RISK-OPPORTUNITY ANALYSIS

Cost-benefit analysis is a tool based on a simple concept: add up the costs and benefits that result from a particular course of action, and you can see whether it does more good than harm. Do this for a range of alternative options, and you can see which one is best. Governments often use cost-benefit analysis in this way, to decide whether to proceed with a proposed policy, or to compare the value of alternative policy options.

The method can be useful when applied within its appropriate domain. As UK Treasury guidance has noted, it is a marginal analysis technique, generally most appropriate in situations where economic structures can be assumed to be unchanged by the intervention, whereas it works less well outside this domain.[1] Similarly, for reasons mentioned below, it tends to work well in situations where the outcomes that matter to policy are relatively certain, and where the interests affected are of limited diversity.

Risk-opportunity analysis is a generalisation of cost benefit analysis, appropriate for use in contexts where change is structural, important outcomes are uncertain, and diverse interests are affected. These conditions apply to many of the policy decisions that governments make in the context of the low carbon transition.

Risk-opportunity analysis (ROA) has three components, each of which can be contrasted with a characteristic of cost-benefit analysis (CBA).

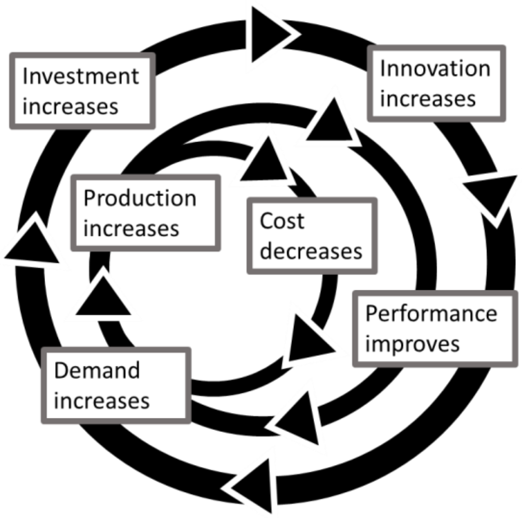
1. Assessing the dynamic effects of policy options

ROA assesses the likely effects of policies on *processes of change* in the economy, as well as expected outcomes at specified moments in time. This is distinct from CBA, which is limited to assessing outcomes at fixed moments in time.

Assessing the effect of policies on processes of change in the economy involves first understanding the dynamics of the economic system of interest, and then identifying how a policy is likely to affect those dynamics. Systems mapping with causal loop diagrams is a well-established method for doing this. The steps in this method include: i) identifying the direction of causal relationships between pairs of variables within the system of interest; and ii) identifying the positive (reinforcing) and negative (balancing) feedbacks that arise from closed loops between sets of variables. The behaviour of the system can be understood as arising from these feedback loops, and the effect of policy options can be assessed in terms of how they would strengthen, weaken, create or break feedback loops.[2]

This method can be used to distinguish policies that are likely to be self-amplifying, accelerating change in a desired direction, from those that are likely to be self-limiting. It can also be used to identify combinations of policies that are mutually reinforcing, as distinct from those that are mutually offsetting.

[1] UK Government HMT Treasury, 'The Green Book: Central Government Guidance on Appraisal and Evaluation', 2018 edition.
[2] Meadows, 2008. 'Thinking in Systems: A Primer'.



In the context of the low carbon transition, it can be useful to consider which policies are likely to be most effective in driving the positive feedbacks of clean technology development and diffusion, and which mutually reinforcing policy packages are best able to achieve a cost effective transition.

If there is a desire to quantify the dynamic effects of policy options, and sufficient time and resources, simulating models (such as system dynamics or agent-based models) can be used for this purpose.

Figure: *Reinforcing feedbacks in the processes of technology innovation and diffusion*[3]

2. Assessing risks and opportunities

ROA assesses opportunities and risks that cannot be confidently quantified, as well as quantifiable costs and benefits, in a structured way and on an equal basis, instead of limiting the analysis to the latter. This means that ROA, unlike CBA, does not express the value of a policy option in a single number. It is intended for use in situations where to do so would be inappropriate.

When CBA is used to assess the 'economic case' for policy, it is sometimes accompanied by a separate assessment of the 'strategic case', which includes consideration of unquantifiable factors. This distinction presents difficulties in contexts where the outcomes of the policy in relation to its main economic objectives are not confidently quantifiable. (For example, in the low carbon transition such objectives could be to incentivise industry investment, accelerate innovation, or build competitiveness in clean technologies). If the primary economic policy objectives are left outside the economic assessment, then the analysis becomes either irrelevant or misleading.

A simple, structured approach to organising information to inform decisions in a context of uncertainty is one commonly used by governments in processes of risk assessment, where possible outcomes are described in terms of their impact and likelihood (sometimes presented on a grid where impact and likelihood are two axes). The same treatment can be applied to opportunities. Assessments of impact and likelihood are made using the best available evidence and expert judgement, quantified if this can be done with reasonable confidence, and presented qualitatively if not. Different parts of this range of outcomes may be important in relation to different policy objectives: for example, in the power sector transition, policymakers may be most interested in expected outcomes in relation to costs, but more interested in low probability, high impact outcomes in relation to security of supply.

Another well-established method that can be used for this part of the assessment is scenario analysis. This is useful when factors critical to a policy's success are outside the control of the decision-maker. It

[3] Sharpe, 2023. 'Five Times Faster: Rethinking the Science, Economics and Diplomacy of Climate Change'. p.130.

involves identifying those critical factors, constructing different (and challenging) possible futures around them, and considering how different policies or strategies would perform in those future conditions.[4] One example of where this approach may be useful is in assessing policies whose objective is to develop industrial competitiveness. In this case, a critical factor outside the government's control is the policies of other countries.

3. Assessing outcomes in multiple dimensions

ROA presents outcomes in multiple dimensions, instead of converting all outcomes into one metric, as is done in CBA. This is appropriate in situations where the diversity of actors, interests, and policy outcomes is highly relevant to achieving the policy objectives.

The limitation of aggregating outcomes in a single metric is that there is no single method for converting outcomes in different dimensions (such as, for example, industrial competitiveness, public health, reduced risks from climate change) into the metric of money. Many such methods have been developed, and the choice of which method to use – a choice which determines the relative weighting that the analysis gives to outcomes in different dimensions – is, unavoidably, to some degree arbitrary.

In ROA, the expected (or possible) policy outcomes in each dimension are presented in the metric most natural to that dimension (e.g. tonnes of CO_2 for avoided emissions; or numbers of people for avoided deaths from air pollution). This avoids confusion between the analytical and the political: the relative value of outcomes in different dimensions can be considered explicitly instead of assumed implicitly.

A well-established method for assessing and presenting outcomes in different dimensions is multi-criteria decision analysis (MCDA). This part of ROA can be done in the same way, but without the final step of assigning scores and weightings to different outcomes, which in MCDA reintroduces the element of arbitrariness that has the drawbacks described above.

Combining the three components of assessment

The three components of assessment described above are interdependent, so this description should not be taken to imply that they are three discrete steps to be followed sequentially. Any one part of the assessment could influence the understanding of the others, meaning that a certain amount of iteration may be needed.

Once the three components have been completed, policy options can be compared in terms of their:

- Direction of change (of any variables of policy interest);
- Magnitude of change (which may or may not be quantifiable; expressed in metrics appropriate to each outcome dimension of interest);
- Pace of change;
- Possible accumulation of risk and opportunity;
- Likelihood, degree of confidence, or range of uncertainty, in each of the above.

[4] See for example the scenarios of the Network for Greening the Financial System and the recommendations of the Task Force on Climate-Related Financial Disclosures on how organisations should use scenarios to assess the implications for their strategies of physical climate risks and transition risks.

Sources of further information

This note is based on two previous documents that originally set out the concept for Risk-Opportunity Analysis. The policy brief 'Deciding how to decide: risk-opportunity analysis as a generalisation of cost-benefit analysis' (Sharpe, S., et al, 2020) provides a more detailed comparison of CBA and ROA, including an illustrative example of how the two approaches can arrive at different conclusions, as well as further explanation and examples of policy problems of non-marginal change. The academic paper 'Risk-opportunity analysis for transformative policy design and appraisal' (Mercure, J-F., et al, 2021) sets out the theoretical basis for ROA.

The report 'The new economics of innovation and transition: evaluating opportunities and risks' (Grubb, M. et al, 2021), from the Economics of Energy Innovation and System Transition project, looks at some of the most outstanding successes achieved in low carbon transitions so far in the UK, China, India, and Brazil, and considers the application of CBA and ROA in relation to the policies that were central to those successes.

The method of systems mapping with causal loop diagrams is explained in detail in 'Thinking in systems' (Meadows, D., 2008). The policy brief 'Systems archetypes: diagnosing systemic issues and designing high-leverage interventions' (Kim, D.H., 1992), gives examples of causal loop diagrams applied to typical systems change problems, along with notes on potential approaches to solutions. See also 'Using systems archetypes to take effective action' by the same author.