing in the standard wall is a simple net present calculation, calculating the expected costs and benefits of the investment. The NPV is $(0.5*70) + (0.5*-100) = -15$. This suggests the investment should not proceed.

Flexibility over the investment decision allows the possibility to upgrade in the future if the impacts of climate change are observed to be high. The expected value of this option can be calculated.

If the impacts of climate change turn out to be high enough to warrant upgrading, then the value of the investment is 70 in net present value terms. If the impacts are low, no upgrade is carried out but the earlier groundworks are sunk costs, totalling 60. However, these sunk costs are lower than in the case of the “standard” wall and overall, the expected value of investing now with the option to upgrade in the future is $(0.5*70) + (0.5*-60) = +5$.

Comparing the two approaches shows an NPV of -15 for the standard approach, and +5 for the Real Options approach. The Real Options approach also has an unmonetised benefit in allowing better views of the river for longer. Flexibility to upgrade in the future is reflected in the higher NPV, and switches the investment decision.

Source: Department for Environment, Food and Rural Affairs

Monte Carlo Analysis

A5.21 Monte Carlo analysis can be used to understand the impact of uncertainty in key evidence or assumptions that are inputs into estimates of cost, benefits or risks as part of an appraisal.

A5.22 Monte Carlo analysis is a simulation-based risk modelling technique that produces expected values and confidence intervals. The outputs are the result of many simulations that model the collective impact of a number of uncertainties. It is useful when there are a number of variables with significant uncertainties, which have known, or reasonably estimated, independent probability distributions. It requires a well estimated model of the likely impacts of an intervention and expert professional input from an operational researcher, statistician, econometrician, or other experienced practitioner.

A5.23 The technique is useful where variations in key inputs are expected and where they are associated with significant levels of risk mitigation costs, such as flood prevention. This can be used to determine what level of investment might be required to deal with extreme events such as rainfall events, which will have a statistical likelihood.

Risk management and categories of risk

A5.24 Risk management is defined as a structured approach to identifying, assessing and managing risks that are identified when designing an intervention or that materialise during its later lifecycle.

A5.25 Effective risk management helps the achievement of wider aims, such as change management, the efficient use of resources, better project management, minimising waste and fraud and supporting innovation.

Options for risk mitigation and management

A5.26 The public sector's risk exposure arises as a result of public policy decisions. Therefore, to optimise social value, risk must be consciously and proportionately managed. Good practice involves:

- identifying possible risks in advance
- putting mechanisms in place to minimise the likelihood risks materialise with adverse effects
- having processes in place to monitor risks and access reliable, up-to-date information
- having the right balance of control in place to mitigate the adverse consequences of risks if they materialise
- having decision making processes supported by a framework of risk analysis and evaluation
- early consultation with stakeholders – experience suggests costs tend to increase as more requirements to mitigate risk are identified. Early consultation will help to identify what those requirements are and how they may be addressed
- avoidance of irreversible decisions and a full assessment of costs, including the potential to delay decisions, allowing more time for the investigation of risks or alternative options
- pilot studies – acquiring more information about risks affecting a project through pilots allows steps to be taken to mitigate risk or increase the benefits

- design flexibility – where future demand and relative prices are uncertain, it may be worth choosing a flexible design. Breaking a project into stages, with reviews at points when it could be stopped or changed, can increase flexibility
- precautionary principle – precautionary action can be taken to mitigate risk. The precautionary principle states that because some outcomes are so undesirable, even though they may be very unlikely, precautionary action is justified. In cases where such risks have been identified, they should be drawn to the attention of senior management and expert advice sought
- procurement contractual risk – that can be contractually transferred to other parties and maintained through good contractual relationships e.g. insurance
- use of proven, rather than leading edge, technology – should be preferred if it reduces risk significantly while providing a proportion of the benefits of higher risk alternatives
- reinstating or developing different options – following the risk analysis, it may be desirable to reinstate options, or develop alternatives that are either less inherently risky or which deal with the risks more efficiently
- abandoning the proposal – finally, the proposal may be so risky that, whatever option is considered, it has to be abandoned

A5.27 Additional guidance on risk management can be obtained from [The Orange Book Management of Risk – Principles and Concepts](#) and further background information can be found in [Risk Analysis and Management for Projects \(RAMP\)](#).

Types of risk

A5.28 Risks can be assigned to 3 main categories which are not mutually exclusive – business, service and external risks.

A5.29 Business risks ([Box 24](#)) remain with the public sector and cannot be transferred. These include the loss of opportunity and poor Value for Money that occurs when schemes under-deliver or fail completely.

Box 24. Business Risks

Risk	Non-transferable risks of failure to the organisation.
Business risk	The risk an organisation fails to deliver its commitments and cannot meet its business objectives.
Reputational risk	The risk confidence in an organisation’s ability to fulfil its business objectives will be undermined.

A5.30 Service related risks may be shared between the public and private sectors. These are listed in [Box 25](#).

Box 25. Service Risks

Service risks	The risk a service is not fit for purpose.
Design risk	The risk a design cannot deliver services to required quality standards.
Planning risk	The risk implementation of a project fails to meet planning permission conditions, planning permission cannot be obtained or if obtained, can only be implemented at costs greater than in the original budget.
Build risk	The risk the construction of physical assets is not completed on time, to budget and specification.
Decant risk	The risk in accommodation projects of needing to decant staff/clients from one site to another.
Environmental risk	The risk the nature of the project has a major impact on an adjacent area and there is a strong likelihood of objection from the public.
Contractual risk	The risk from the contractual arrangements between two parties.
Operational risk	The risk operating costs vary from budget and that performance standards slip, or a service cannot be provided.
Availability and performance risk	The risk the amount of service provided is less than required under the contract.
Demand risk	The risk the demand for a service does not match the levels planned, projected or assumed. As the demand for a service may be partially controllable by the public body concerned, the risk to the public sector may be less than perceived by the private sector.
Volume risk	The risk actual usage of the service varies from the levels forecast.
Maintenance risk	The risk that the costs of keeping the assets in good condition vary from budget.
Technology risk	The risk that changes in technology result in services being provided using old technology.
Funding risk	The risk that the availability of funding leads to delays and reductions in scope.
Residual value risk	The risk due to the uncertainty of the physical asset at the end of the contract period.

A5.31 External risks ([Box 26](#) below) arise from the wider environment, not the intervention being appraised.

Box 26. External Risks

External Risk	The risks that are not connected to the proposal being considered.
Catastrophe risks	These unpredictable risks, which may be related to changes in economic growth, are allowed for in the social discount rate and do not have to be costed separately e.g. technological disruption, natural disasters, unexpected policy changes and other unforeseeable occurrences.
Regulatory risk	The risk a change in law or regulations will affect the costs or benefits of a project.

Transferring risk

A5.32 The responsibility for management of risk should be allocated to the organisation best placed to manage it whether in the public or private sector. The objective is optimal allocation of risk, not maximum transfer, and this is important to deliver Value for Money. Not all risks can be transferred.

A5.33 Successful risk transfer from the public sector to the private sector requires a clear understanding of risks, the likely impact they may have on the suppliers' incentives and financing costs and the limits of risk transfer which are possible. Commercial arrangements should reflect where the private sector has clear ownership, responsibility and control of certain risks it can manage more effectively.

A5.34 Public Private Partnership (PPP) arrangements may provide cost-effective and efficient risk management through risk transfer and sharing. Generally PPP schemes should transfer risks to the private sector when a supplier is better able to manage or influence the outcome. For example, the bundling of design, build and maintenance into a commercial agreement may affect the way they are planned, implemented and managed, and can lead to a higher quality outcome at the operational stage. Risks to be considered include:

- design and construction risk (to cost and/ or time)
- technology and obsolescence risks
- commissioning and operating risks (including maintenance)
- regulation and similar risks (including taxation, planning permission)
- demand (or volume/ usage), funding or income risks
- residual value risk
- project financing risk

Policy, programme and project level risk management

A5.35 Risk management strategies should be adopted in a way that is appropriate to their scale. A risk register is required to identify, quantify and value risk. It should identify who owns each risk, provide an assessment of the likelihood and an estimate of the impact on project outcomes. The purpose of the risk register is to provide oversight of risks and their management. Information on the status of each risk is also included and the register should be updated, maintained and reviewed. A basic risk register template is provided in [Box 27](#). A risk allocation table is also recommended, an example is set out in [Box 28](#).

Box 27. Risk Register

Risk number (unique within register)	
Risk type	
Author (who raised it)	
Date identified	
Date last updated	
Description	
Likelihood	
Interdependencies with other sources of risk	
Expected impact	
Bearer of risk	
Countermeasures	
Risk status and risk action status	

Box 28. Example of Risk Allocation Table

Risk	Scale	Bearer		Key Issues
		Purchaser	Provider	
Obsolescence	Low		✓	Assets require low levels of technology
Demand Risk	Med	✓		...
Design Risk	High		✓	...
Residual Value	Low	✓		...
3 rd Party Revenues	Low		✓	...
Regulatory Change	High	✓		...
Etc.

The interaction between risk, optimism bias and contingency

A5.36 As set out previously, as an appraisal is developed, risks and risk costs should be identified and the optimism bias allowance included at the outset should be reduced.

A5.37 The contributory factors leading to the need for optimism bias should be reviewed by appraisers. The main strategies for reducing the adjustment are:

- full identification of stakeholder requirements (including consultation)
- realistic scoping when selecting the shortlisted options
- accurate costing
- risk mitigation and management

A5.38 The contingency provision should reflect the sum of measured risk (costs of risks avoided, shared and mitigated on an expected likelihood basis) and optimism bias adjustment estimated in nominal prices. This reflects potential liabilities. Contingency provision should be allocated to the reserves of the overseeing or approving body, not a project or programme budget.

A6 ■ Discounting

A6.1 This Annex sets out the role of discounting in appraisal and how the 3.5% discount rate is derived. It also provides guidance on long term discounting and the treatment of intergenerational wealth transfers. Discounting and its role in appraisal are introduced in [Chapter 2](#) and [Chapter 5](#).

Role of discounting

A6.2 Discounting in the public sector allows costs and benefits with different time spans to be compared on a common “present value” basis. The public sector discount rate adjusts for social time preference, defined as the value society attaches to present, as opposed to future, consumption. It is based on comparisons of utility across different points in time or different generations.

A6.3 The Green Book discount rate, known as the Social Time Preference Rate (STPR), for use in UK government appraisal is set at 3.5% in real terms. This rate has been used in the UK since 2003. Exceptions to the use of the standard STPR are outlined below.

A6.4 The use of the STPR in public sector appraisal differs from private sector discounting. Decisions about the overall size of public spending and allocation of budgets are taken on a top down basis. The costs associated with raising funds (i.e. through taxes or debt issuance) are not used when appraising individual projects, programmes or policies. The cost of borrowing is not included as a decision variable on whether to go ahead with an individual project or not. In addition, there is no allowance for project specific risk in the STPR as risks should be identified and costed explicitly in appraisal. This approach to the STPR contrasts with private sector discounting which incorporates allowances for the cost of raising capital and compensation for risk.

Breakdown of the discount rate

A6.5 The STPR has two components:⁴⁰

- ‘time preference’ – the rate at which consumption and public spending are discounted over time, assuming no change in per capita consumption. This captures the preference for value now rather than later.
- ‘wealth effect’ – this reflects expected growth in per capita consumption over time, where future consumption will be higher relative to current consumption and is expected to have a lower utility.

A6.6 The STPR is expressed as:

- $r = \rho + \mu g$

where:

- r is the STPR

⁴⁰ Based on Ramsey F.P. (1928) "A Mathematical Theory of Saving" *Economic Journal*, Vol. 38, No. 152, pp. 543-559

- ρ (rho) is time preference comprising pure time preference (δ , delta) and catastrophic risk (L)
- μg is the wealth effect. The marginal utility of consumption (μ , mu), multiplied by expected growth rate of future real per capita consumption g

A6.7 As recognised in the 2003 Green Book there are a range of estimates of the individual components of the discount rate.⁴¹ Research continues to illustrate a range of plausible estimates but concludes that the overall discount rate of 3.5% remains within that range and is justifiable.⁴²

A6.8 The way in which the STPR is applied in the Green Book requires each component to be specified. This facilitates sensitivity analysis and clarifies treatment where individual components of the discount rate should be adjusted (e.g. for health discounting). The overall values ascribed to specific components of the STPR are retained from the 2003 edition as set out below. The calculation of the STPR is shown in [Box 29](#).

Estimates of ρ

A6.9 The estimate of ρ (rho) is the sum of:

- an allowance for time preference (δ)
- an allowance for unpredictable risks not normally included in appraisal, known as ‘catastrophic’ and ‘systemic’ risk (L)

A6.10 The risks contained in L could, for example, be disruptions due to unforeseeable and rapid technological advances that lead to obsolescence, or natural disasters that are not directly connected to the appraisal. L also includes a small premium for ‘systemic risk’ because costs and benefits are usually positively correlated to real income per capita. With regard to time preference, δ , Freeman, Groom and Spackman (2018)⁴³ survey the evidence and show that plausible values range from 0% to 1%. Coupled with an estimate of 1% for the risk component, L , this is compatible with a value of 1.5% for the overall value of ρ .

A6.11 For the purposes of the STPR the estimate of δ is retained at 0.5% and the estimate of L is retained at 1%. The estimate of ρ is therefore 1.5%.

Estimates of μ and g

A6.12 Available evidence suggests a range of plausible values of μ (mu). The 2003 edition of the Green Book set a value of 1. As set out in [Annex 3](#), the estimate used by DWP for distributional weighting is 1.3 (based on Layard et al. 2008⁴⁴), while Groom and Maddison (2018)⁴⁵ use a number of techniques to estimate a pooled value of 1.5.

A6.13 Historic growth rates in consumption per capita depend on the time period considered and the extent to which more recent growth rates or projections are considered to be representative of long term trends. The 2003 Green Book set g at 2%. Freeman, Groom and

⁴¹ See discussion paper: Spackman, M. (2016) “Appropriate time discounting in the public sector” GRI Working Paper No. 182. Grantham Research Institute on Climate Change and Environment. London School of Economics.

⁴² See Freeman, Groom and Spackman (2018) “Social Discount Rates for Cost-Benefit Analysis: A Report for HM Treasury” published on the [HMT Green Book web page](#)

⁴³ *ibid.*

⁴⁴ Layard et al. (2008) “The marginal utility of income” *Journal of Public Economics*, Vol. 92, pp. 1846-1857.

⁴⁵ Groom and Maddison (2018) “New Estimates of the Elasticity of Marginal Utility for the UK” forthcoming in *Environmental and Resource Economics*. Working paper version (2013) Centre for Climate Change Economics and Policy Working Paper No. 141.

Spackman (2018)⁴⁶ reference average real annual per capita consumption growth for the UK for the period 1949 – 2016 of 2.2% per year. Estimates based on ONS data from the recent past, for example 1996 to 2016, are lower at 1.7% per year.⁴⁷

A6.14 Future projected growth rates are also relevant. Long-run forecasts of GDP growth (rather than consumption) from the Office of Budget Responsibility are for growth of 2.2% per year in real terms. This implies an annual projected growth rate of GDP per capita of 1.9%.⁴⁸

A6.15 Taken together, the range of estimates of μ and g suggest 2% remains plausible as an estimate of the overall wealth effect. For the purposes of the STPR the estimate of μ is retained at 1 and g at 2%.

Box 29. Calculation Of STPR

$$r = \rho + \mu g$$

Where $\rho = 1.5\%$; $\mu = 1.0$; and $g = 2\%$

$$0.015 + 1 \times 0.02 = 3.5\%$$

Exceptions to the standard STPR

A6.16 The recommended discount rate for risk to health and life values is 1.5%. This is because the ‘wealth effect’, or real per capita consumption growth element of the discount rate, is excluded. As set out in [Annex 2](#), health and life effects are expressed using welfare or utility values, such as Quality Adjusted Life Years (QALYs), as opposed to monetary values. The diminishing marginal utility associated with higher incomes does not apply as the welfare or utility associated with additional years of life will not decline as real incomes rise.

A6.17 The standard UK discount rate may not be appropriate for appraisal of Official Development Assistance (ODA) expenditure. For example, long term growth rates, the probability of catastrophic risk and the macro-economic effects associated with expenditure may differ. An appropriate estimate of the STPR for the recipient country should be used. Government departments should contact Department for International Development if they require further information.

Long term discounting

A6.18 Policies or projects which involve long term effects may require a different approach. This can be particularly important for policies expected to have significant environmental effects. Where long term effects are expected to occur, the appraisal of proposals may involve longer timescales. Generally, the maximum life span of an intervention is assumed to be up to 60 years. This may be extended where there is evidence a longer time period is required for the full effects of an intervention to materialise.

A6.19 The standard STPR of 3.5% applied in appraisal should decline over the long term due to uncertainty about future values of its components. The declining rates are shown in [Table 8](#). To support practical application in appraisal, discount factors by year can be found in [Table 9](#) and

⁴⁶ See Freeman, Groom and Spackman (2018) “Social Discount Rates for Cost-Benefit Analysis: A Report for HM Treasury” published on the [HMT Green Book web page](#)

⁴⁷ The ONS quarterly national accounts publication provides historic consumption data. Based on analysis in December 2017 the approximate compound annual growth rate in consumptions per capita between 1996 and 2016 was 1.7%. Freeman, Groom and Spackman (2018) provide a range of estimates for different historical horizons.

⁴⁸ Long-run forecast of GDP growth from the Office for Budget Responsibility – Long-term economic determinants – November 2017 Economic and fiscal outlook – supplementary documents published on 24th of January 2018. Estimate of average long-term GDP per capita growth consistent with OBR’s long term economic determinants.

Table 10 below in addition to the [Green Book web-pages](#). The basis for the approach to long-term discounting set out here can be found in supplementary guidance on [intergenerational wealth transfers and social discounting](#).

Intergenerational effects

A6.20 Where the possible effects of an intervention being examined as part of an appraisal are long term and involve very substantial or irreversible wealth transfers between generations further sensitivity analysis is appropriate. This involves applying both the standard Green Book discount rate and a reduced discount rate (excluding pure social time preference, δ) to costs and benefits. These are shown as the “reduced rate” values in [Table 8](#) and also decline over time in line with the standard STPR.

A6.21 When applying this approach the Net Present Social Value (NPSV) using the standard STPR and the reduced rate STPR should both be included in the results of the appraisal and explained clearly. The difference between these two estimates of NPSV provides an estimate of the intergenerational wealth transfer attributable to pure social time preference which should be part of the explanation of the approach.

Table 8. Declining Long Term Discount Rate

Year	0 – 30	31 – 75	76 – 125
STPR (standard)	3.50%	3.00%	2.50%
STPR (reduced rate where pure STP = 0)	3.00%	2.57%	2.14%
Health	1.50%	1.29%	1.07%
Health (reduced rate where pure STP = 0)	1.00%	0.86%	0.71%

A6.22 In addition to declining values for the standard STPR and a reduced rate STPR further sensitivity analysis to increase transparency and visibility of long term effects can be undertaken. This involves presenting:

- the average discounted annual cost of the effect over the first 30 years, alongside the calculation of UK welfare
- an indication of how long the effect is expected to persist
- an indication of the level of accuracy indicated by a range of reasonable values
- an explanation of how the value may be expected to change in the future

A6.23 Further information on the basis for this approach to intergenerational effects can be found in supplementary guidance on [intergenerational wealth transfers and social discounting](#).

Discounting and inflation

A6.24 Discounting is solely concerned with adjusting for social time preference and has nothing to do with adjusting for inflation. The recommended Green Book discount rate applies to real values, with the effects of general inflation already removed. To promote transparency the best practice approach is to first convert costs or benefits to a real price basis, and then perform the discounting adjustment. The inflation rate and discount rate should not be added and applied to costs and benefits, as it gives an arithmetically incorrect result.

Table 9. Standard Discount Rates and Associated Discount Factors

Year	Discount Rate	Discount Factor	Year	Discount Rate	Discount Factor
0		1	31	3.000%	0.3459
1	3.500%	0.9662	32	3.000%	0.3358
2	3.500%	0.9335	33	3.000%	0.3260
3	3.500%	0.9019	34	3.000%	0.3165
4	3.500%	0.8714	35	3.000%	0.3073
5	3.500%	0.8420	36	3.000%	0.2984
6	3.500%	0.8135	37	3.000%	0.2897
7	3.500%	0.7860	38	3.000%	0.2812
8	3.500%	0.7594	39	3.000%	0.2731
9	3.500%	0.7337	40	3.000%	0.2651
10	3.500%	0.7089	41	3.000%	0.2574
11	3.500%	0.6849	42	3.000%	0.2499
12	3.500%	0.6618	43	3.000%	0.2426
13	3.500%	0.6394	44	3.000%	0.2355
14	3.500%	0.6178	45	3.000%	0.2287
15	3.500%	0.5969	46	3.000%	0.2220
16	3.500%	0.5767	47	3.000%	0.2156
17	3.500%	0.5572	48	3.000%	0.2093
18	3.500%	0.5384	49	3.000%	0.2032
19	3.500%	0.5202	50	3.000%	0.1973
20	3.500%	0.5026	51	3.000%	0.1915
21	3.500%	0.4856	52	3.000%	0.1859
22	3.500%	0.4692	53	3.000%	0.1805
23	3.500%	0.4533	54	3.000%	0.1753
24	3.500%	0.4380	55	3.000%	0.1702
25	3.500%	0.4231	56	3.000%	0.1652
26	3.500%	0.4088	57	3.000%	0.1604
27	3.500%	0.3950	58	3.000%	0.1557
28	3.500%	0.3817	59	3.000%	0.1512
29	3.500%	0.3687	60	3.000%	0.1468
30	3.500%	0.3563	61	3.000%	0.1425

Table 10. Health Discount Rates and Associated Discount Factors

Year	Health Discount Rate	Health Discount Factor	Year	Health Discount Rate	Health Discount Factor
0		1	31	1.286%	0.6316
1	1.500%	0.9852	32	1.286%	0.6236
2	1.500%	0.9707	33	1.286%	0.6157
3	1.500%	0.9563	34	1.286%	0.6079
4	1.500%	0.9422	35	1.286%	0.6002
5	1.500%	0.9283	36	1.286%	0.5926
6	1.500%	0.9145	37	1.286%	0.5850
7	1.500%	0.9010	38	1.286%	0.5776
8	1.500%	0.8877	39	1.286%	0.5703
9	1.500%	0.8746	40	1.286%	0.5630
10	1.500%	0.8617	41	1.286%	0.5559
11	1.500%	0.8489	42	1.286%	0.5488
12	1.500%	0.8364	43	1.286%	0.5419
13	1.500%	0.8240	44	1.286%	0.5350
14	1.500%	0.8118	45	1.286%	0.5282
15	1.500%	0.7999	46	1.286%	0.5215
16	1.500%	0.7880	47	1.286%	0.5149
17	1.500%	0.7764	48	1.286%	0.5083
18	1.500%	0.7649	49	1.286%	0.5019
19	1.500%	0.7536	50	1.286%	0.4955
20	1.500%	0.7425	51	1.286%	0.4892
21	1.500%	0.7315	52	1.286%	0.4830
22	1.500%	0.7207	53	1.286%	0.4769
23	1.500%	0.7100	54	1.286%	0.4708
24	1.500%	0.6995	55	1.286%	0.4649
25	1.500%	0.6892	56	1.286%	0.4590
26	1.500%	0.6790	57	1.286%	0.4531
27	1.500%	0.6690	58	1.286%	0.4474
28	1.500%	0.6591	59	1.286%	0.4417
29	1.500%	0.6494	60	1.286%	0.4361
30	1.500%	0.6398	61	1.286%	0.4306

List of Green Book Supplementary Guidance

Supplementary Guidance Collection

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Glossary

Additionality is a real increase in social value that would not have occurred in the absence of the intervention being appraised.

Adverse Selection may occur where asymmetric information restricts the quality of a traded good. This typically happens because the side with more information can negotiate a more favourable exchange than would otherwise be the case.

Affordability is an assessment of the costs of an intervention to the public sector taking into account current and expected future budgets.

Agglomeration benefits come when firms and/or people locate near one another in geographical clusters.

Appraisal is the process of defining objectives, examining options and weighing up the relevant costs, benefits, risks and uncertainties before a decision is made.

Assessment may refer to either an appraisal or an evaluation.

Business As Usual is the continuation of current arrangements as if the intervention under consideration were not to happen. This serves as a benchmark to compare alternative interventions.

Contingency provision should reflect the sum of measured risk (costs of risks avoided, shared and mitigated on an expected likelihood basis) and optimism bias adjustment estimated in nominal prices.

Contingent valuation is a different description of stated preference valuation, where individuals are asked how much they would be willing to pay to obtain a good or service, or how much they would require to compensate them to give it up.

Cost of capital is the cost of raising funds and is sometimes expressed as an annual percentage rate.

Deadweight refers to outcomes that would have occurred without the intervention. This is used to determine the difference that can be attributed to an intervention.

Diminishing marginal utility is the tendency for the satisfaction individuals derive from an additional unit of a good or service to diminish as more units are acquired or consumed.

Diminishing marginal utility of income states that the value of an additional pound of income is higher for a low income recipient and lower for a high income recipient.

Discounting is a technique used to compare costs and benefits occurring over different periods of time.

Discount rate is the annual percentage rate at which the present value of future monetary values are estimated to decrease over time.

Displacement is the degree to which an increase in economic activity promoted by an intervention is offset by reductions in economic activity elsewhere.

Do-minimum option as used in the Green Book refers to the minimum intervention required to deliver core objectives. This excludes any additional features that may also be possible and bring additional benefits.

Economic efficiency is achieved when nobody can be made better off without someone else being made worse off. Such efficiency enhances social welfare by ensuring resources are allocated and used in the most productive manner possible.

Effectiveness is a measure of the extent to which a proposed intervention achieves its objectives.

Evaluation is the systematic assessment of an intervention's design, implementation and outcomes.

Expected value is the weighted average of all possible values of a variable, where the weights are the probabilities.

External Benefits are benefits of production or consumption of a good which are not taken into account by individuals or included in the price of a good in a perfectly competitive market.

External Costs are costs of production or consumption of a good which are not taken into account by individuals or included in the price of a good in a perfectly competitive market.

Externalities occur when consuming or producing a good or service produces benefits or costs for others that are not directly involved in the consumption or production.

GDP deflator is 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.

Gold Plating is the inclusion in an option of additional features that add little value but add significantly to cost.

Hedonic pricing is a form of revealed preference valuation that uses data from related surrogate markets and econometric techniques to estimate a value for a good or service.

Information asymmetry is a difference in the information available to parties involved in a transaction that gives an advantage to one side. This is because it is relevant to determining an efficient contract, a fair price or for rewarding performance.

Intervention refers to a policy, programme or project that is being appraised.

Implementation refers to the activities required to deliver an intervention following approval.

Irreversibility describes an option that would create a significant change that practically or affordably cannot be undone.

Leakage describes the leakage of benefits intended for a recipient group or area into another group or area.

Long-list refers to the initial, wide set of possible options considered in the first stage of appraisal to achieve objectives.

Market failure is where, for one reason or another, the market mechanism alone cannot achieve economic efficiency.

Market value or price is the price at which a commodity can be bought or sold, determined through the interaction of buyers and sellers in a market.

Marginal utility is the change in satisfaction experienced by a consumer from a small change in the consumption of a good or service.

Monte Carlo Analysis is a simulation-based risk modelling technique that produces expected values and confidence intervals as a result of many simulations that model the collective impact of a number of uncertainties.

Moral Hazard occurs when an individual changes their behaviour and takes risks because they are protected from negative consequences and someone else bears the costs.

Multi Criteria Decision Analysis is a technique for dealing with complex unmonetisable values. It can be employed, in certain circumstances, at the long-listing stage to consider unmonetisable trade-offs.

Net Present Value (NPV) is a generic term for the sum of a stream of future values (that are already in real prices) that have been discounted (in the Green Book by the social time preference rate) to bring them to today's value.

Net Present Social Value (NPSV) is the present value of a stream of future costs and benefits to UK society (that are already in real prices) that have been discounted over the life of a proposal by the social time preference rate.

Opportunity cost is the value which reflects the best alternative use a good or service could be put to.

Optimism bias is the proven tendency for appraisers to be over-optimistic about key project parameters, including capital costs, operating costs, project duration and benefits delivery.

Options Framework is a process where an initial long-list is reduced to a short-list by breaking a proposal down into a sequence of strategic choices looking at scope, solution, delivery, implementation and funding.

Outcome refers to the consequences to society of a change in service or policy. For example, improved life expectancy of the population.

Output refers to the change in the level or quality of a service delivered. For example, more cardiovascular operations carried out.

PPP refers to a Public Private Partnership. This includes **PFI**, or Private Finance Initiative, which involves the private sector in the design, creation (or construction), operation and initial financing of a publicly provided service. **PF2** is a specific form of Private Finance Initiative.

Precautionary principle refers to the concept that where the potential consequences of a perceived risk are significantly adverse, action may still be justified even if the probability of occurrence is low.

Preferred Option is the option preferred after a detailed analysis of the short-list. Comparison of each short-list option, and their advantages over Business As Usual allows identification of the best option for the delivery of public value.

Preferred Way Forward, found using the options framework, is the option most likely to deliver SMART objectives at the long-list stage. This option, together with Business As Usual, a viable do-minimum and other alternatives are taken forward as a short-list for more detailed appraisal.

Price index is a standardised measure of price levels over time. General price indices cover a wide range of prices and include the GDP deflator, the Consumer Price Index (CPI) and the Retail Price Index (RPI). There are also separate price indices that apply to one commodity or type of commodity.

Proposal refers to a policy, programme or project that is being appraised. See also Intervention.

Prosperity is measured by the level of social value as defined in the Green Book, so that an increase in social value is an increase in prosperity and a decrease in social value is a fall in prosperity.

Public Sector Comparator or Comparable Public Option is an option for direct public provision with comparable output assumptions to a Public Private Partnership option, including allowances for risk and tax. This creates a level playing field in support of a true comparison in social value terms.

Real option theory or analysis is used to estimate the benefit of delaying a decision by retaining flexibility in situations, where knowledge is increasing significantly over time, leading to potentially better informed decisions.

Real price is the nominal price (i.e. current cash price at the time) deflated by a measure of inflation.

Real terms is a reference to the value of expenditure at a specified general price level (calculated by dividing a nominal cash value by a general price index).

Relative price effect is the movement over time of a specific price index (such as Information Technology) relative to a general price index (such as the GDP deflator).

Relevant costs and benefits are the costs and benefits to UK society overall that affect or can be affected by a proposal or decision.

Resources in the Green Book is used to mean real goods and services excluding other costs. It is widely used in other ways that have different meanings depending on context.

Resource Cost is used in the Green Book in the economic sense to mean the costs of goods and services excluding transfer payments such as for example VAT. In resource accounting, 'resource costs' are accruals expressed in real terms.

Revealed preference is a value shown or inferred as a result of people's actions.

Risks are specific uncertainties that arise in the design, planning and implementation of an intervention.

Risk costs are the costs of avoiding, transferring or mitigating risks associated with a specific project, programme or policy. The costs of risk mitigation are based on a combination of likelihood of a risk materialising and its cost.

Risk register refers to a tool used to record, the risks specific to a proposal, their likelihood and value and the assignment of risk management responsibility.

Sensitivity Analysis involves exploring the sensitivity of expected outcomes of an intervention to potential changes in key input variables. It can be used to test the impact of changes in assumptions and should be clearly presented in the results of appraisal.

Shadow price refers to an estimated value of a good where market prices are not available, or do not reflect total costs and benefits.

Short-list refers to the filtered set of viable options to be taken forward to the more detailed analysis stage of appraisal.

Social Benefits are the total increase in the welfare of society from an economic action – the sum of the benefit to the agent performing the action plus the benefit accruing to society as a result of the action (external benefits).

Social Cost is the total cost to society of an economic activity – the sum of the opportunity costs of the resources used by the agent carrying out the activity, plus any additional costs imposed on society from the activity (external costs).

Social Cost Benefit Analysis quantifies in monetary terms all effects on UK social welfare. Costs to society are given a negative value and benefits to society a positive value. Costs to the public sector are counted as a social welfare cost.

Social Cost-Effectiveness Analysis compares the costs of alternative ways of producing the same or similar outputs.

Social Time Preference Rate or STPR is defined as the value society attaches to present, as opposed to future, consumption.

Social Value is the net measure of total welfare resulting from an option or intervention. Alternatively, it is the sum of total benefits and total costs of an intervention, including private and social costs and benefits.

Stated preference is a technique for eliciting willingness to pay for something that is non-marketed, and is derived from responses to expertly designed surveys.

Substitution where firms or consumers substitute one activity for another as a result of intervention. As economic activity changes, it may lead to productivity changes which are costs or benefits.

Switching value refers to the value a key input variable would need to take for a proposed intervention to switch from a recommended option to another option, or a proposal not to receive funding approval.

Systematic risk is the variation in outputs that is correlated with movements in the wider economy and which cannot therefore be reduced by diversification or other means of risk management.

Transfer payments pass purchasing power from one person to another and do not involve the consumption of resources. They include the transfer of resources between people such as gifts, taxes or social security payments and should be excluded from the overall estimate of social value.

Willingness to Accept is a technique for the inference of value of a non-marketed good or service from the amount that respondents to a survey are willing to accept to give up a good or service.

Willingness to Pay is a technique for the inference of value of a non-marketed good or service from statements of the amount that respondents to an expertly designed survey are willing to pay to acquire a good or service.

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