



COST-BENEFIT ANALYSIS FOR DECISION MAKING

A short guidebook for decision makers



DECISION- MAKING IS A FUNDAMENTAL DRIVER OF CHANGE IN SOCIETY

We believe that great decisions that are well implemented are a fundamental driver of positive progress in government, in business and ultimately in society. Unfortunately, not all of the decisions that we make are great. Poor decisions can have significant impacts – everyone remembers Kodak’s decision not to invest in digital photography even though they had undertaken research that suggested that it would devour its established film business. Kodak is not an unusual example. Poor decision making is all around us. The Harvard Business Review reported that between 70 percent and 90 percent of all mergers and acquisitions were failures and according to another study 60 percent of executives reported that bad decisions were as frequent as good ones within their organisation.

Poor decision making can have larger consequences than those experienced by Kodak and other companies. Governments make big decisions every day that affect the lives of everyone in the community. At the very least, they make funding and budget decisions that affect our collective wealth and well-being. In this context, making the best decision possible within a given set of circumstances and knowledge at the time the decision is made is critical to maximising progress and positive change within our communities.

Applying the principles and frameworks from economics can help decision makers make great decisions. This short non-technical guide outlines what Cost-Benefit Analysis is, when it could be used and the key components of undertaking the analysis. It also explains how to interpret common CBA results and some of the pitfalls to be avoided when undertaking a CBA. We hope that this short guide provides decision makers with some understanding of how CBA works and how it can assist in the decision making processes and ultimately help you to inform, influence and make great decisions.

COST-BENEFIT ANALYSIS

What is it?

At its simplest, Cost Benefit Analysis (or CBA) is based on the idea that any new public policy or new project by the public sector should contribute to more to society than it takes away. To assess this, CBA attempts to sum up all of the benefits and all of the costs 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 access 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 the road toll 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. We outline some of these techniques in the following pages.

Why use it?

Policy, program and project evaluation

Cost-benefit analysis is useful when considering whether or not a particular course of action will have an overall positive or negative economic impact on the community. A course of action in this context might be a new policy or program that is being developed or perhaps a new infrastructure project. An evidence based evaluation, based on a consistent and methodologically sound approach means that decision-makers can approve or reject proposed changes with greater confidence that their decision will enhance social welfare rather than reduce it.

Post Completion Reviews

CBA is also a useful tool in evaluating the impact of an existing policy, program or infrastructure project. Post Completion Reviews or *ex post* analysis of a policy or program assesses the actual costs and benefits that occurred as a result of the change compared with the costs and benefits that would have occurred without the change being implemented. Such reviews can provide decision makers with a better understanding of project outcomes and assist in the evaluation of future projects.

Project prioritisation and selection

Because CBA provides an evaluation methodology and reporting metrics that are applicable to a variety of different policies, programs and projects, it can be used to prioritise projects in relation to each other enabling decision makers to select the highest value policy, program or project from those under consideration.

Early project option assessment

Often in seeking to address a specific issue or problem, a project team may develop a substantial number of options which may address the problem in very different ways. Detailed development of every option may be prohibitively expensive. Some options, however, may be able to be excluded early in the option development process by applying the principles of CBA in a consistent but shortened version of the technique known as Rapid CBA. Rapid CBA can allow project teams to determine those options that are unlikely to have a positive impact on social welfare early in the option development process allowing project teams to focus more time on viable options.

What's involved?

Conceptually simple, analytically complex

While conceptually simple, preparation of a CBA can be analytically complex. It may, for example, require the forecasting of future demand for a product or service or the valuation of costs and benefits that are not traded in the marketplace and for which, as a consequence, no market price is observable. It may require consideration of external costs and benefits and how these should be treated and valued.

Then there are considerations about what the outcomes of a project should be compared to, how to treat costs and benefits into the future, ensuring that double counting is avoided and determining how should risk be incorporated into the analysis.

This section outlines at a high level, the steps we take when undertaking a CBA. This overview is not intended to provide a detailed coverage of these issues. For those who would like more detailed guidance, there are several good overviews of the matters outlined above, particularly in the context of major project evaluation in Australia. We have listed some of these in Appendix A.

Starting the CBA – Specifying the base case

CBA compares an expected (or actual in the case of a Post Completion Review) project outcome with what would have happened if the project, policy or program was not progressed. This counter-factual is typically referred to as the 'base case'.

The base case is the benchmark against which all other options are compared and accurate specification of the base case underpins the accuracy of the remaining analysis. Importantly, the base case is not a 'do nothing' option. Rather it is a statement of the expected outcome of the current course of action, together with any announced or required spending to maintain that course of action into the future. Such spending might, for example, include requirement maintenance spending to ensure that a facility is maintained to current levels of service. Mis-specifying the base case will mean that the CBA will produce mis-leading results.

Identifying costs and benefits

CBA considers the social costs and benefits of a proposed policy, program or project. As a result, many of the costs and benefits considered in the CBA that accrue to producers, consumers and the community more generally are not typically considered in the financial assessment.

Different policies, programs and projects will result in different costs and benefits so each CBA will necessarily consider a different set of costs and benefits. The first step in valuing these is to identify and categorise each impact that is material to the analysis. Again, while conceptually simple, there are adjustments that need to be made. For example, CBA does not typically consider taxes as a cost or a benefit as they are simply a transfer between taxpayers (either producers or consumers) and the Government. However, there are some inputs that might be important in a CBA that include taxes – fuel for example includes fuel excise and other taxes and adjustments will need to be made.

Identifying costs and benefits

Costs and benefits can be considered as impacts on producers or consumers as well as external impacts on third parties. Different projects and policies will have differing impacts across these categories and each CAB needs to consider whether specific costs and benefits are material to the analysis being undertaken

Private costs

- Initial project capital costs
- Project operating costs – operating and maintenance costs over the analysis period
- Capital replacement costs – cost of replacing assets during the analysis period, for example, replacement of IT systems during the analysis period.
- Decommissioning and rehabilitation costs – costs associated with the decommissioning of existing assets and services and rehabilitation of the environment.
- Other costs incurred directly or indirectly by the project, such as by other government agencies

Private producer benefits

- Increased operating revenue – the economic value from changes in revenue to the owner or operator.
- Increased ancillary revenue – the increase in revenue from other activities that may accrue as a result of the project. For example, revenue from airport retail concessions or advertising revenue
- Avoided capital costs – costs avoided as a result of the project. For example, capital acquisitions that are no longer required.
- Avoided operating cost – for example, savings in maintenance, compliance and investment costs

Private consumer benefits

- Improved accessibility – for example, lower cost of accessing essential facilities such as hospitals or improvements in access to services and infrastructure
- Travel time savings – the economic value of reduced scheduled journey time
- Savings in vehicle operating costs
- Service reliability – the economic value of improvements in reliability
- Service improvement – the economic value of greater amenity from higher specification of services
- Health and safety – the economic value arising from a reduction in accidents, deaths, disease and security incidents
- Resilience – economic benefit derived from improved resilience to adverse events
- Residual value of assets – the measurement of residual or terminal values as a proxy for future user benefits beyond the analysis period.

External costs and benefits

- Environmental externalities – positive and negative impacts on the environment as a result of the project. This may include reductions or improvements in air quality, carbon emissions, water pollution, noise and so on.
- Network externalities – changes in user behaviour may impact a broader network result into congestion and health and safety issues elsewhere in a network
- Land use impacts – benefits and costs associated with changes in land user as a result of a project
- Health and safety externalities – costs or benefits accruing to third parties as a result of a policy or project. For example, governments may experience a reduction in health expenditure due to a reduction in accidents as a result of a project
- Other social impacts – for example, a freeway project bisecting a local may reduce connectivity within the community and impose costs that are not captured elsewhere

Estimating demand

Once the categories of costs and benefits have been identified, it is necessary to estimate the change in the cost or benefit that will result from the proposed policy, program or project. In many cases, this requires forecasting changes in the demand for something.

Forecasting demand requires estimating the change in consumer behaviour (and sometimes producers behaviour) over the analysis period. In some cases, the expected behavioural response from a change in some parameter has already been measured and has been codified in widely accepted guidelines, such as those that exist in Australia for transport project evaluation. In other cases, it will be necessary to undertake statistical and econometric analysis and may include consideration of demographic factors, the likely behavioural response to a change in service level or price (or both) and the range of alternatives available to consumers and producers (for example, people may decide to drive when bus fares increase).

Monetising cost and benefits

Once there is an understanding of the categories of costs and benefits and the change in project impact (for example as a result of the future changes in demand) it is necessary to monetise the costs and benefits. In some instances, this is a relatively simple process. Project capital costs, for example, are usually already expressed in dollar terms. In many instances, however, costs are not expressed in dollar terms.

The value of a person's life, the benefit of improved air quality and the cost associated with traffic congestion are all examples of intangible costs and benefits that require some consideration as to their dollar value if they are to be included in a CBA. To monetise these values, economists have developed a number of techniques. These include estimating the value of something based on the value of a related thing. For example, one approach to the valuation of a human life is to link its value to a person's lifetime earning potential, known as the Human Capital Approach.

The Human Capital Approach is one type of valuation methodology known generically as Revealed Preference (RP). In this case, people reveal their preferences by requiring more money for more dangerous jobs. Similar approaches can be used to estimate the value of, say, national parks, through consumers revealing how much time, effort and money they are willing to spend to travel to a park in the first place.

In some cases, it is not possible to examine consumers revealed preferences. In this case, monetising costs may require using a Stated Preference (SP) Methodology. In the SP approach, consumers are surveyed as asked about their willingness to pay for something (say, a park or improved health outcome). Alternatively, they may be asked about how much they would need to be paid in order to accept something (for example, how much would they need to be paid to accept increased congestion on their commuter to work).

These approaches can be expensive and complex to undertake. There is a substantial body of work that has been undertaken in how to structure and conduct RP and SP surveys, and how they should be analysed and interpreted.

Because of the complexity and cost associated with RP and SP methods, they may not be feasible or financially viable options for smaller CBAs. In these cases, consideration may be given to methods that provide an indicative and indirect valuation of non-monetary costs and benefits. One approach is to estimate the replacement cost of an unpriced asset. What would it cost, for example, to replace a playground or a park somewhere else. Another method known as Benefit Transfer is to use valuation estimates from a different study or analysis and transfer those estimates to the CBA being undertaken. This approach is appropriate only when the characteristics between the two studies are sufficiently similar to allow comparison.

Determining the analysis period

Choosing an appropriate analysis period is an important consideration in the CBA design. In theory, the analysis period should be consistent with the expected life of project asset, policy or program. For infrastructure assets, the expected life is typically assumed to be the operating life of the asset measured from the first year in which the asset starts to produce benefits. Different assets will have different operating life spans and there are some guidelines that outline the lives of specific asset classes.

The appropriate analysis period for policy and program evaluations is less clear. In theory, the analysis period should be the life of the policy but unless the proposed policy settings provide for a sunset clause, the 'operating life span' of the policy may be unclear.

In both cases judgement needs to be applied to ensure that the analysis period is not too short so that it missed material benefits beyond the analysis period nor too long such that accurately forecasting benefits and costs becomes impossible.

The discount rate

Another important analysis design question is the selection of an appropriate discount rate. Discount rates are used to 'discount' future costs and benefits allowing the CBA to take into account the time preference for money (that is the concept that people would value a dollar today more than they would value a dollar in a year's time) and risk.

It is important to ensure that the correct approach to the discount rate is followed. Typically, the discount rate used in economic CBA is different to that used in a financial appraisal which is often more focussed on the cost of capital. Discount rates used in economic CBA is also usually a real discount rate reflecting the fact that the appraisal is often undertaken in real rather than nominal dollars.

Discounting future costs and benefits means that, at high discount rates, future benefit (and cost) streams will become less important as they get further away from the present day. This can have implications for project appraisal when there are large upfront costs and a long stream of benefits into the future.

Sensitivity testing

Testing the results of the CBA to key inputs is an important component of the CBA appraisal. Sensitivity testing is the methodical flexing of inputs to determine the sensitivity of the results to those inputs. The robustness of the central result of the CBA can then be assessed by decision makers against how sensitive it is to risk and uncertainty surrounding critical inputs.

Typically, sensitivity testing might be undertaken on a range of inputs and parameters including the discount rate, the costs and benefits used in the analysis and the analysis period. Additional sensitivity test may be undertaken in relation to different components of the CBA depending on the subject matter – for example, a transport CBA may assess the sensitivity to traffic demand forecasts.

Sensitivity testing typically involves inputs being flexed individually so that the impact of each individual input can be assessed. It is also possible to combine the flexing of inputs to provide decision makers with a 'worst case' and 'best case' scenario.

Interpreting the results

Cost-benefit analyses typically provide a number of key measures for decision makers to assess the economic merit of the policy, program or project under consideration. These measures include the

- Net present value
- Benefit-cost ratio
- Net present value per dollar of capital invested
- First year rate of return.

Net present value

The net present value (NPV) is the sum of the discounted project benefits less the discounted project costs. When the benefits exceed the costs, the net present value will be positive indicating the project has economic merit

Benefit-cost ratio

The benefit cost ratio (BCR) is the ratio of the present value of the benefits to the present value of the costs. Where the NPV provides an indication of the total amount of the net benefit, the BCR provides an indication of the benefit for each dollar spent on the project. A project, policy or program is potentially worth pursuing if its BCR is above 1.

Net present value per dollar of capital invested

The NPV per dollar of capital invested (NPVI) is a measure of the overall economic return of a project in relation to its requirement for fixed capital and is generally used to rank projects in a budget constrained environment.

First year rate of return

The first year rate of return (FYRR) is a measure of the value created by the project in its first year of operation. It can be used to determine whether a project should be commence as planned, deferred or brought forward. A FYRR that is below the discount rate may suggest that a project should be deferred. Conversely, if the FYRR is substantially higher than the discount rate, the it may be an indication that it should be brought forward.

Traps for young players

Double counting

Double counting (particularly the double counting of benefits) can often arise in the development of CBAs. Double counting can occur in a number of ways in CBAs.

- Firstly, there can be double counting when an SP survey has been undertaken which has been designed to capture participants' willingness to pay for something which has several component characteristics and then one of the components is counted again separately in the analysis.
- Secondly, double counting can occur when a value is utilised using the Benefit Transfer Method and there is a lack of understanding of the components that were included in the original valuation. For example, a disability adjusted life year may include a reduction in labour productivity so it is not appropriate to include lost productivity again in the analysis.
- Thirdly, the economic value may be embodied in the price of an asset but may be double counted as a separate benefit. For example, if a new road project resulted in an increase in house values due to the lower commuting cost. The lower commuting cost is already reflected in the house price and should not be counted again.
- Finally, some things may look like benefits but simply reflect activity transferred from somewhere else. For example, a new dam may lead to an increase in recreational activities at the dam but this activity may have occurred elsewhere anyway.

Not excluding irrelevant item

CBAs represent an economic appraisal of a project, policy or program. As such, they exclude a number of items that might otherwise be included in other appraisals (such as economic impact assessments or a financial appraisal). Items that should be excluded from a CBA include:

- Sunk costs – such costs are past costs which are irrecoverable. CBAs relate to new expenditure and as a result all past costs should be excluded.
- Depreciation – depreciation is an accounting treatment for the allocation of the cost of a capital asset over its estimated useful life. Including depreciation in the CBA would double count the capital cost of the project, policy or program.
- Interest – Interest costs are implicitly included in the discount rate used to discount future benefits and costs to the present day. Including them explicitly in the CBA would double count the impact of interest rates.
- Transfer payments – transfer payments are payments between groups that do not involve any transfer of economic resources. Taxes are an example of transfer payments. Because the CBA is an economic appraisal, these payments should be excluded from the CBA analysis.


Confusing costs as benefits


While it sounds like it should be a simple activity to allocate costs and benefits, in practice it turns out not to be the case. A common mistake is to allocate increases in employment as a result of a project as a benefit. Employment generally is a cost to a project, much in the same way as the capital required to be invested in the project is a cost to the project.

Want more information on how cost-benefit analysis can help inform great decisions?

NineSquared provides economic and commercial advisory services to both the public and private sector. Our economics team specialises in undertaking cost-benefit analysis for the evaluation of policies, programs and projects. Our engagements have ranged from analysing the costs and benefits in transportation, technology, parks and recreation, health infrastructure and justice. We have helped clients evaluate multi-billion dollar projects as well as projects that have required investments of only a few thousand dollars. We are also experienced in the use of CBA for policy and program evaluation as well as using CBA for project prioritisation.

If you would like more information on how you can use CBA in making better decisions or just need to understand how to go about ensuring that a CBA is undertaken for your project, we'd love to hear from you.

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