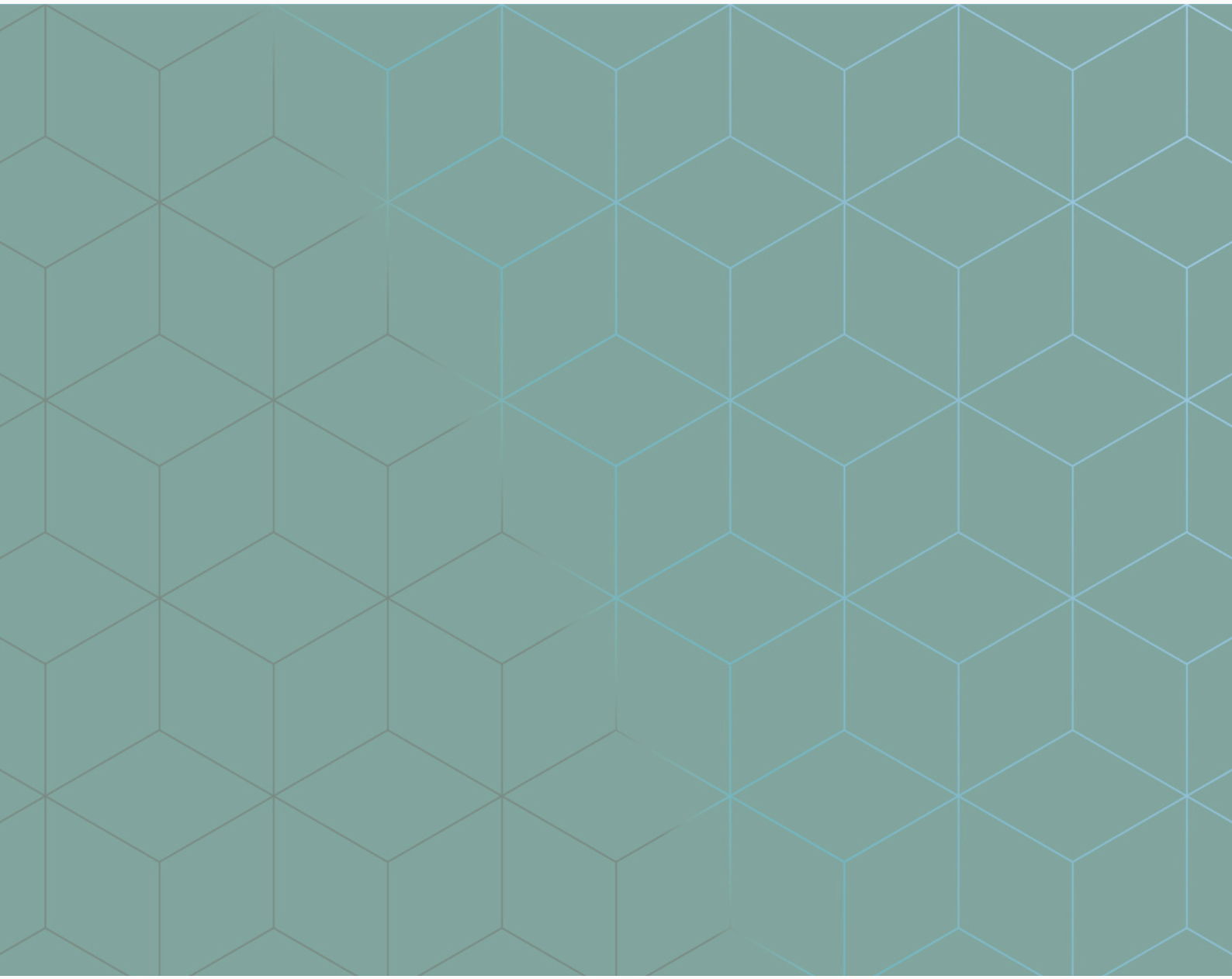
UNDERSTANDING COST BENEFIT ANALYSIS

Understanding Outputs



NineSquared

Introduction

Making the best decision possible within a given set of circumstances and knowledge available at the time is critical to maximising progress and positive change within our communities.

Governments make big decisions every day that affect the lives of everyone in the community. This includes funding and budget decisions that affect our collective wealth and well-being.

We believe that great decisions that are well implemented are a fundamental driver of positive progress in government, in business and ultimately in society. Over the last couple of years, big steps have been made by government to implement improvements in evaluation and decision-making frameworks for new and large projects/initiatives. This is important because, over time, all investment decisions start to add up and if some decisions are made for short term and other reasons then any long-term economic costs will ultimately be borne by the community. The long team time between investing in projects and realising benefits means such costs are sometimes not fully appreciated.

Applying the principles and frameworks from economics can help decision makers make great decisions. This short non-technical guide builds on the previously released Cost-Benefit Analysis for Decision Making. It explains how CBAs can be used to inform decision making and provides an overview of the types of questions CBA can answer. We hope that this short guide provides decision makers with an understanding of how CBAs can be used and ultimately how it can help you inform, influence and make great decisions.

What is CBA?

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At its simplest, Cost Benefit Analysis (or CBA) is based on the idea that any new project or policy by the public sector should contribute more to society than it costs. To assess this, CBA attempts to sum up all of the benefits and all of the coss associated with a new project or policy to see if the benefits are greater than the costs over the life of the project or policy.

Simple enough. However, CBA attempts to sum up not only the financial costs and benefits, things like construction costs and savings that a person might gain from a specific policy setting, but also the social costs and benefits to arrive at an evaluation of the overall impact on social welfare. To do so, CBA considers costs like the reduction in air quality that might result from a project that creates pollution, or perhaps the social benefits of reducing deaths and injuries because a road has been made safer. These costs and benefits cannot typically be observed in the market place. These social costs have to be estimated using techniques that have been developed by economists over many years.

What Does it All Mean?

Whether you have very little data, or all the data in the world, CBAs deliver a set of outputs to help inform decision making. These outputs are designed to be easy to interpret, easy to use and encompassing of all information.

That said, the raft of information presented in analyses can be confusing. The purpose of this guide is to provide overarching considerations when interpreting CBA outputs.

Common terms

BCR

AThe benefit cost ratio, or BCR, is calculated by dividing the discounted benefits by the discounted costs. The BCR is the most commonly used output of a CBA. It is the figure that most of the discussion will focus on as it is a simple measure of whether the benefits outweigh the costs.

When a BCR is greater than 1, it indicates that the project or initiative has greater benefits than costs. Where a BCR is less than 1, it indicates that the opposite is true.

BCRs are most useful when ranking initiatives from an economic efficiency perspective where there is a budget constraint. In essence, BCRs measure the efficiency of the investment, rather than the magnitude of the impact. Another way to interpret a BCR is that it represents the benefit attained for each dollar spent.

NPV

The Net Present Value, or NPV, is calculated by subtracting the discounted costs from the discounted benefits.

NPVs are calculated as part of every CBA. It should be considered hand-in-hand with the BCR. When the NPV is positive, it indicates that the project or initiative has greater benefits than costs. Where the NPV is negative, it indicates that the opposite is true. NPVs are most useful when:

- Deciding between mutually exclusive options for the same initiative
- Assessing alternative combinations of related initiatives (where implementation of one affects the benefits and/or costs of another)
- Comparing implementation timings for the same initiative.

NPV is a measure of total economic benefit (or dis-benefit). Rather than being a measure of efficiency, it is a measure of magnitude.

IRR

The Internal Rate of Return, or IRR, is the discount rate that delivers an NPV of $0. Effectively, it is the discount rate required to have the discounted costs equal to the discounted benefits. There are cases where the IRR is unable to be calculated as there is no real number which may be used to deliver an NPV of $0.

NPVI

The Net Present Value Per Dollar Invested, or NPVI, is calculated by dividing the NPV by the investment (capital) costs.

The NPVI can be used for ranking initiatives subject to a budget constraint.

FYRR

The first-year rate of return, or FYRR, measures the economic return in the first year of project operation. This compares the present value of benefits in the first year to the total capital and operating cost of the project. Where the FYRR is below the chosen discount rate, deferral of the project may be warranted. This must be considered in context with the project specification, particularly where there is an unavoidable ramp-up period.

Understanding the NPV & BCR

A common question in economic assessments is whether the NPV or the BCR should be used as the 'main' result.

As with anything in economics, there are a range of considerations when answering this question.

In a majority of cases, the NPV and BCR will tell the same story. Where an NPV is positive, the BCR will be above one. Where an NPV is negative, the BCR will be below one. This ultimately means that both will provide the same information regarding whether benefits are greater than costs.

The trick is where there are competing options or priorities. In some cases, an option will be preferred using NPV, while another will be preferred using BCR. As an example, Option 1 has a larger BCR than Option 2, but Option 2 has the larger NPV.What do we do in such situations?

NPV should be used for identifying a preferred option where they are mutually exclusive. That is, if only one of the options can be delivered, the option which has the largest magnitude of impact should be preferred.

Where there is a budget constraint, BCR becomes the preferred metric. Combining various options with the highest BCRs will sum to provide a greater NPV. As such, using BCR as the primary focus becomes important.

When in doubt:

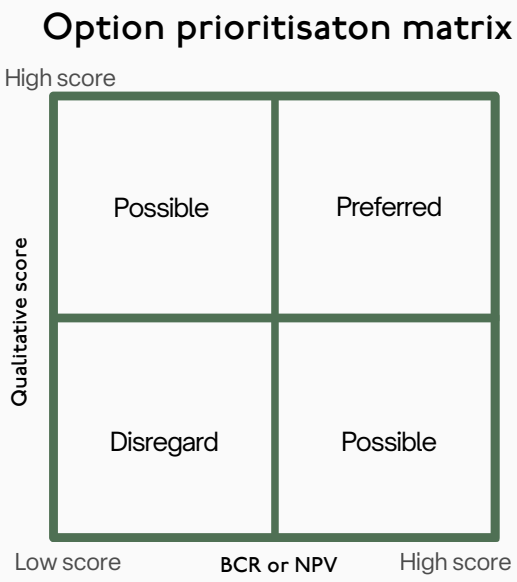
- NPV represents the greatest magnitude of impact
- BCR represents the most efficient impact.

Considering qualitative impacts

Despite the best effort of practitioners, not all impacts are able to be monetised. If impacts are not monetised, they are not considered in the headline results such as NPV and BCR. This means that some projects or options are not accurately assessed, particularly where key impacts are unable to be quantified or monetised.

Qualitative analysis can supplement the headline results to provide decision makers with an understanding of the non-quantitative impacts. This is often done by quantifying any known elements of a benefit or cost, then reporting the expected likelihood and probability. Often, this is a 'best guess' of the economist or project team based on the available information.

Qualitative outputs can be combined with the headline CBA results in many ways. We often present qualitative outputs and quantitative outputs in a chart to provide a well-rounded understanding of an initiative. An example of this type of analysis is shown below, where the horizontal axis represents the BCR (or NPV) and the vertical axis represents the qualitative score (or multi-criteria score). Options which score well in both categories become the preferred options, while those who score poorly in both are typically disregarded.



Sensitivity testing

Typically, headline outputs of a CBA are point estimates. That is, a single figure is reported.

In reality, there is uncertainty surrounding the headline results. Whether this relate to uncertainty in how the project or initiative will be delivered, uncertainty in how people will react to the project, or more broadly, uncertainty relating to government policy, population growth, or changes in the economy.

Sensitivity testing is typically carried out by systematically adjusting the key inputs or assumptions in the cost-benefit analysis (CBA) to observe how these changes impact the overall results. The process usually begins by identifying the critical variables that could significantly influence the outcome, such as costs, benefits, discount rates, or the time horizon of the project. Once these variables are identified, analysts adjust them individually, often within a predefined range, to see how the changes affect the net present value (NPV) or the benefit-cost ratio, which are common indicators of a project's feasibility.

For example, if the initial analysis assumes a construction cost of $10 million, sensitivity testing might involve recalculating the analysis with costs set at $12 million and $8 million to see how this variation influences the overall benefit of the project. Similarly, the analysis might consider different discount rates to account for variations in the time value of money, testing how changes in these rates affect the perceived value of future benefits. The results of these tests are typically displayed in a sensitivity table or a spider plot, which visually represents how sensitive the outcome is to each variable. This approach provides a clear view of the range of possible outcomes, helping analysts and decision-makers understand the potential risks and uncertainties associated with the project.

This process is particularly valuable because it highlights the degree of uncertainty in the analysis, offering a clearer picture of the possible outcomes under different scenarios. For instance, if a small change in the discount rate—a factor that reflects the value of future benefits in today's terms—substantially alters the net benefit of a project, this indicates that the CBA is highly sensitive to this variable. As a result, decision-makers might consider this sensitivity when weighing the project’s potential risks and rewards. Overall, sensitivity testing enhances the reliability of cost-benefit analysis by providing a more nuanced understanding of how changes in key assumptions might influence the final recommendation.

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Got questions?
Reach out to us for answers

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