**Summary**

A well planned and well executed participation and consultation strategy will lead to better proposals and greater support for their implementation.

The strategy should be objective-led and should clearly fit with the stages of the planning exercise with explicit links between the outcomes of consultation exercises and planning decisions.

Planners should be pragmatic, taking account of previous work done and the range and strength of opinion in the strategy. Pragmatism should also extend to designing the strategy to fit the circumstances of the planning exercise and the constraints upon it.

The strategy should be targeted to ensure that the views gathered are representative and that people in typically "hard to reach" groups play a full part.

The strategy should have the following attributes:

- It should be open so that those taking part understand the process and can see how their views are being taken into account;
- It should start as early as possible in the planning exercise and continue throughout to maximise ownership;
- It should involve stakeholders both in the identification of problems and the development of solutions;
- It should provide feedback to contributors wherever possible;

A range of approaches to participation and consultation are reviewed and their applicability discussed.

The Scottish Executive requires as wide a range of participation and consultation as practical and appropriate to be undertaken, and documented, for any proposal for which it provides funding support or approval.

# 12. RISK AND UNCERTAINTY

## 12.1 Introduction

12.1.1 In appraisals there is always likely to be some difference between what is expected, and what eventually happens, because of biases unwittingly inherent in the appraisal, and risks and uncertainties that materialise. As a result, it is important to identify and mitigate risks, and make allowances for "optimism bias".

12.1.2 The main aim of taking account of risks, uncertainties, and optimism bias is to obtain the best possible estimates of the costs and benefits of each option. Appraisers should calculate an expected value of all risks for each option, and consider how exposed each option is to future uncertainty. In addition, before and during implementation, steps should be taken to prevent and mitigate both risks and uncertainties. Risk management strategies should be adopted for the appraisal and implementation of large transport policies, programmes or projects, while their principles can be applied to smaller proposals.

## 12.2 Risk Management

12.2.1 Risk management is a structured approach to identifying, assessing and controlling risks that emerge during the course of the policy, programme or project lifecycle. Its task is to support better decision-making through good understanding of the risks inherent in a proposal and their likely impact. Risk management involves:

- Identifying possible risks in advance and putting mechanisms in place to minimise the likelihood of their materialising with adverse effects;
- Having processes in place to monitor risks, and access to reliable, up-to-date information about risks;
- The right balance of control in place to mitigate the adverse consequences of the risks, if they should materialise; and
- Decision-making processes supported by a framework of risk analysis and evaluation.

12.2.2 At the level of individual transport projects, risk management strategies should be adopted in a way that is appropriate to their scale. The aim of risk management is not necessarily to completely eliminate risks, but to reduce them wherever the cost of mitigation is less than the cost of the risk.

## 12.3 Assessing Optimism Bias and Risks

12.3.1 There is a demonstrated, systematic, tendency for project appraisers to be overly optimistic. This is a worldwide phenomenon that affects all types of projects, including transport, in both the private and public sectors. The available evidence[1] suggests that many project parameters are affected by optimism – appraisers tend

[1] Mott MacDonald's study entitled "Review of Large Public Procurement in the UK" can be found at: http://www.hm-treasury.gov.uk/media//62ABA/greenbook_mott.pdf

to overstate benefits, and understate timings and costs, both capital and operational.

12.3.2 To redress this tendency, appraisers should make explicit adjustments for this bias when appraising projects. These will take the form of increasing estimates of the costs and decreasing, and delaying the receipt of, estimated benefits. Sensitivity testing should be used to consider uncertainties around the adjustment for optimism bias. Switching values[2] should be shown where appropriate.

12.3.3 Project appraisers should review all the contributing factors that lead to cost and time overruns, as identified by research of previous transport projects. Table 12.1 outlines some of the main factors that need to be taken into account when examining two main types of optimism bias: capital costs and works duration.

**Table 12.1: Optimism Bias Factors**

| **Contributing Factors** | | | | |
|---|---|---|---|---|
| **Procurement** | **Project Specific** | **Client Specific** | **Environment** | **External Influences** |
| Complexity of contract structure | Design complexity | Inadequacy of business case | Public relations | Political |
| Late contractor involvement in design | Degree of innovation | Large number of stakeholders | Site characteristics | Economic |
| Poor contractor capabilities | Environmental impact | Funding availability | Permits/consents/approvals | Legislation/ regulations |
| Government guidelines | | Project management team | | Technology |
| Information management | | Poor project intelligence | | |

12.3.4 All the contributory factors should be considered in the appraisal. The importance of these factors will depend upon the specific transport project. For example, in a project involving the construction of a railway tunnel you would expect the design complexity of the project to have a significant impact on the level of optimism bias for the project. Generally, the more complex the design of a project, the more likely costs and works duration will exceed the initial forecasts.

12.3.5 Similarly, in transport proposals that involve a degree of innovation in the project design, then it is crucial to take full account of the optimism bias involved in the project. If there are no previous projects which have involved similar design, optimism bias will tend to be higher than for transport projects involving standard project design. The reason behind this is that there are likely to be factors which have not been either taken into account or foreseen at the initial stages of the project design.

[2] The values at which decisions are likely to change.

12.3.6 If a transport project has a number of stakeholders, it is possible that different parties will have different interests in the project. This could result in potential conflicts during various stages of the project, which could result in an unclear specification for the project, delays in approval of the next stage, and ultimately delays in project delivery.

12.3.7 The main strategies for reducing optimism bias are:

- Full identification of stakeholder requirements (including consultation);
- Accurate costings; and
- Project risk and management.

## 12.4 Applying Optimism Bias Factors

12.4.1 Reference should be made to the Treasury Guidance[3] for the specific upper and lower bounds for the contributing factors to optimism bias. These will differ depending on the nature of the project. There are six specific project types: standard buildings; non-standard buildings; standard civil engineering; non-standard civil engineering; equipment/development; and outsourcing.

12.4.2 The majority of transport projects will be classified as either standard or non-standard civil engineering projects. For example, the building of new roads and the up-grading of existing roads will usually be classified as standard civil engineering. Meanwhile, more unique projects such as building a tunnel for a railway would be classified as non-standard civil engineering. Comparing these two types of projects, the evidence suggests that the optimism bias for non-standard civil engineering tends to be higher than for standard civil engineering. For further information on the upper and lower bounds of optimism bias for the different classifications of projects, reference should be made to Mott MacDonald's report on large public procurement in the UK[4].

12.4.3 Ideally, rather than use these generic factors, adjustments for bias should be based on empirical evidence from past and/or similar projects and adjusted for the unique characteristics of the project in hand. It is anticipated that further work will be carried out by the Executive and other bodies in order to refine the figures for optimism bias in transport projects. Advice on applying optimism bias factors should be sought from the Scottish Executive at an early stage of project development. Before reaching decisions, both cost estimates and adjustments for optimism should be independently reviewed.

12.4.4 Having adjusted for optimism, the planner should be in a position to provide a better estimate, earlier on, of key parameters. Enforcing these adjustments is designed to complement and encourage, rather than replace existing good practice in terms of calculating project specific risk adjustments and contingency allowances. They are

[3] The Treasury's guidance on optimism bias can be found at:
http://www.hm-treasury.gov.uk/media//50A21/GreenBook_optimism_bias.pdf

[4] Mott MacDonald's study entitled "Review of Large Public Procurement in the UK" can be found at:
http://www.hm-treasury.gov.uk/media//62ABA/greenbook_mott.pdf

also designed to encourage more accurate costings. Accordingly, adjustments for optimism may be reduced as more reliable estimates of relevant costs are built up, risks are explicitly assessed and quantified, and work to minimise project-specific risk is undertaken.

## 12.5 Valuing Risks and Calculating Expected Values

12.5.1 As project design and development progresses, it should become possible to explicitly quantify and value risk factors. Ultimately, appraisers should aim to adjust costs and benefits in order to calculate risk-adjusted "expected values". As the previous section explained, in the early stages of an appraisal these adjustments may be encompassed by a general uplift to a project's net present cost, to offset and adjust for undue optimism. But as the appraisal proceeds, more project-specific risks will have been identified thus reducing the need for the application of more general optimism bias factors.

12.5.2 An expected value provides a single value for the expected impact of all risks. It is calculated by multiplying the likelihood of the risk occurring by the size of the outcome, and summing the results for all the risks and outcomes. It is therefore best used when both the likelihood and outcome can be reasonably estimated. For larger projects, more formal techniques such as Monte Carlo analysis may prove useful[5].

**Example**

It has been proposed that a railway line should be extended in order to serve a town which has experienced rapid population growth in recent years. The most likely ("base") total cost of the railway extension is estimated to be £75m. However, one of the sections of the proposed line will cross a disused coal mine. The cost of this section is estimated at £10m, but there is a risk that construction costs could increase significantly if there are technical problems with building the line over the coal mine. The table below outlines the possible costs for this section of the line, and their respective probabilities.

| | | | |
|---|---|---|---|
| **BASE COST** | | | £75m |
| | Additional Cost | Probability | Expected value |
| No complications | £0m | 0.5 | £0m |
| Minor Complications | £7m | 0.3 | £2.1m |
| Major Complications | £15m | 0.2 | £3m |
| **EXPECTED COST OF RISK** | | | £5.1m |
| **TOTAL EXPECTED COST** | | | £81.1m |

[5] Refer to HM Treasury's "The Green Book: Appraisal and Evaluation in Central Government", available at http://www.hm-treasury.gov.uk/economic_data_and_tools/greenbook/data_greenbook_index.cfm

## 12.6 Unanticipated Risks and Contingency Allowances

12.6.1 In situations where it is possible to correctly identify all risks and the likelihood of them occurring, the expected value approach should produce an unbiased estimate of costs and benefits. However in general even with a well-developed project there will remain some risks which cannot be foreseen (i.e. unanticipated risks). In such cases it will not be possible to include these risks in the expected value approach as neither the cost of the risk nor its probability will be known. Instead, a contingency figure should be added to the expected value in order to take account of possible unanticipated risks – in effect, to allow for "residual optimism bias".

12.6.2 With reference to the above example, it is possible that during construction of the railway line some rare artefacts are discovered. This risk may not have been identified in advance, and would have a cost implication on the project. The discovery would at least lead to delays in the construction of the line, or at worst could force the railway to be diverted around the site. Therefore it would be appropriate to add in an extra provision for such risks occurring. For example, if a residual of 10 per cent of the original cost of the project is added to the expected cost of the project, this would leave the overall cost of the project at £88.6m (i.e. 10 per cent of £75m added to £81.1m). Here you would be making provisions for both anticipated and unanticipated risks.

12.6.3 Ultimately, once a project has been designed and costed in detail, risks have been effectively mitigated, and full allowances have been made for anticipated and unanticipated risks, then there should be no need for further generic optimism bias adjustments. The contingency allowance referred to above should, in effect, cover the "lower bound" optimism bias adjustments recommended by the Treasury.

## 12.7 Assessing Uncertainty

12.7.1 An expected value is a useful starting point for understanding the impact of risk between different options. However no matter how well risks are identified and analysed, the future is inherently uncertain. Therefore it is also essential to consider how future uncertainties could affect the choice between options.

### Sensitivity Analysis

12.7.2 Sensitivity analysis is a fundamental part of the appraisal process. It is used to test the vulnerability of options to future uncertainties which are unavoidable. Through analysing the range of values that key variables may take, you can examine how this may alter the preferred option.

12.7.3 The calculation of switching values shows by how much a variable would have to fall or rise to make it not worth undertaking an option. This should be considered a crucial input into the decision as to whether a proposal should proceed.

12.7.4 Therefore it should be the norm rather than the exception, to carry out sensitivity analysis on the key variables for a given transport project. These variables will usually have a significant impact on either the overall cost or benefit of the project.

12.7.5 For example, forecast demand for a proposed new railway line would play a crucial role in justifying whether or not the line would cover the operating costs and/or contribute to the capital costs of the project.