

{ Cost–Benefit Analysis

POLICY
ESSENTIALS

ABOUT THIS PUBLICATION

The Business Council of Australia (BCA) brings together the chief executives of 100 of Australia's leading companies. For almost 30 years, the BCA has provided a unique forum for some of Australia's most experienced corporate leaders to contribute to public policy reform that affects business and the community as a whole. Our vision is for Australia to be the best place in the world in which to live, learn, work and do business.

This publication, *Policy Essentials: Cost–Benefit Analysis*, is a guide issued by the Business Council of Australia to raise understanding within the public sector and the broader community of the importance of conducting cost–benefit analysis for major public policy decisions, regulations and projects. It includes a report authored for the BCA by Deloitte Access Economics titled 'Familiarisation of the Cost–Benefit Analysis Framework'.

The BCA 'Policy Essentials' occasional series provides practical resources to promote good public policy governance and practice in Australia.

FOREWORD

WHY DID THE BUSINESS COUNCIL OF AUSTRALIA DEVELOP THIS TOOL?

Over many years, the Business Council of Australia has promoted the importance of using cost–benefit analysis (CBA) to evaluate major public expenditure and regulatory decisions, particularly in relation to infrastructure.

We have become increasingly concerned that decisions which involve considerable expenditure or which have significant impacts in the community are being made without a proper evaluation of the costs, benefits and risks involved. This has often led to poor prioritisation, cost blowouts and poor regulations that have had costly or unintended consequences.

For public infrastructure provision, the broader community and business want to see that the right projects and priorities are being funded and that they represent value for money.

When members of the community see considerable funds being expended on projects where the benefit is not clear, they

lose confidence in the broader decision-making processes of government, and this often makes other reforms very difficult.

In this context, the Business Council of Australia identified a need for a simple guide on what a cost–benefit analysis should contain and commissioned Deloitte Access Economics to develop this resource. We felt it was important to go back to basics to explain exactly what we mean when we call for cost–benefit analysis.

The council hopes this guide will help promote the discipline across Australia by providing a tool that governments, private sector organisations and, indeed, taxpayers draw on to ensure public money is spent wisely and efficiently.

WHY DO WE THINK COST–BENEFIT ANALYSIS IS IMPORTANT?

In government and private sector decision-making there are always competing priorities for funds.

The purpose of doing a CBA is to allow competing policy priorities to be compared in a consistent way, and for their economic, social and environmental impacts to be assessed.

In all areas of policy, the function of the CBA is to assist policymakers to identify the best way to deliver the strategic objectives of governments. One example is in the development of our cities. Cost–benefit analysis can help to achieve the strategic aims of a holistic metropolitan plan by weighing up the economic, social and environmental impacts of different transport infrastructure options and identifying the best approach for the long term.

WHAT ARE THE ESSENTIAL ELEMENTS?

1. Cost–benefit analysis needs to be future looking

A good cost–benefit analysis will guide decision-making in the best interests of current and future generations by taking a long-term view that factors in economic and population growth over time.

The CBA methodology also allows for the consideration of future benefits and risks that are largely unknown or difficult to quantify.

Governments have to pursue policy priorities where there are unknowns – because they are seen to be in the public good or because they are necessarily based on future assumptions. The CBA discipline can help policymakers to wrestle with intangibles and communicate assumptions and judgements in a transparent way.

Uncertainty about the future is no reason to avoid a CBA. In fact it makes the case for undertaking rigorous and transparent CBA even stronger.

2. Cost–benefit analysis needs to be objective

Objectivity is critically important when determining the expected costs and benefits of a policy or project. CBAs (both private and public) often fail because future costs are underestimated and future benefits overstated, due to a tendency for ‘optimism bias’.

Independent assessment is a good way to build objectivity into the CBA.

Objectivity also requires that the main findings are based on a realistic ‘central case’ that depicts the most likely outcomes for costs and benefits in the future. It is then fine to test alternative outcomes under best-case and worst-case scenarios.

3. Cost–benefit analysis needs to consider implementation risks

Cost–benefit analysis ensures implementation risks can be identified and assessed upfront so they can be factored into a project’s implementation program. CBAs can be applied to capital projects as well as major policy and change management initiatives.

4. Cost–benefit analysis needs to be easily understood so it can be subject to a degree of contestability

A CBA needs to be straightforward and readily understood by a wide range of people. The idea is not for them to be ‘black boxes’ for technicians but tools that people can use to look at priorities and contest them.

The Business Council of Australia hopes this resource will demonstrate to a wide audience how cost–benefit analysis can help us plan for the needs of future Australians carefully, responsibly and openly.



Tony Shepherd AO
President, Business Council of Australia

Deloitte Access Economics

Familiarisation of the cost
benefit analysis framework
Business Council of Australia

Contents

1	Evidence-based policy	2
1.1	The case for evidence-based policy	2
1.2	What is cost-benefit analysis?.....	3
1.3	When and why a cost-benefit analysis should be used	4
1.4	How should a cost-benefit analysis be undertaken?	6
1.5	Understanding and managing the limitations of cost-benefit analysis.....	8
1.6	Summary	11
2	Key steps in a CBA	13
2.1	The base case	13
2.2	Policy options	14
2.3	Costs	15
2.4	Benefits	16
2.5	Estimates and assumptions.....	17
2.6	Valuing costs and benefits	18
2.7	Calculating the impact in today's value	19
2.8	Calculating the overall value	20
2.9	Post-implementation review	22
3	Conclusion	24

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1 Evidence-based policy

The purpose of the paper is to demonstrate the importance of evidence-based policymaking and the important role cost-benefit analysis can have in supporting this process.

1.1 The case for evidence-based policy

Governments come to power with an objective to improve the wellbeing of Australians and to set policies they consider to be in the national interest. They have to make difficult choices about how they tax, regulate and spend or invest funds on behalf of taxpayers in order to deliver economic, social and environmental outcomes that will improve the lives of citizens.

In order for government decision-makers to ensure that government policy is generating the maximum benefit for society, decisions need to be based on robust evidence. Further, that evidence needs to be communicated transparently and in a timely manner to business and the community. Evidence is crucial to good government policy outcomes because it:

- helps policymakers work out which policy options are likely to achieve the best results; and
- helps in getting policy implemented in circumstances where there is opposition to it.

Opposition to good policy decisions – policies that make the community as a whole better off – is quite common, as are incentives for governments to pursue poor decisions that appeal to a narrow interest base. By developing and communicating an evidence base for a policy decision, policymakers can select the best policy options for the community overall, educate the public about the reasons for the policy and counter the claims of special interest groups.

The Productivity Commission endorses this view as follows:

“Effective policy development demands careful analysis of different options, drawing on available evidence. Good process is the key to ensuring that this happens, whether in developing new policies or evaluating existing programs. Evidence-based analysis and good process matter because getting policy right matters. Public policy measures can have pervasive effects on the wellbeing of the community”.¹

Good quality, evidence-based decision-making employs fit-for-purpose tools, transparency and objectivity. The purpose of this paper is to explore one of the key tools for evidence-based policymaking—Cost-benefit analysis (CBA)—and how it should be conducted to ensure transparency and objectivity.

¹ Productivity Commission 2010, *Annual Report 2009-10*, Annual Report Series, Productivity Commission, Canberra, available at: http://www.pc.gov.au/__data/assets/pdf_file/0014/103352/annual-report-2009-10.pdf, last accessed 14.12.11.

1.2 What is cost-benefit analysis?

Cost-benefit analysis (CBA) is a tool that supports evidence-based policymaking and can be used widely for this purpose. The basis of CBA is very simple. For a given policy proposal, it compares the total forecast costs to the community and economy of a policy with the total forecast benefits, to see whether the benefits outweigh the costs and by how much. It provides a framework for analysing information in a logical and consistent way. CBA can assist policymakers to determine which policy most effectively and efficiently achieves a stated objective or to prioritise the most beneficial of a suite of potential policy options.

While the CBA is simple in theory and would be a good tool to have for any policy decision, in some cases there are complexities in the use of the CBA to be considered. These are discussed later in this paper. These complexities should not, however, be used as a reason against using CBA or a similar tool that exposes decision-making to rigorous scrutiny.

Throughout this paper, we primarily refer to the use of CBA in the context of government making an investment decision but CBA can also be used to evaluate decisions about taxation, regulation and program spending.

Government funds for investment in infrastructure and public policy initiatives are limited. These funds come at a significant cost to Australian society, through taxes collected by local, State and Territory, and Commonwealth governments. If governments had not collected these taxes, the funds would have been available to private individuals and businesses to spend, save or invest. It is therefore in the interests of all Australians that government expenditure prioritises investments that generate the biggest net benefits for society. When this occurs, taxation yields substantial rewards to the Australian community and supports the economy.

At present CBA is not necessarily conducted and/or made publicly available as part of the decision-making process for all government investments. The Business Council of Australia recognises that a better understanding of the benefits of including a properly conducted CBA as part of the decision-making process is one way to promote the use of CBAs in assisting with public investment decision-making.

The purpose of this paper is to illustrate that CBA, if done well, can improve and assist with making evidenced-based investment decisions. Further, for CBAs to be used effectively in public debate and decision-making, decision-makers must be held to account for the calibre of the evidence base. Interested parties within business and the community, therefore, need to be able to read and understand a CBA. The purpose of this paper is also to familiarise readers with the approach and terms used in CBA so that they are able to cut through the jargon to the substance of the analysis.

It is important to note that this paper is not an instruction manual for undertaking a CBA. There are weighty guides and manuals dedicated to that purpose.² The CBA concepts discussed in this paper are generic in nature and are relevant to a variety of investments made by different decision-making bodies.

² CBA manuals include Office of Best Practice Regulation (2007) 'Best practice regulation handbook'; Department of Finance and Administration 2006, *Handbook of cost-benefit analysis*; Civil Aviation Safety Authority 2007, *Cost Benefit Analysis Methodology Procedures Manual*; OECD 2006, *Cost-Benefit Analysis and the Environment*

1.3 When and why a cost-benefit analysis should be used

Usually there are several policy options available for achieving the objectives of governments. It is important to use CBA or an equivalent policy assessment tool early in any policy development process to ensure different options are identified and considered on their merits and that the option with the best outcome for the community is chosen.

CBA should be used by decision-makers to help answer the following types of questions:

- What approaches could achieve the stated objective of the project?
- Which, if any, of the proposed approaches provide a benefit to the community as a whole?
- Should a proposed investment be undertaken?
- Should an investment be continued?
- How are the costs and benefits of a policy option distributed?
- Which groups within the community, business and government benefit from the proposal and which groups are adversely affected?

CBA should be used to assess all of the options that may achieve a desired outcome, not to justify a preferred approach prior to an investment decision. CBA conducted after a political announcement is usually an exercise in ‘ticking the box’, rather than an honest assessment of all the possible approaches to meeting the desired objective. After a preferred approach has been identified, care should be taken to update the CBA as the project evolves through the planning process.

The case for using cost benefit analysis does not mean governments should be locked in to setting policies according to a CBA’s results. CBA’s rely on assumptions that are not possible to predict with utmost certainty. There may also be other strategic factors to take into account that are difficult to assess within the CBA. Michael Woods, Deputy Chairman of the Productivity Commission, neatly summarised the role of CBA in contemporary evidence-based policy in comments to a public hearing of the Joint Committee on the National Broadband Network.

“As a general principle we continue to believe that cost-benefit analysis is a useful tool. We also make the point that you do not actually rely exclusively on the numbers that a cost-benefit analysis will produce because it is the product of many assumptions. As long as it is a transparent process of identifying the various costs and benefits and it is transparent as to the assumptions that you have made...then that is a useful contributor to decision making.”³

³ Australian Government (2011) Joint Committee on the National Broadband Network, *Rollout of the National Broadband Network* (Official Committee Hansard) (17 June) available at: <http://www.aph.gov.au/hansard/joint/commttee/J120.pdf> last accessed 14.12.11.

The difference between CBA and a business case

CBA is different from building a business case. The purpose of a business case is to outline the commercial rationale for undertaking a project and to define the parameters and management factors involved in the project itself. It provides the project manager with a tool to guide the design, management and evaluation of the project. In this way, a business case is typically focused on the impacts of an investment for a particular organisation while CBA provides a wider assessment of the impacts on society as a whole.

It is important to note that while the process of assessing costs and benefits is a mandatory requirement of some formal government processes, such as a Regulatory Impact Statement (RIS)⁴, undertaking a CBA is not compulsory for all proposed government policies or investments.

1.3.1 Rail gauge standardisation: an example of the insights CBA can offer

The history of CBA in Australia can be traced back to Federation and the debate surrounding the standardisation of rail gauges in Australia. The essence of this example stems from the incompatibility of the nation's railway systems which operate on three different gauges: 3'6", 4'8½" and 5'3". The issue of standardisation of gauges has been seen from the time of Federation very much in terms of an investment project. The problem of incompatible gauges, and hence the implied wisdom of unifying the various railway lines, is embedded in the Australian psyche.

However, an earlier version of the CBA analysis undertaken on the costs of standardising gauges at the Victoria-New South Wales border found that given the initial error of different gauges, unification, at least at the time of Federation, would not have been the economically sensible decision. Ultimately, the cost of standardisation outweighed the overall benefit. Whether the balance of costs and benefits would have swung the other way in later years is a moot point: both the benefits derived from rail freight and the cost of standardisation rose dramatically in the early 20th century.

Australian railway systems continue to operate on three different gauges. However, standard gauge (4'8½") line now links all Australian mainland capital cities. Opened in 2004, the connection to Darwin was carried out despite several cost-benefit studies indicating that costs would exceed benefits. Conversion of other sections appears also to have been undertaken on primarily political grounds; probably in the absence of prior cost-benefit analysis.

This example illustrates the benefit of a CBA. As stated in the Office of Best Practice working paper on cost-benefit analysis, *A century of Australian cost-benefit analysis: lessons from the past and the present*, this example is a:

⁴ A Regulation Impact Statement (RIS) is required, under the Australian Government's requirements, when a regulatory proposal is likely to have an impact on business or the not-for-profit sector, unless that impact is of a minor or machinery nature and does not substantially alter existing arrangements. The RIS must be cleared by the Office of Best Practice Regulation (OBPR) before it and the associated regulatory proposal can proceed to the decision maker.

“... clear lesson is that there is no substitute for rigorous economic analysis as an input into informed decision-making. This is most particularly true for large, ‘nation-building’ projects where it may seem perfectly obvious to the man in the street that they should proceed.”⁵

1.4 How should a cost-benefit analysis be undertaken?

There are four key elements to undertaking a CBA:

- the CBA must be an objective assessment of the proposed policy option or options;
- the team engaged to undertake the CBA should have the breadth of expertise, both economic and subject matter specific, to identify and consider technical and other issues during the analysis;
- the CBA should be updated with any new and significant information as it comes to hand; and
- the CBA should be publicly released.

Each element is discussed in further detail in the sections below.

1.4.1 The importance of objectivity

Good evidence-based policymaking requires objectivity. Studies of previous CBAs have demonstrated that where this criterion is not met there is a persistent bias towards over-estimating the benefits and under-estimating the costs. This tendency was demonstrated in a study by Bent Flyvbjerg from the University of Oxford that compared the forecast costs and benefits with the realised costs and benefits for large transport infrastructure builds.

This study included more than 200 transport projects from a range of countries and over a number of decades. It found that bias towards over-estimating the benefits and under-estimating the costs was irrespective of the country in which the investment was made and that the estimates had not improved over time. Flyvbjerg chose to focus on transport infrastructure for his study because the best data existed for transport projects. However, comparative research shows that the problems identified above are relevant to a wide range of other project types.⁶

There are two plausible reasons for the persistent bias in the assessment of costs and benefits: planning fallacy and strategic misrepresentation. Planning fallacy occurs when managers make decisions based on optimism rather than on a rational weighting of gains, losses and probabilities. It is a tendency for people and organisations to under-estimate how long they will need to complete a task, even when they have experience of similar tasks over-running. Strategic misrepresentation occurs when project planners and promoters deliberately over-estimate the benefits and under-estimate the costs in order to increase the likelihood that their project will get funding.

⁵ Dobes, L (2008), *A century of Australian cost-benefit analysis: lessons from the past and the present*. Working Paper in cost-benefit analysis for the Office of Best Practice Regulation, Commonwealth Department of Finance and Deregulation.

⁶ Flyvbjerg, B. 2009, ‘Survival of the unfittest: why the worst infrastructure gets built and what we can do about it’, *Oxford Review of Economic Policy*, volume 25, Number 3, pp. 344-367.

The persistent over-estimation of benefits and under-estimation of costs does not demonstrate that CBA is useless and should be abandoned. It demonstrates the importance of ensuring objectivity. As such, CBA should be conducted by an independent party. This does not necessarily dictate that a CBA cannot be done in-house, but it does require that those responsible for conducting the CBA be sufficiently removed from those within the organisation who are promoting an investment or policy proposal.

1.4.2 Expertise to undertake CBA

The credibility of a CBA is influenced by the suitability of the third party appointed to conduct the CBA. As stated above, objectivity is a vital consideration when appointing a third party. In insuring the quality of the CBA, the appropriate level of expertise must also be considered. The team engaged to undertake CBA should be multidisciplinary, with the specific skills sets required varying depending on the project under consideration.

CBAs for government investments are generally led by economists or professionals with requisite experience and skills in calculating both financial and non-financial costs and benefits. However, subject matter experts such as management accountants, engineers, public policy administrators and procurement specialists can provide vital input into the development of assumptions and providing objective analysis.

1.4.3 Updating the CBA with new information

CBAs are often undertaken relatively early in the life of or as a foundation step to undertaking an investment. However, over time, the project may evolve and new information becomes available. It is important that the CBA is updated as that occurs. This requires ensuring that the CBA is properly documented and transparent and can, therefore, be readily updated as new information comes to hand.

1.4.4 Transparency

Good evidence-based policymaking also requires transparency. To ensure transparency it is particularly important that:

- cost, timing and benefit estimates are clearly evidence-based for instance by drawing from the experience of comparable projects and policies or from robust publicly available research;
- the assessment clearly articulates how cost, timing and benefit estimates were developed; and
- the assessment and all information used in making the assessment are made available for scrutiny by the public.

Transparency allows the public to critically evaluate the estimates and assumptions that drive the final result; ultimately this builds confidence in the policy.

1.5 Understanding and managing the limitations of cost-benefit analysis

This section summarises some of the key criticisms of CBA and demonstrates how these can be mitigated. Common criticisms include:

- uncertainty in the estimates;
- equity considerations; and
- the cost and time involved in undertaking a CBA.

1.5.1 Uncertainty in the estimates

CBA is typically conducted prior to a decision to invest in a policy option. It is therefore a forecast of the *likely or expected* costs and benefits. Forecasts will always, in part, be based on assumptions and estimates.

A common criticism of CBA is that analysing future costs and benefits rests on making a complex set of assumptions that cannot with any certainty be expected to bear close relationship with the real world outcomes. The resulting evaluation is therefore highly uncertain and rarely an accurate reflection of the realised impact of the investment. This is made worse when the assumptions reflect a bias in the forecaster's view of the future.

Uncertainty in cost-benefit analysis can be taken into account by using various quantitative tools and techniques including sensitivity analysis. Sensitivity analysis is a form of quantitative analysis that examines how outcomes vary as individual assumptions or estimates are changed. Sensitivity analysis can help draw attention to those factors that require especially careful assessment or management. This analysis can address two key questions.

- Would the proposal still be worthwhile pursuing if some of the key assumptions do not eventuate?
- Are there actions that should be taken to reduce the risks before accepting a particular option?

The sensitivity analysis needs to be well designed and clearly presented. It should give a realistic picture of the extent to which the selected option is still worthwhile pursuing even if there are significant changes in a key variable or variables.

The availability of tools and techniques, such as sensitivity analysis, to assess the impact of uncertainty negates this justification for not preparing CBA.

It also demonstrates the importance of following up a CBA with an assessment that compares the actual performance of the investment or policy with the forecast performance. This second step contributes to building an information source on comparable projects that can be drawn upon to reduce the uncertainty associated with estimates and assumptions for future CBAs. Ensuring that a post-investment assessment is undertaken also works to introduce further accountability as the assessment will reflect the accuracy of the CBA and consequently the quality of the analysis.

1.5.2 Equity considerations

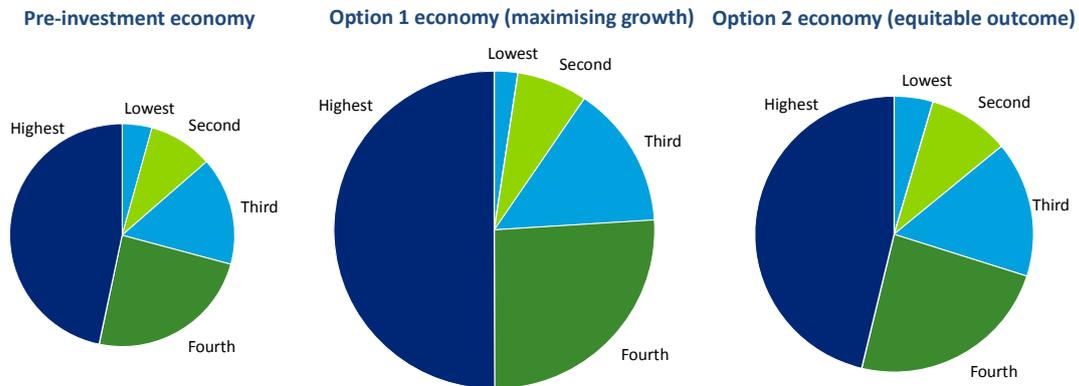
CBA's are also often criticised because they do not involve an assessment of the equity impacts of a particular investment. Distributional impacts can't be valued in monetary terms; hence the quantitative values in a CBA will not encapsulate equity considerations.

While CBA's are not primarily geared to addressing equity considerations, a CBA can be designed to not only provide information on the impact of an investment decision in terms of the size of the economy (the size of the pie) but also how economic prosperity is distributed between different groups within society (how the pie is sliced). This can be done either through the use of multi-criteria analysis (see section 2.8) or by undertaking separate CBA's for the different groups identified. This can inform policymakers about the distributive equity issues associated with an investment and the quantum of forgone benefit if decision-makers choose not to make the investment.

An investment can have a very positive economic impact but result in very negative equity outcomes. For instance, a proposed airport expansion may generate substantial economic benefits but result in significant negative impacts on the residents in the surrounding area from air and noise pollution and reduced property values. There is no requirement that a CBA make a judgement about the empirical evidence on the equity of distribution or social value of impacts enjoyed or suffered by different groups. It is required only that these be documented to the extent that the data and other resources permit.

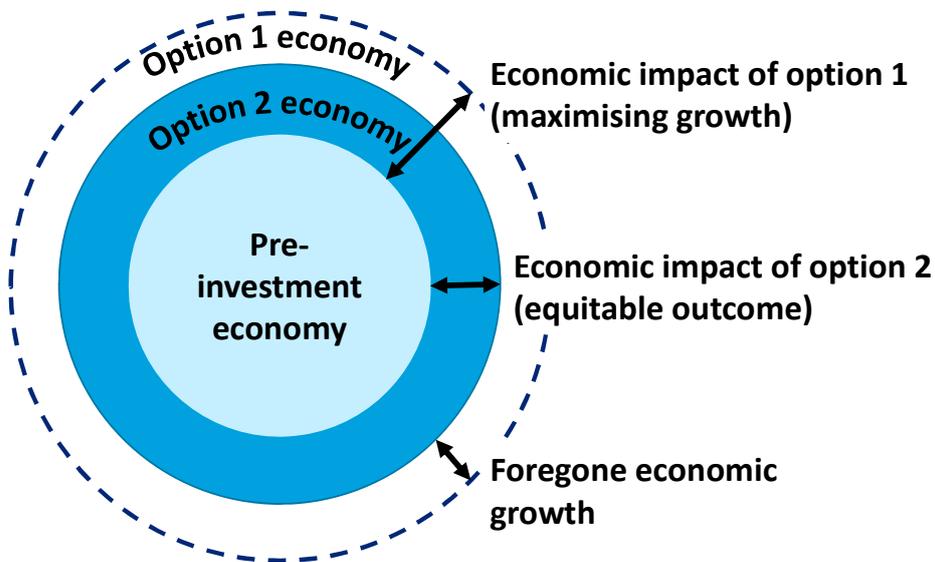
Figure 1.1 illustrates how two different policy options might theoretically affect economic growth and how that growth might be distributed between the five economic quintiles of the population. Both policy option 1 and 2 result in economic growth. Option 1 generates greater overall growth but the majority of that growth benefits high income earners (those in the fourth and the highest quintile) to the detriment of low and middle income earners (those in the third through to lowest quintile). Option 2, on the other hand, generates a lower level of overall growth but the growth benefits all members of society.

Figure 1.1



How these distributive consequences might translate into an assessment of the social value of the project can be left to the political process. It is the role of the decision-maker to decide if the equity impacts are acceptable or if it is possible to redistribute some of the economic growth generated by the investment to mitigate adverse equity impacts.

Figure 1.2



Where it is decided that, despite a policy option having the largest net benefit to society as a whole, the distributive impacts are such that the policy option is not deemed desirable, the CBA makes explicit the value decision-makers have placed on ensuring fairness. This is the foregone economic growth resulting from favouring option 2 over option 1. Figure 1.2 demonstrates how a CBA may contribute to assessing the pay-offs between economic growth and fairness should decision-makers favour policy option 2 (equitable outcome) above policy option 1 (maximising growth).

Rural and regional equity issues

Consideration of the impact of potential investments on rural and regional Australia represents a particular class of equity considerations that are often factored into

government decision-making. Providing services to rural and regional customers is often more costly than providing the same services in metropolitan areas. In order to ensure equitable access, however, governments often require the provision of services at uniform prices or standards for city and country customers.

Where rural and regional equity is a requirement of the investment, crude cost-benefit measures could suggest that rural and regional customers are benefiting at the expense of the rest of the community. However, it is not always valid to equate the benefit generated for rural and regional customers through services provided, with the ultimate beneficiary.

Support for rural and regional communities arises not only from equity considerations, but also because of national interest reasons for supporting decentralisation through subsidising rural and regional communities. That is, productive and sustainable regional and rural communities are critical to the viability of many of Australia's commodities exports industries and assisting decentralisation is another way of dealing with urban problems of congestion, pollution and other social problems. Hence some of the benefits of equitable distribution to regional and rural areas can be assigned a monetary value and captured in the benefit-cost ratio.

The approaches to considering equity in a CBA discussed above are also all valid when considering the impacts of an investment or policy approach on rural and regional Australia.

1.5.3 Cost and time of undertaking a CBA

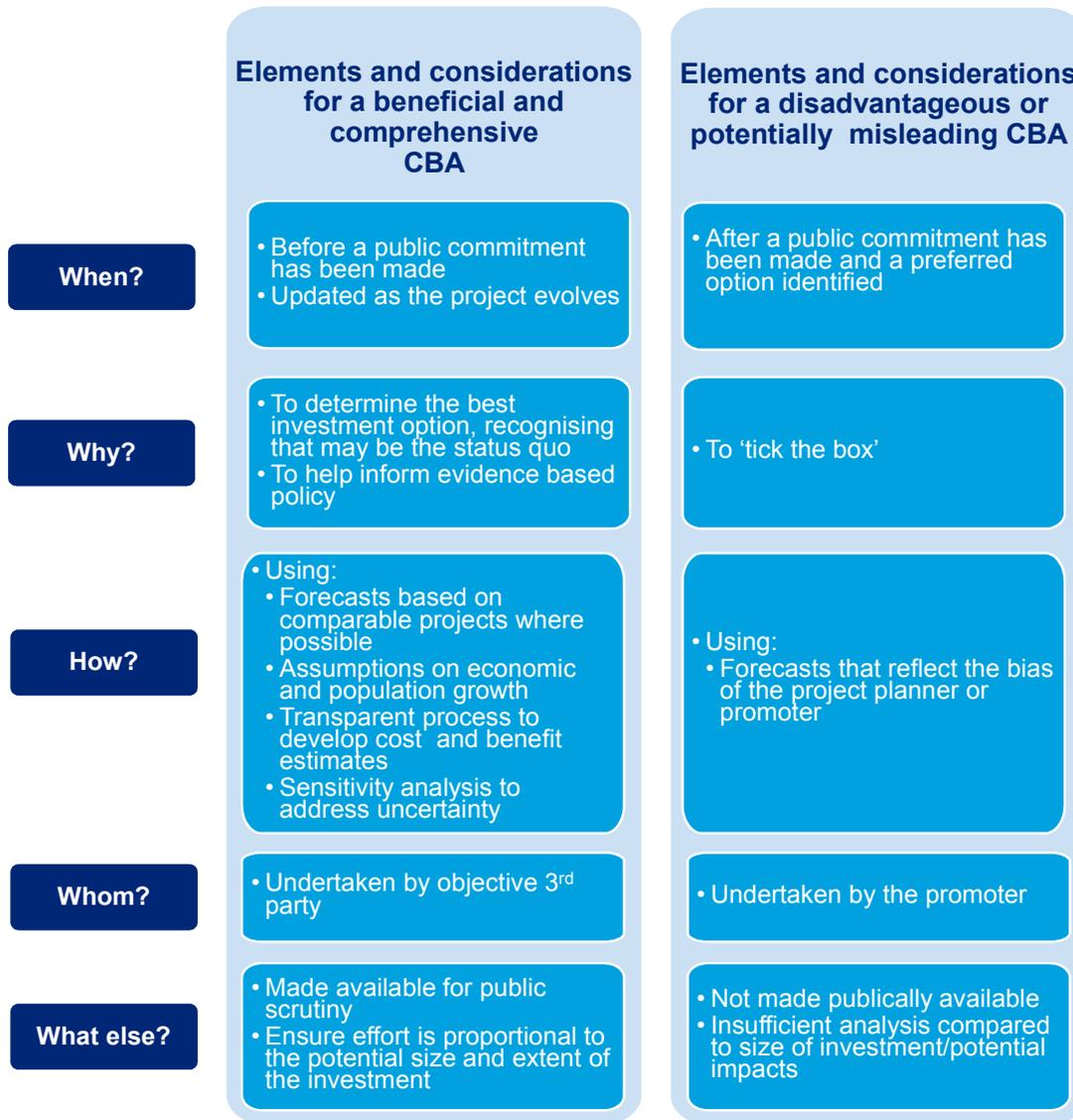
The cost and time involved in undertaking a CBA should be proportional to the size of the investment and/or its expected impact on the economy and the community. Small short-term investments do not warrant the same level of analysis as capital-intensive nationwide investments. For example, for a \$20 million investment with a useful life of two years, it is not an appropriate allocation of resources to invest in a comprehensive CBA that involves significant and costly primary data collection. In this instance, it may be more appropriate to rely on existing information from similar investments locally or internationally.

By contrast, a CBA for a \$2 billion major infrastructure investment should involve significant primary data collection to ensure that the analysis is based on the most accurate and relevant information.

1.6 Summary

This chapter has covered the when, why, how and by whom a CBA should be conducted to ensure that the outcomes are meaningful and can support the development of evidence-based decision-making in government. Figure 1.3 summarises the key aspects of the above discussion.

Figure 1.3



The next chapter summarises the key steps to a CBA and provides a worked example of a CBA.

2 Key steps in a CBA

As noted in the previous chapter, in order for the interested parties within business, the community and government to be able to scrutinise a CBA, they need to be able to read past the jargon to the substance of the analysis. This chapter provides a summary of the main steps in constructing a CBA. These include:

- establishing the **base case** – or the ‘no change’ policy option;
- defining the **policy options** to be evaluated and compared against the base case and against each other;
- laying out the **estimates** and **assumptions** for external factors affecting the policy outcomes;
- defining and estimating the **costs** of a policy proposal;
- defining and estimating the **benefits** of a policy proposal; and
- drawing a **conclusion**.

A real world example, cancer screening, has been used to provide an example of how the main elements of a CBA can be employed.

Cancer screening example: Introduction to the issue

The Federal Government is concerned about the number of false positive results (i.e. where a radiologist decides a cancer screening result is abnormal but no cancer is present). False positive results require additional testing to rule out cancer which can be costly and time consuming. False positive results also lead to physical discomfort and anxiety and other forms of psychological distress in the affected patient.

The government would like to improve cancer screening by reducing the number of false positive results. To identify the best approach, the government chooses to undertake a cost-benefit analysis of its options for alternative approaches to cancer screening.

2.1 The base case

An initial question to ask when preparing or reading a CBA is – ‘*what would happen if this investment did not take place?*’ This is the base case. The base case lays out what would occur in the business as usual scenario where there is no decision to undertake a government investment or policy reform. Essentially it lays out ‘*what would the world look like without that change?*’

The base case allows the CBA to compare two futures: the future with the investment and that without the investment. The base case is used to measure the changes that are created as a result of the investment. These changes are often referred to as the ‘incremental’ impacts.

The base case does not mean ‘*how things have been in the past*’. It is important that the base case has been clearly defined. If the base case is not logical or well articulated, it will be difficult to assess the incremental impacts of the investment options.

The base case should include any observed long term trends. In particular, the base case needs to account for future population and economic growth. All forecasts contain an element of uncertainty. In order to address this uncertainty, forecasters need to develop different forecast scenarios (usually low, mid-range and high scenarios).

For example, the Australian Bureau of Statistics (ABS) produces population growth forecasts: Series A (high), Series B (mid-range) and Series C (low). Unless there is a compelling reason to do otherwise, these are the forecasts that should make up the low mid-range and high population growth forecasts in the base case.

A CBA cannot be conducted without a base case.

Cancer screening example: Establishing the base case

The Federal Government is considering how it can improve the effectiveness of its cancer screening programs. The base case will include the ABS forecasts of population growth and the historical rates of cancer screening in the population and patients receiving false positives.

The base case will include an assessment of the costs of the current approach:

- the cost of funding cancer screening providers to purchase and maintain current technology;
- the cost of additional testing resulting from false-positive results; and
- the emotional and physical 'costs' to patients who receive false-positive readings.

The base case will also include an assessment of the benefits of the current approach:

- the positive health outcomes generated by the early detection of cancer as a result of current technology.

2.2 Policy options

The purpose of any investment proposal is to achieve an outcome that improves the wellbeing of the community. In many instances there are multiple approaches that could achieve the outcome. These are described in the CBA as policy options. The base case is considered a special policy option as it corresponds to a "no change" option.

Similar to the base case, the policy options in a CBA should be clearly articulated and reasonable. It is also important to consider whether there are any policy options that may have been overlooked and not included in the CBA. A well thought-out CBA includes all the feasible options and provides justification where options have not been covered.

Cancer screening example: The policy options

The desired outcome of the investment is to improve the level of accuracy for cancer screening. The policy options that may achieve this outcome (and that are compared to the base case) include:

- investing in new scanning equipment that uses more accurate technology;
- introducing a minimum volume of cancer screening examinations to be read each year by radiologists employed by the program – higher screening volumes have been associated with lower rates of false-positive readings; and
- increased education and supervision requirements for radiologists with a higher than average rate of false positives.

2.3 Costs

The cost assessment within a CBA takes into account all the impacts of the policy options that produce undesirable impacts. The costs describe what has to be given up to implement the investment or policy option. A useful way of looking at the costs of an investment or policy option is to identify which individuals or groups in the community are worse-off as a result.

Individuals or groups that may experience costs as a result of a policy or investment typically include the following:

- **Government:** a one-off expenditure on new infrastructure or the start-up and on-going cost of running a program or initiative.
- **Business:** additional time or money spent on performing administration, education and compliance associated with meeting government requirements as a result of new policy.
- **The community:** short term disruption in services, noise pollution and loss of amenity for instance from the construction or operation of new infrastructure.

The full range of costs in a CBA should be identified, even those that may be difficult to measure. Understating or overlooking a cost that is difficult or impossible to quantify is a common hazard with CBAs.

All costs must be considered relative to the base case – that is, the costs that are additional to the base case.

Cancer screening example: The costs

Costs that may be identified in the following policy options include:

- **Option 1:** Investing in new scanning equipment that uses more accurate technology (high cost option).
 - Cost of purchasing new equipment.
 - Time spent training staff to use new equipment.
- **Option 2:** Introducing minimum volume of cancer screenings each year for radiologists employed by the program (low cost option).
 - Cost of establishing a monitoring program.
 - Additional time spent monitoring mammogram readings per radiologist.
- **Option 3:** Increased education and supervision requirements for radiologists with a higher than average rate of false positives (lowest cost option).
 - Cost of developing and implementing a training program.
 - Time spent by radiologists for undertaking the training.

2.4 Benefits

The benefit assessment of a CBA describes the impacts of the investment that produce advantageous or desirable effects. When identifying the benefits it may be helpful to ask, *'who is made better off as a result of the investment?'* For the following individuals and groups these could include:

- **Government:** time or money saved through more efficient programs or processes.
- **Businesses:** reduction in time or cost, particularly with respect to administration, or improvements in efficiency, productivity and innovation.
- **The community:** increase in welfare, safety, participation and/or connectivity.

Many CBAs will also look at benefits according to the 'triple-bottom-line.' The triple-bottom line covers the positive economic, environmental and social outcomes of the investment. While there is nothing wrong with classifying benefits under these headings, it is crucial to avoid double-counting.

For example, an investment in new transport infrastructure results in reduced commuter times for a particular residential area. This impact could be valued as the travel time savings or the increase in house prices for that residential area, which is the market reflecting the reduced travel time. If a CBA includes both impacts, it is double-counting.

Like the cost side of the CBA, it is important to identify all the benefits related to the policy options and measure them relative to the base case.

Cancer screening example: The benefits

Benefits that may be identified for all three options include:

- Reduction in false positive results.
- Reduction in anxiety levels and/or psychological distress experienced by patients.
- Reduction in time taken off work for needing further testing.
- Enhanced reputation of radiologists.

The magnitude of the benefits will occur to different degrees depending on the effectiveness of the policy option:

- **Option 1:** Most effective
- **Option 2:** Least effective
- **Option 3:** Somewhat effective

2.5 Estimates and assumptions

The magnitude of costs and benefits for different policy options will be built up from a range of estimates and assumptions. Estimates are variables where there is existing evidence, preferably from multiple sources. Assumptions are variables where there is less robust data and the team developing the CBA has had to use judgement. Estimates are clearly preferable to assumptions.

A CBA, however, almost always includes assumptions because not all of the information needed to perform the analysis is available. Just because it is necessary to make some assumptions to conduct a CBA does not mean it is not worth doing. All analysis of decisions involves some assumptions about the future, and CBA is no different in that respect. One of the great strengths of CBA is that it makes it clear what the key assumptions are that affect whether or not a project is worthwhile and allows for the systematic testing of those assumptions.

The basis for estimates should be transparently documented in the CBA, including all data sources used to develop the estimate. Similarly, where assumptions are used, they should be fully documented, explained and justified.

Cancer screening example: The assumptions

The following assumptions might be made in order develop the estimates of the costs and benefits:

- Increasing patronage rates for routine cancer screenings as a result of providing a more reliable service under each of the options. Option 1 would be expected to generate the biggest impact in this regard because it is the most effective at reducing false positives. However, all the options would be expected to have some impact.
- For option 3, the number of false positives per radiologist that should trigger increased education and supervision requirements will need to be assumed because there is no current research about the optimal intervention point.

2.6 Valuing costs and benefits

Impacts that can be valued

There are a number of strategies to quantify (i.e. express in dollar terms) the cost and benefits of the impacts that will occur under policy options. For some impacts, measurement is reasonably straightforward as there is a market price⁷, such as the cost of labour, equipment or materials.

Cancer screening example: Impacts with a market price

For the three policy options under consideration, the following activities have a market price that can be drawn upon to estimate the cost of the policy change:

- The cost of performing a biopsy.
- The cost of purchasing and maintaining cancer screening technology.
- The cost of radiologist's time spent undertaking additional training activities.
- The cost of developing training resources.

For other impacts no market prices exist because goods and services are not charged for or because the impact cannot be bought or sold. For example, air quality does not have a market price and health is not tradable. In the absence of market prices, certain techniques can be used to evaluate the impact of a non-market good. These techniques use market data for goods and services that are in some specific way related to the value of the impact in question or survey people on what the value of the impact might be worth to them.

Cancer screening example: Non-market goods that may be valued

The amount of money individuals are willing to pay to reduce the risk of false positive results.

Impacts that cannot be quantitatively valued

Some costs and benefits can be difficult to value in dollar terms because their impact is unknown or uncertain. Others cannot be valued even if their impact is known because they are difficult to express with a monetary value. Examples can include environmental, social and cultural impacts.

Even if impacts cannot be valued, it is important that they are identified and described. In some instances it may be possible to quantify the impact in non-monetary terms. For example, the impact of an investment that reduces greenhouse gas emissions could be quantified as the expected reduction in global emissions.

Cancer screening example: Impacts that cannot be quantitatively valued

Greater confidence in the accuracy of health services and the value of cancer screening as a result of a reduction in false positive cancer screen readings.

⁷ The market price is the current price at which a good or service can be bought or sold.

2.7 Calculating the impact in today's value

The costs and benefits identified in a CBA typically occur over a number of years. In order to compare costs and benefits over time, the values attached to costs and benefits in future years need to be converted and expressed in today's dollar value. This referred to as 'discounting' future values.

Discounting the value of future costs and benefits makes all future impacts comparable by removing two effects:

- **Inflation:** future values are adjusted to remove the effects of price rises, e.g. the CPI.
- **Time value of money:** future values are adjusted because individuals prefer a dollar today rather than the (more uncertain) promise of a dollar tomorrow.

Discounting future values makes it possible to calculate cumulative costs and benefits in a way that accounts for differences over the time period. A CBA should clearly define the following elements:

- **The base year:** the year in which the value of all costs and benefits are expressed, usually the year in which the CBA is conducted.
- **The discount rate:** the percentage rate at which future values are reduced to bring them into line with today's values.

Discount rate

The discount rate is used to convert costs and benefits that occur in different time periods to a base year. There is no single discount rate that is appropriate for every project. Discount rates are typically selected based on the following components:

- **Risk-free rate:** the ten-year Commonwealth Bond rate.
- **Market risk premium:** this compensates for the risk associated with the expected net benefits, compared to investing in a risk-free asset.

State treasury departments typically publish Technical Notes that provide guidance on the calculation and use of discount rates to assess investments.

The selection of the discount rate has an impact on the size of the costs and benefits reported. As in the simple example in Table 1, a higher discount rate can markedly reduce the value of a future cost or benefit. This is an effect which intensifies over time.

Table 1: Impact of the discount rate

Discount rate	Today	Today + 1 yr	Today + 5yr
3%	\$100.00	\$97.09	\$86.26
7%	\$100.00	\$93.46	\$71.30

As the discount rate can change the size of the cost and benefit, it must be clearly stated in the CBA. It is often worthwhile to assess the sensitivity of a CBA to the discount rate chosen by re-calculating the costs and benefits under different discount rates to identify the degree to which discount rate changes alter the outcome of an assessment.

2.8 Calculating the overall value

Measuring 'quantitative' values

The final stage in the CBA assessment is to calculate the value of each policy option taking into account all future discounted benefits and all future discounted costs.

The final overall value is usually expressed in one of three ways:

- **Net present value:** The net present value (NPV) is typically one of the most straightforward and commonly used methods to calculate the overall financial value of an option in a CBA. It compares all future discounted benefits to all future discounted costs to arrive at a single value of the policy in today's dollars. If the NPV is positive, the investment improves efficiency because it involves benefits that, over time, more than outweigh the costs. If the NPV is negative, the investment is inefficient. Policy options can then be compared by the size of their NPV.
- **Internal rate of return:** The internal rate of return (IRR) finds a discount rate which makes the NPV equal to zero. In some cases, the higher a proposed investment's IRR, the more preferable it is to undertake. However, there are many pitfalls involved in relying on IRRs, including the possibility that there will be more than one value for the discount rate that makes a project's NPV zero.
- **Benefit-cost ratio:** The benefit-cost ratio (BCR) measures the ratio of the present value of benefits to the present value of costs. As with the IRR, in some cases the highest BCR is used when deciding between alternative options. However, this too involves considerable risks, including the sensitivity of BCR to what is treated as a cost and what is treated as a benefit.

In a CBA some options may be easier to value than others. Although CBA places an emphasis on quantifying in dollar terms the impacts of potential options, the CBA should not be biased towards an option just because it is easy to value. This does not necessarily make it the best approach. However, where difficult-to-value impacts are included, it is crucial, for the reasons set out above, to document carefully and transparently the manner in which that has been done.

Cancer screening example: Measuring the quantitative value

An assessment of the costs and benefits of the three options demonstrates that all three options generate a net benefit. Option 3 has the highest NPV and the highest benefit-cost ratio. Option 3 is therefore the preferred option.

	Option 1	Option 2	Option 3
Costs			
First year costs	\$200 million	\$26 million	\$15 million
Cost for each subsequent year	\$5 million	\$4 million	\$10 million
NPV costs for 20 years	\$235 million	\$63 million	\$111 million
Benefits			
Reduced rate of false positives	50% reduction	15% reduction	35% reduction
Value of each avoided false positive	\$500		
NPV benefits for 20 years	\$243 million	\$73 million	\$170 million
Net impact			
NPV	\$8 million	\$10 million	\$59 million
Benefit cost ratio	1.0	1.2	1.5

Note: The figures in this table are fictitious and are presented for illustrative purposes only.

Measuring 'qualitative' values - "Multi-criteria analysis"

The methods described above are used to measure quantifiable benefit and costs. Yet most proposals being considered by decision-makers will need to take into account benefits and costs that are not financial or quantifiable. Multi-criteria analysis (MCA) refers to a range of techniques to assess policy options that can be used to bring together quantifiable and unquantifiable impacts. The approach enables the inclusion of a wider range of criteria – for example, social and environmental considerations – as opposed to methods used in a typical financial analysis.

MCA, however, is far less able to control for quality compared to conventional CBA. Indeed, once a project is complete, it is often impossible to go back and verify whether a multi-criteria evaluation made at the time a project was launched proved in any sense correct. As a result, MCA should only be used where a compelling case can be made that a conventional CBA would be inappropriate, and then only as a supplement to a CBA.

Having benefits or costs that are unquantifiable does not rule out the ability to establish an overall value or **score for each option**.

For example, for financial, economic, social and environmental benefits and costs, quantifiable impacts which are assessed in physical units (e.g. dollars) could be converted to a score from -4 to +4 (any scale could be used). Unquantifiable impacts are simply described then converted to a score from -4 to +4. This score is determined relative to the base case as shown in the table below. Options would be ranked for each criterion (financial, social, environmental, etc). A total score for each option could then be calculated.

As noted previously, this can be a valid approach to conducting a CBA as long as judgements about how options are expected to perform against criteria are transparent,

defensible and understood. However, there are significant risks involved in such an approach. To begin with, the scores may be subjective and difficult to interpret. Additionally, it is not obvious how one would assess whether the scores were sensible, either at the time the evaluation was made or subsequently.

While impacts cannot always be quantified, the discussion surrounding the MCA within the CBA should establish as much of an evidence base as possible for the scores (with the proviso that the effort is proportionate to the size of the investment).

Table 2: Scoring of options in a CBA

Assessment value	Score
Very much better than the base case	+ 4
Much better than the base case	+ 3
Moderately better than the base case	+ 2
Little better than the base case	+ 1
Same as the base case	0
Little worse than the base case	- 1
Moderately worse than the base case	- 2
Much worse than the base case	- 3
Very much worse than the base case	- 4

2.9 Post-implementation review

Following the development of a CBA that has contributed to a particular investment outcome, a post-implementation review should be conducted. This is an important and often overlooked step, even where a CBA has been produced. The purpose of a post-implementation review is to find out:

- Whether the expected benefits of the project have been realised.
- Assess whether any aspects of the current project require remedy:
 - Consider effectiveness of on-going delivery and whether there is any scope for improved value-for-money
 - Determine whether forecasts of expected demand/need for the project should be revised/managed
 - Review risk register and management strategies
- What lessons can be learned from the project for future investment projects, such as:
 - Successful methodologies/approaches to reinforce in future CBAs
 - Cost and benefit assumptions that can be used for other comparable CBAs (e.g. identify where cost assumptions have been underestimated and what further analysis could have been undertaken)
 - Ways of reducing the risk and improving the management of future projects.

A post-implementation review should be conducted after enough time has elapsed so that the actual benefits (as opposed to the expected benefits) of the new investment can be measured and evaluated by an independent party.

3 Conclusion

Investment decisions by governments need to be based on robust assessment of their future costs and benefits to ensure they are making the best use of taxpayers' funds and deriving the maximum benefits for society.

CBA is one of the key tools that can assist in the development of evidenced-based policy if it is conducted with transparency and objectivity. It provides a framework for weighing up different impacts arising from policy decisions and impacts which occur in different time periods.

Why CBA is important

OECD

The OECD has long championed efficient decision-making using economic analysis ... cost-benefit analysis has been widely practised, notably in the fields of environmental policy, transport planning, and healthcare. In the last decade or so, cost-benefit analysis has been substantially developed both in terms of the underlying theory and in terms of sophisticated applications.⁸

Productivity Commission

In the real world, policy is developed in a fluid environment, is subject to competing vested and political interests, and can be driven by pressure to act quickly to solve headline-grabbing problems. Ideally, we need systems that are informed by evidence at each stage of policy development, from when an issue is first identified, to the development of the most appropriate response, and subsequent evaluation of its effectiveness.⁹

Resources for the Future

The advantages of CBA (and CEA) include transparency and the resulting potential for engendering accountability; the provision of a framework for consistent data collection and identification of gaps and uncertainty in knowledge; and, with the use of a money metric, the ability to aggregate dissimilar effects – such as those on health, visibility, and crops – into one measure of net benefits.¹⁰

Dr Leo Dobes

Cost-benefit analysis is the only method that allows comparisons between sectors such as roads, hospitals, Defence, etc, as well as being capable of comprehensive analysis that takes into account factors such as environmental effects and other social costs and benefits. It is therefore best placed for 'whole of government' determination of spending priorities.¹¹

⁸ OECD (2006), *Cost-Benefit Analysis and the Environment: Recent Developments*.

⁹ Banks, G (2009), *Challenges of Evidence-Based Policy Making*. Contemporary Government Challenges, Australian Government, Productivity Commission, Australian Public Service Commission.

¹⁰ Kopp, R.J., Krupnick A.J., Toman, M. (1997), *Cost-Benefit Analysis and Regulatory Reform: An Assessment of the Science and the Art*. Discussion Paper 97-19, Resources for the Future.

Critics of CBA cite uncertainty in the estimates of future costs and benefits, the importance of equity considerations and the cost and time required to undertake a CBA to argue against its use. As discussed in this paper, these perceived shortcomings can be addressed to a large extent within the standard CBA methodology and are not a reason for failing to comprehensively assess the costs and benefits of major policy decisions.

CBA should not be the only input into the decision making process but it is a highly useful tool that can substantially improve the implementation of public policy in Australia to the benefit of all current and future citizens.

¹¹ Dobes, L (2008), *A century of Australian cost-benefit analysis: lessons from the past and the present*. Working Paper in cost-benefit analysis for the Office of Best Practice Regulation, Commonwealth Department of Finance and Deregulation.



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Business Council of Australia ABN 75 008 483 216

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