MOVING FROM EVALUATION TO VALUATION

Improving project appraisals by monetising more economic, social and environmental impacts

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INFRASTRUCTURE VICTORIA

WHAT THIS PAPER IS ABOUT

This paper outlines how government can improve its assessment and appraisal of infrastructure proposals when making investment decisions by monetising more economic, social and environmental impacts.

This is the first in a series of papers from Infrastructure Victoria's research program on improving the way government undertakes project appraisal. The focus of this research is to improve the government's ability to more consistently assess the relative merits of infrastructure projects, programs and policies by developing tools to help value, in monetary terms or 'dollar terms', more economic, social and environmental impacts. This will help extend the use of cost benefit analysis (CBA) — which produces Net Present Values (NPV) and Benefit Cost Ratios (BCRs) — across non-transport sectors and monetise key economic, social and environmental impacts not currently captured in CBA in the transport sector.

These papers will propose parameter values — that is, unit costs in dollar terms for some economic, social and environmental impacts — to be used in CBA. This will lead to the development of a CBA tool that can be used as a quick and cost-effective way of initially assessing and prioritising project, program and policy options.

If you are interested in understanding more about how the economic, social and environmental impacts from infrastructure proposals could be valued in monetary terms, this paper is for you.

This first paper outlines:

- Limitations with the current approach to evaluating infrastructure projects, programs and policies.
- How CBA in the social housing, health, criminal justice and transport sectors can be further developed or strengthened by improving the valuation of non-market impacts.
- The impacts that could be considered in CBA for each sector.
- Why using the benefit transfer method — that is, using proxies from other jurisdictions or studies to estimate impact — is our preferred approach as a first step to extending and improving the use of CBA in non-transport sectors.
- Different methods, data sources and evaluation instruments that can be used to ascribe monetary values to more economic, social and environmental impacts.
- A selection of parameter values that are currently used in other Australian states and internationally that could be adopted in Victoria.

What this paper is not about

This paper does not:

- Recommend adopting the parameter values identified in this paper. Recommended parameter values will be incorporated in our CBA tool to be released in 2017.
- Quantify the economic, social and environmental impacts of specific projects. This will continue to be undertaken on a project-by-project basis as part of the formal planning, business case development and assessment processes that apply to investment proposals in Victoria.
- Identify economic, social and environmental impacts beyond the social housing, health, criminal justice and transport sectors. This will be the focus of our future research.
- Deal with equity and distributional impacts of infrastructure proposals on different members of the community.

As part of our research in 2017, we will also develop and seek feedback on our proposed CBA tool.

How to find out more

The technical appendices in this paper provide tables of impacts with parameter values that we have identified from our research.

The technical appendices describe in more detail the available parameter values, including their methodologies and assumptions, as well as the sources of information and databases used by Infrastructure Victoria in preparing this paper.

How to get involved

Stakeholder and community feedback is an important part of our research on monetising economic, social and environmental impacts of infrastructure projects, programs and policies.

This paper includes key questions which we are seeking your feedback on. To provide feedback, please email it to enquiries@infrastructurevictoria.com.au.

Summary

GOVERNMENT NEEDS BETTER TOOLS TO CHOOSE THE BEST INVESTMENTS.

To meet infrastructure challenges over the next 30 years, government has to ensure it maximises value-for-money. We see CBA as a key tool to support decision making.

COST BENEFIT ANALYSIS ALLOWS OPTIONS TO BE QUANTIFIED IN MONETARY TERMS AND COMPARED ON A CONSISTENT BASIS.

CBA provides an objective and consistent framework for weighing up the different impacts occurring at different periods across all infrastructure sectors.

COST BENEFIT ANALYSIS IS NOT PERFECT AS IT DOES NOT CAPTURE ALL IMPACTS.

CBA assigns values to costs and benefits. We know that it is not possible to value all costs and benefits.

MORE CAN BE DONE TO EXTEND THE USE OF COST BENEFIT ANALYSIS AND CAPTURE MORE IMPACTS.

Improving and extending the use of CBA consistently will help government make more informed investment decisions.

OPPORTUNITIES EXIST TO MOVE FROM EVALUATING IMPACTS OF SOME INFRASTRUCTURE PROJECTS AND POLICIES TO VALUING THEM.

We may never be able to value all economic, social and environmental impacts of infrastructure projects in monetary terms. But there are existing valuation approaches than can be applied to value some of these impacts more consistently.

Governments make investment decisions by allocating taxpayer funds to projects, programs and policies across all sectors. Doing this requires a more consistent and systematic approach to assessing projects, programs and polices when comparing and prioritising investment across all infrastructure sectors. Such an approach will help identify which projects, programs and policies will have the biggest impact. We think government needs better tools to choose the best investments and maximise value-for-money when developing and assessing proposals.

Cost benefit analysis (CBA) is a rigorous and transparent method that seeks to quantify and value the costs and benefits of a project in monetary terms. This helps governments to quantify and more consistently compare the relative merits of infrastructure projects, programs and policies. CBA can help governments rank projects and programs, and more clearly demonstrate how the public dollar is spent on the best project or program. We see CBA as an important and necessary tool, but not the only tool, to support government in making sound investment decisions.

CBA is not new and it is not perfect. It does not capture all impacts of an investment. However, we think improving and extending the use of CBA will help government make more informed investment decisions and spend more wisely.

CBA is used now for major transport projects. However, it currently does not capture all economic, social and environmental impacts which may result from a transport project, program or policy. For example, it does not quantify or 'monetise' the impact of building transport projects on urban amenity.

For other infrastructure sectors, Victoria does not use CBA consistently, if at all. While most Victorian Government departments are able to quantify the impacts of projects and programs, it is sometimes difficult to ascribe monetary values to all project impacts — especially those that are not observed in the market, such as noise emissions from vehicles. In addition, the cost of undertaking primary research to derive these values prevents some departments from undertaking CBA.

These limitations make it challenging for government to transparently appraise the best option. Instead, governments seek to *evaluate* the economic, social and environmental outcomes that infrastructure projects, programs, and policies will deliver by quantifying their impacts in non-monetary terms or by making a subjective assessment.

We think opportunities exist to move from *evaluating* impacts of some infrastructure projects and policies to *valuing* them – therefore enabling CBA to be used.

Though we recognise that it will not be possible to put a 'dollar value' on all the economic, social and environmental impacts for all investment decisions.

Our research objective is to develop tools, techniques and parameter values — such as unit costs/per dollar, where feasible — for ascribing monetary values to economic, social and environmental impacts of infrastructure projects and programs. Our initial research focuses on improving CBA in the **social housing, health, criminal justice and transport sectors**. This will lead to the development of a CBA tool.

These sectors have key challenges that need to be addressed for Victoria as they account for a significant part of state investment in infrastructure. There are also international best practice examples to provide guidance for improving CBA in these sectors. For example, some jurisdictions such as New South Wales already use CBA for health projects and programs.

As a first step to improving CBA in these sectors, we propose to draw on proxies from other jurisdictions or estimates from studies to ascribe monetary values to impacts where market prices do not exist. This is known as the 'benefit transfer' method. We are also commissioning work to develop Victorian specific parameters for amenities to improve the use of CBA in the transport sector.

The tool we will develop will complement and make use of existing Victorian and Commonwealth Government, and Infrastructure Australia guidelines for developing or assessing infrastructure proposals. The tool will not replace these guidelines.

In the **social housing sector**, significant non-market or 'intangible' benefits are yet to be priced consistently for CBA. There is scope for using the Social Return on Investment (SROI) method more widely — especially within government agencies — to determine social impacts in monetary terms. Existing international and Australian databases could also be used to derive values for social housing impacts.

In the **health sector**, CBA is currently the least-used approach for project appraisal. While there are significant economic, social and environmental impacts from health interventions, current project appraisal methodologies do not properly account for a majority of these impacts. Merging existing health evaluation instruments — such as Quality Adjusted Life Year (QALY) with Value of Statistical Life Year (VSLY) — would enable them to be priced or monetised. This would be an important step forward in undertaking CBA in the health sector.

While CBA has been increasingly embraced in the **criminal justice** sector, the absence of specific appraisal guidelines related to the justice system and crime prevention means that the use of CBA is ad-hoc or inconsistently applied. There is also limited data available to ascribe monetary values to a number of non-market impacts. However, the Victorian Department of Justice and Regulation (DJR) has developed costs of crime parameter values in 2011, and more recently released a set of updated values in a consultation paper *Estimates of the Costs of Crime in Victoria, October 2016* to its stakeholders for their review and comment. We think there is scope to use existing databases, including DJR's cost of crime database, to more consistently use these impacts in CBA for this sector. In particular, we consider monetising the impacts to victims of crime, such as loss of productivity, pain and suffering, and lost quality of life, as important for CBA.

The **transport sector** has a well-developed and accepted methodology for valuing impacts and defining parameter values used in CBA. However, the sector would benefit from including additional non-market impacts in CBA in two specific areas: undertaking valuation of natural and urban amenities, and valuing the impacts on biodiversity and the ecosystem.

Across each of these sectors, we are seeking feedback on key questions in this paper to identify:

- Other economic, social and environmental impacts that should be considered and can be ascribed monetary values using the benefit transfer method mostly for the non-transport sector.
- Other appropriate methods to value economic, social and environmental impacts that do not require primary valuation research.
- Other sources of information or data that can help monetise economic, social and environmental impacts.
- Which economic, social or environmental impacts are the most important to be monetised for each sector.

Feedback we receive will inform our future papers and development of a CBA tool.

Our future papers will outline further evidence collected and the results of our commissioned research on Victorian amenities. We will set out a comprehensive list of economic, social and environmental impacts to be considered in CBA for project appraisal in Victoria, and recommend tools, databases, methodologies and parameter values for valuing these impacts.

Contents

Introduction

Why improving the valuation of economic, social and environmental impacts matters

Significant public investment will be required to meet Victoria's infrastructure needs over the next three decades. This will need to be met by government from available funds in an environment of competing demands across all sectors.

Given the magnitude of public spending required, it is crucial that governments make the right investment decisions and allocate resources efficiently, including prioritising investments appropriately, improving services to the community and delivering value-for-money. The ability to make good investment choices applies not only to capital spending on projects, but also to recurring programs and policies across infrastructure sectors.

Following the release of *Victoria's 30-year infrastructure strategy* in December, the Victorian Government will need a consistent and systematic approach to making sound investment decisions on infrastructure investment proposals and business cases which are subsequently developed. It needs to be able to more consistently measure and assess the economic, social and environmental impacts of projects and programs. Tools need to be developed to value more of these economic, social and environmental impacts. This will help government compare competing projects and programs across a range of sectors when making investment decisions. Such an approach could also help government more clearly demonstrate to the community the merits of its investment decisions.

Why moving from evaluation to valuation is challenging

Currently, the Victorian Department of Treasury and Finance (DTF) Investment Lifecycle and High Value High Risk guidelines[1] are the main reference used by Victorian Government agencies for preparing infrastructure investment proposals (see **Appendix A.1** for an overview of DTF's Investment Lifecycle framework). These guidelines recommend the use of CBA as the preferred economic appraisal method. However, these guidelines are not consistently applied in preparing infrastructure investment proposal across agencies because:

- Values for monetising impacts, particularly non-market impacts, are not readily available.
- There are no easy-to-use tools available to undertake economic appraisal.
- The use of other techniques, such as cost utility analysis, is deemed robust enough for some agencies to compare and prioritise projects within the one sector.

As a consequence, investment proposals received by government can fall short of best practice by inconsistently estimating the economic benefits of different infrastructure projects (such as building hospitals and prisons) in monetary terms. This is a common challenge facing other jurisdictions.

We consider CBA is an important and necessary tool to strengthen and support robust decision-making on infrastructure investments. By including economic, social and environmental values, CBA is a rigorous and transparent tool that quantifies and measures the costs and benefits of a project, program and policy in monetary terms. This monetisation enables transparent comparison between options.

Our research outlined in this paper is focused on improving the use of CBA as a tool for project appraisals in Victoria.

1 Victorian Department of Treasury and Finance (2013).

Our approach

In developing this paper, we have reviewed literature on project appraisal in Australia and internationally to understand current and best practice approaches and tools. We have spoken to key stakeholders within the Victorian Government, as well as economists, academics and practitioners in other Australian jurisdictions and overseas.

Consistent with Infrastructure Victoria's approach, our analysis considers a range of sectors. We decided to focus on the social housing, health, criminal justice and transport sectors because these sectors have key challenges that need to be addressed for Victoria. These sectors also account for a significant part of state investment and there is a wide body of international best practice examples available for these sectors.

We propose to develop values for assessing the impacts of proposed infrastructure investment in Victoria by using the 'benefit transfer method' — that is, by developing proxies from best practice approaches in relevant jurisdictions or data sources — as a first step towards improving the valuation of economic, social and environmental impacts.

We have also commissioned a valuation study which uses hedonic pricing.[2] The result of this work will produce Victorian specific parameter values for natural and urban amenities which will be particularly useful for the transport sector and will be included in our next publication.

2 Hedonic pricing is a method of pricing based on the principle that the price of a marketed good is affected by external factors that can lower or raise the 'base' price of the good. The hedonic pricing model is used to estimate the extent to which price is affected by these factors.

How can project appraisals be improved?

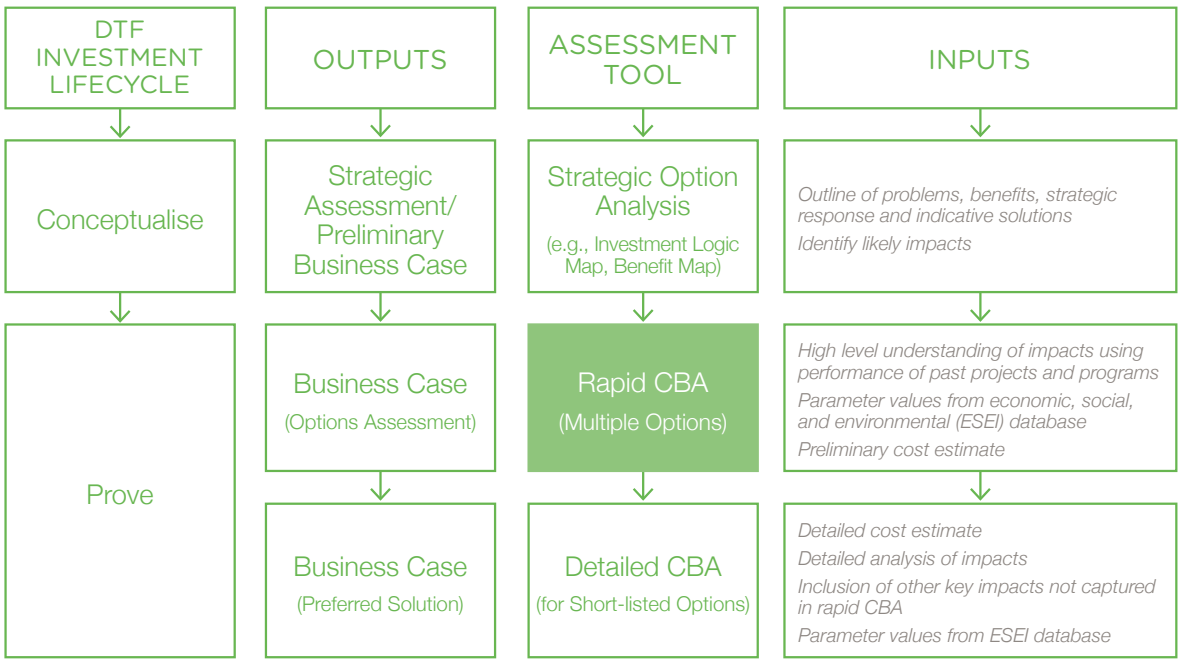
Our research aims to improve assessment of projects by extending and expanding the use of CBA across more sectors, improving project appraisal by monetising more economic, social and environmental impacts and developing a 'CBA tool'.

This CBA tool will assist government agencies in the first two stages of the investment lifecycle. Specifically, it could be used to help shortlist options in business case development as a quick and cost-effective way of initially assessing and prioritising project, program and policy options (i.e. rapid CBA). The CBA tool could also be used at the preliminary business case stage to support arguments for strategic options as depicted in Figure 1.

In developing *Victoria's draft 30-year infrastructure strategy*, we undertook a similar approach to the early stages of this lifecycle to assess the contribution of each option to specific needs. We used the best available evidence. For example, we commissioned a preliminary CBA of some major transport projects.[3] This is the first time government has been able to consistently compare the relative benefits of these projects. We have also used a range of economic, social and environmental indicators, strategic options assessments, multi-criteria analysis, and scenario and sensitivity testing when assessing infrastructure project, program and policy options.

In addition to CBA, there is a range of other tools available to explore options and prioritise solutions during project appraisal. An overview of these other tools is at **Appendix A.2**.

Figure 1 Application of rapid CBA in DTF Investment Lifecycle Framework



3 See KPMG, Arup & Jacobs (2016) report for more details.

Using cost benefit analysis

Cost benefit analysis (CBA) involves measuring costs and benefits in commensurate terms — usually monetary terms. If benefits exceed costs, then the project or program provides a positive return to government. If the benefits do not exceed the costs, the project or program does not provide a positive return or meet the economic efficiency objective. This decision rule assumes that most of the major impacts have been monetised and included in the CBA. However, decision-makers may sometimes decide to recommend an initiative even though the benefits do not exceed the costs to meet broader government objectives. CBA produces indicators such as Net Present Value and Benefit Cost Ratio — See Box 1.

Wherever it is possible to use CBA, it is the preferred appraisal tool because it shows costs and benefits in the same unit (dollars in present value). Comparisons across all interventions are more straightforward and the analysis can determine the absolute efficiency of a specific solution as well as its efficiency relative to other potential solutions.

BOX 1: WHAT ARE NET PRESENT VALUE AND BENEFIT COST RATIO?

Net Present Value (NPV) and Benefit Cost Ratio (BCR) are two common indicators produced as part of a CBA:

- **Net Present Value** represents the monetary or dollar value of the overall impact generated by a project or proposal. It reflects the benefits delivered over time less the costs in monetary terms, or the 'return on investment'. It is calculated as the present value of the stream of benefits less the present value of costs. This demonstrates the absolute size and scale of a project.
- **Benefit Cost Ratio** summarises the overall value-for-money of a project or proposal. It expresses in present value terms the benefits delivered to the community by a proposal relative to the cost of implementing it. This helps demonstrate the overall net increase or decrease from an investment or its relative benefit compared to another project. For example, a BCR of 1.20 means for every dollar invested, an extra 20 cents is returned to society.

Initiatives with NPV greater than zero or a BCR greater than one demonstrate net positive impacts to the society.

NPV is the primary indicator used for selecting the best option as it demonstrates the size or scale of the benefit from the project.

BCR is a good supplementary indicator, particularly when there is a budgetary constraint because it helps prioritise initiatives within a given funding envelope. For example, when two projects are estimated to have the same NPV, the project with a higher BCR provides greater benefits to society.

These indicators are affected by the ability to measure the positive and negative impacts of investment proposals in monetary terms.

Why should CBA be used?

CBA helps the government make better investment decisions to maximise outcomes. The key advantages of CBA over other appraisal tools are its ability to compare:

- Costs and benefits by expressing the values in monetary terms as far as possible.
- Costs and benefits that occur at different points in time by 'discounting[14] future costs and benefits to present value or today's dollars.
- Projects across sectors by using one unit value (dollars in present value). This advantage is particularly valuable when comparing projects and programs where outcomes vary and the timing and length of impacts differs.

Why should we improve project appraisal by extending the use of CBA?

In Victoria and internationally, CBA is an accepted and widely used tool for appraising projects in the transport sector. However, it is not widely and consistently used in other sectors such as social housing, health, justice, education or environment sectors. This makes it harder for any government with a constrained budget to consistently compare projects and decide which projects the next or last public dollar should be spent on.

We think Victoria can improve the way it appraises projects by moving from qualitative assessment, such as the use of multi-criteria analysis in some sectors, to monetising more costs and benefits using CBA.

Our research has shown that CBA is used internationally for appraising projects, programs and policies in the social housing, health, criminal justice and transport sectors. For example, NSW are now using CBA in the health sector. As depicted in Figure 2, the approach in Victoria has been improving — moving from qualitative to monetary assessment of impacts. However, improvements can still be made to move towards best practice.

Figure 2 Comparison of Victorian project appraisal practice with national/international best practice

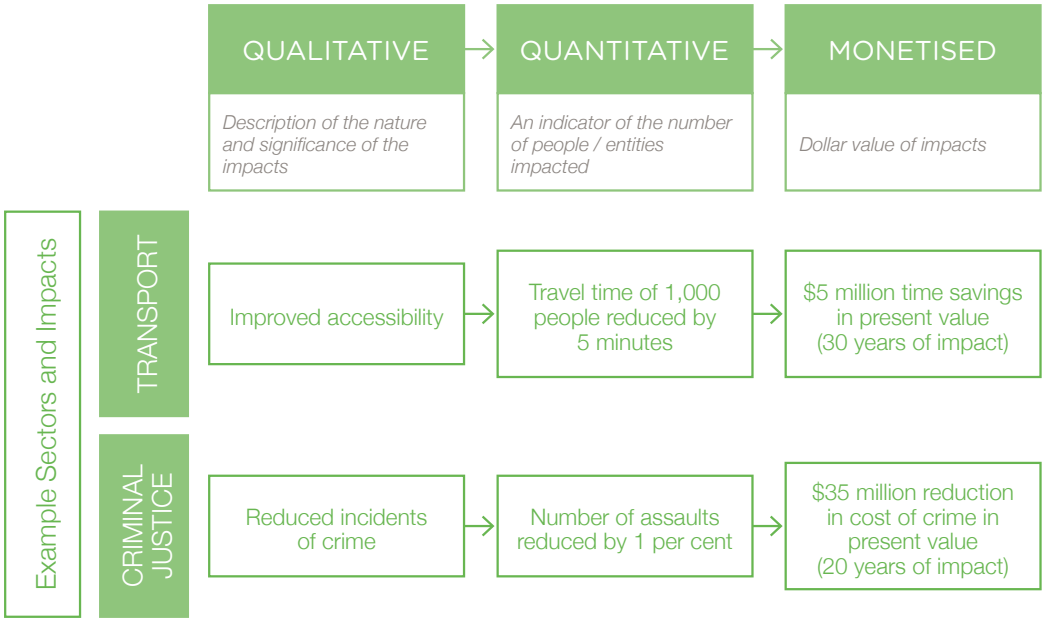
Sector	Impacts	Qualitative (descriptive)	Quantitative (numbers)	Monetised (dollars)
Social Housing	Economic Social Environmental			
Health	Economic Social Environmental			
Criminal Justice	Economic Social Environmental			
Transport	Economic Social Environmental Wider Economic Impacts			

4 Discounting is a process of determining the value of future cost or benefits/revenue in today's price. It reflects the generally accepted understanding that a dollar is worth more today than it would be worth tomorrow.

We think extending and expanding the use of CBA by monetising impacts as far as possible will help the government to consistently compare options to make more informed investment decisions and spend its budget more wisely.

Figure 3 demonstrates how moving from qualitative to monetary assessments helps compare options with different outcomes and time horizons using a commensurate unit (monetary values).

Figure 3 Examples of different levels of information used for project appraisals



Note: Dollar values used for illustration purposes only and do not represent the value of impacts.

What are the challenges in using CBA in any sector?

Although CBA has key advantages, it can be challenging to apply and use for some infrastructure projects, programs and policies in any sector. These challenges are outlined below.

Monetising non-market impacts

The main challenge of CBA is its requirement to ascribe monetary values to all economic, social and environmental impacts of a project. Some impacts can be difficult to value in dollar terms mainly because market prices for certain outcomes do not exist. This applies especially to projects and programs that improve welfare and general wellbeing, where desired outcomes are difficult to value in monetary terms – such as improving quality of life, reducing pain and suffering or saving lives as a result of health interventions or crime prevention projects.

Economists have overcome this challenge by developing a range of monetisation methods and techniques to help estimate the value of an outcome when market prices are not observable. For example, one method is to measure 'willingness to pay', where discrete choice experiments (providing a list of choices with the question 'how much are you willing to pay?') can help to determine the price of the good that buyers are willing to pay. Nevertheless, non-market impacts are usually estimated with some level of subjectivity, often based on past experiences and expectations, which could be biased.

We recognise CBA may not be the right tool to use when a monetary value cannot be ascribed to key impacts or outcomes delivered by the project.

Uncertain outcomes

Some impacts are hard to value because the magnitude of outcome is uncertain or unknown. This applies particularly to pioneering projects and programs, or where outcomes are not directly attributable to the project due to other factors. For example, it is uncertain how much land use changes will result from extending a rail line or building a new station because land use development is also dependent on other factors, such as economic growth and competition from other locations.

Equity and distributional considerations

By aggregating benefits into one value, regardless who receives the benefits and who pays the costs, there is an implicit assumption in CBA that a dollar gain/loss for one person is the same as a dollar gain/loss to another person. However, different segments of the community would put different values on impacts depending on their situation. For example, people who have less travel options, such as the young and the older population, would value improvements in public transport more than people who have access to cars. See Box 2 overleaf.

There is an ongoing debate whether CBA should solely focus on maximising economic efficiency — only allowing other channels such as the taxation system and social programs to address equity and distributional issues.

Current CBA practice in Victoria adopts this approach as many equity and distributional impacts are not currently included in CBA. Discussions of distributional impacts are occasionally provided as supplementary evidence to inform final decisions. However, in the United States, regulatory guidelines now require the integration of distributional analysis as part of its CBA (but still recognising that some costs and benefits are difficult to quantify). While this approach provides stronger and more in-depth basis for decision-making, it is also technically challenging, particularly in assigning values to different segments of the community.

Another equity issue is accounting for the impacts of a project or program on future generations. This relates particularly to the use of natural resources and environmental assets where it may be considered 'unfair' not to take into account the depletion of these resources on future generations who had no say in the original decision. There is ongoing debate about the level of discount rate[5] to take into account when assessing intergenerational impacts, but there is growing recognition of the importance of considering and measuring sustainability when appraising projects.

5 The basis of a discount rate can either be the opportunity cost of capital, such as the 7 per cent rate recommended by Infrastructure Australia, which is based on the long-term real bond rate plus a premium for systematic risk, or the social time preference rate, such as the 3.5 per cent rate used in the United Kingdom.

BOX 2: HOW ARE EQUITY AND DISTRIBUTIONAL IMPACTS OMITTED IN CBA?

It is possible for an infrastructure project to have very different equity and distributional impacts depending on who has access to the infrastructure. While the project will have a CBA that produces a positive figure, it does not take into account who benefits and the relative gains received by different people.

For example, let us consider two areas of Melbourne:

- One that is well serviced by public transport, connected to more employment opportunities and has higher income per household compared to the Melbourne average.
- One that is less serviced by public transport, less connected to employment opportunities and has lower income per household compared to the Melbourne average.

In undertaking a CBA for additional bus services for either of the areas, traditional CBA methodology would not consider the greater benefit experienced by the less affluent area from the investment which results in them having more opportunity to access employment, compared to the higher income area. This is because traditional CBA methodology makes assumptions that the benefit of the project is the same for both areas' residents, usually based on **average** values.

The challenge of using CBA is how to incorporate the relatively higher benefits received by a less affluent community so that equity objectives can be considered.

Currently, CBA alone does not pick up on these differences, and needs to be accompanied by a qualitative discussion to describe the equity and distributional impacts.

Why do we need to improve CBA?

We think there is opportunity to not only extend and expand the use of CBA in Victoria but also to strengthen its application in existing sectors.

We recognise that CBA is not perfect because it does not account for all economic, social and environmental impacts of projects, policies and programs. However, opportunities exist to improve CBA and expand its use.

In Victoria and internationally, traditional CBA in the transport sector is widely accepted as a rigorous approach for assessing projects. However, CBA in the transport sector has also been criticised because:

- It accounts for all the costs of a project but does not capture all the positive or negative impacts. For example, when building a tunnel, CBA will reflect the large cost of a tunnel, but does not reflect the benefits of preserving amenities in surrounding suburbs and the amenity impact on land values. This is particularly apparent when an alternative approach, such as building a road through a suburb or park, has a much lower cost but is estimated to deliver the same benefits. This means that the 'at grade' solution has a higher BCR than is realistic if the amenity impacts are considered.
- There are different practices for ascribing monetary values to some direct and wider economic impacts delivered by a project, program or policy.
- There are risks in double counting benefits of projects, policies and programs.

Work is also underway in Australia to establish standard parameter values for CBA, such as those developed to measure both direct and wider economic impacts by the Transport and Infrastructure Council (TIC), and the values of cost of crime in Victoria by the Department of Justice and Regulation (DJR). This will help capture more impacts in existing CBA approaches. However, we still think progress can also be made to value more economic, social and environmental impacts in all sectors.

This will allow government to more comprehensively assess positive and negative impacts delivered by projects, programs and policies. Being able to value more of these impacts in CBA will affect projects differently compared to previous approaches. Some will show that they are more positive, because benefits that were not previously counted or measured are incorporated; others will be less positive because more negative impacts are valued. Either way, this will result in a more comprehensive assessment of projects.

Together, extending and expanding the use of CBA across more sectors, and valuing more impacts in existing CBA approaches will be a step forward in helping government to make more informed investment decisions and spend more wisely.

However, we recognise that no single tool can fully account for all the impacts of projects, programs and policies. This is also a limitation of CBA.

We recognise that it will not be possible to put a 'dollar value' on all the economic, social and environmental impacts arising from government investment decisions. Governments will always need to invest in projects, policies and programs which achieve broader social and environmental objectives. Decision-makers will still need to be aware of, and are able to use, complementary tools that can support CBA, such as multi-criteria analysis and qualitative analysis of non-quantified and distributional impacts.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Ascribing monetary values to impacts

Monetary values can be ascribed to non-market impacts using various approaches. Our research focuses mainly on the use of the benefit transfer method to ascribe monetary values against economic, social and environmental impacts for non-transport sectors.

The main challenge of cost benefit analysis (CBA) is ascribing monetary values to non-market impacts.

The easiest way to monetise an impact is when its values can be observed in market prices in a competitive market environment — such as the premium people are willing to pay for being close to a park when buying a house. However, there are many instances where market prices may be observed, but these prices do not accurately reflect social values (including the presence of external factors). In these cases, the value of the impact is usually adjusted to reflect the external factors.

It becomes harder to monetise impacts when market prices do not exist. Many government projects, programs and policies fall into this category. When market prices are not observable, it may be possible to identify surrogate market prices. The most common methods to monetise non-market impacts that can be used in CBA are discussed below.

Stated preference

The stated preference method estimates non-market values based on constructed or hypothetical markets by asking people what they are willing to pay for a hypothetical good or service, or what they are willing to receive as compensation to tolerate a cost or a loss. This is done by surveying a sample of people considered representative of the wider population. The two main approaches of the stated preference method are:

- **Contingent valuation** surveys usually contain well-defined elements that include a description of the study, details of proposed changes, and some socio-economic and attitudinal questions.

  Given this background information, respondents are asked whether they support a project or infrastructure investment given that they are required to pay a certain amount of money towards it, with the payment amounts being varied between respondents.

  The advantage of contingent valuation is that it is recognised as the standard instrument in valuing non-market impacts for public policy. However, it is also very costly to conduct and can be subject to the biased opinions of respondents as valuations are based on hypothetical situations.
- **Choice modelling** is similar to contingent valuation in that it contains background information about the proposed good or service and debriefing information. The main difference is in the form of the questions.

  Respondents are presented with a series of choices on how resources should be used and asked to choose their preferred alternative. The trade-offs respondents make when choosing between alternatives are quantified using statistical techniques. Where one of the attributes involves monetary payments, the resulting trade-offs can be used to estimate the monetary value of each choice.

  Choice modelling is useful when a number of policy options with different outcomes are being compared. However, it is also a resource intensive approach and the results can be influenced by biased opinions.

Revealed preference

Revealed preference methods use information from related markets to attribute a value for non-market goods. Three approaches are widely used:

- **Hedonic pricing** estimates the price of a non-market good by valuing its implicit price or attributes by observing actual markets in which those attributes are traded. For example, in the case of housing, these attributes could be the number of rooms, types of views and proximity to amenities.

  This method has been used to estimate the implicit values of natural and urban amenities by analysing house prices. It has also been used to estimate the value of a statistical life by analysing wages across jobs with different levels of risk.
- The **travel-cost method** is usually applied to the valuation of recreational use of natural environmental assets, such as woodlands, forests, wetlands, national parks and so on.

  The method uses travel costs (such as entry fees and value of time spent to and at the site) as a proxy for the price of visiting the site. This data is used to estimate the consumer surplus that people derive from visiting the site – that is, the trade-off between satisfaction gained from participating in an activity and the costs or value of time given up.
- The **expenditure aversion** or **defensive expenditure method** estimates the cost to an individual or agency of eliminating a risk or expenditure to maximise an outcome. For example, the amount of money a household would pay for clean drinking water to avert the harmful effects of a decline in drinking water quality. In theory, this is measuring the willingness to pay to avoid a decline in drinking water quality.

In general, revealed preference methods are only useful where values can be deduced from market behaviour. For example, measuring the value of amenities by estimating the impact they have on property values. This means that non-use values are generally excluded (see Box 3). Revealed preference methods also require data to be collected for a large number of transactions in which there is sufficient variation of the non-market attribute or characteristic.

BOX 3: WHAT ARE 'USE' AND 'NON-USE' VALUES?

Use values

Use values are based on actual use of a good, service or asset/infrastructure and are more likely than other types of values to have a corresponding market activity that gives rise to a measure of value through a market price. For example, the benefit people derive from visiting a park.

Non-use values

Non-use values, also referred to as 'passive use' values, are values that are not associated with actual use — or even the option to use — of a good, service or asset. Existence value is an example of a non-use value, where value is ascribed simply as a result of knowing that something exists, even if the person ascribing the value will never see or use the good, service or asset. For example, the benefit that people receive knowing that an endangered species of animal still exists in a remote forest.

Benefit transfer

Non-market impacts can also be valued by drawing on estimates from available stated or revealed preference studies, known as the benefit transfer method. As new primary valuation studies can be costly and time consuming, benefit transfer can provide considerable savings by using the results of studies already undertaken.

There are two main approaches to benefit transfer:

- **Unit value transfer** involves transferring a single number or set of numbers from pre-existing primary studies to the current context.

  Unit value transfer can be ascribed 'as is' or adjusted using a variety of approaches (i.e. by accounting for income or purchasing power parity differences). For example, governments do not conduct primary research for mortality risk for every new initiative. Instead, it estimates the Value of Statistical Life (VSL) adjusted for inflation based on previous studies.

- **Function transfer** derives information using an estimated approach on a new study, typically by using parametric functions derived from its original research.

  It is usually used in cases where the goods or services or the user population differs. For example, the UK approach in estimating agglomeration effects of major transport projects can be transferred by adjusting for Australian specific differences in locations and industry responses to changes in accessibility. Function transfer typically outperforms unit value transfers in terms of accuracy, but that is not always the case.

Benefit transfer is the most common way in which non-market valuation has been incorporated into policy analysis.

Figure 4 Complexity and issues for consideration for each valuation technique

Valuation technique	BENEFIT TRANSFER	REVEALED PREFERENCE		STATED PREFERENCE
Complexity	LOW	MEDIUM	HIGH	VERY HIGH
Approach	Using proxies from other jurisdictions or primary valuation studies to ascribe market values for impacts.	**Travel cost method** – collecting data on time and money spent on a site to estimate value. **Expenditure aversion/ defensive expenditure** – estimating potential cost averted to eliminate risk.	**Hedonic price modelling** – econometric analysis of related market to estimate value of an asset (i.e. estimating the value of urban amenities on property prices).	**Contingent valuation/ choice modelling** – estimating people's willingness to pay so to assign value on a hypothetical asset or intervention.
Issues to consider	The most cost effective approach as primary valuation is not undertaken. Relies on the availability and validity of existing studies. May have inaccuracies as values are not tailored for the project considered.	Requires collecting raw data to estimate the value of an asset or program. Only applicable when cost or pricing information is collected and accessible. Only captures use values.	Very resource intensive and requires good quality data. The method is often technically demanding. Only captures use values.	Requires significant resources in designing appropriate surveys and undertaking fieldwork. Are designed based on hypothetical situations and are subject to bias. Captures both use and non-use values.

Which valuation techniques should be used?

For each non-market impact, there is usually more than one method available to estimate its value as part of a project appraisal.

The choice of primary valuation method is usually based on the availability of existing studies or supporting data, the size of the project, the size of the potential impacts, the availability of resources and the need to include non-use values. The level of complexity and issues to be considered are outlined in Figure 4 in the previous page.

Regardless of the choice of primary valuation techniques used, the accuracy of all estimates should be explained and sensitivity analysis should be undertaken to demonstrate how the results change under alternative assumptions.

Techniques used in this research work

The research presented in this paper focuses mainly on the use of the benefit transfer method to ascribe monetary values against economic, social and environmental impacts for non-transport sectors. This is the first step we are taking in valuing non-market impacts as it is the most cost effective and least complex approach in determining parameter values for developing a rapid CBA tool.

While we recognise that the benefit transfer method may present inaccuracies, this can be minimised by undertaking sensitivity analysis using a range of suitable values.

Most parameter values will be identified by directly drawing from existing research. Some values will be adapted by deriving parallel values from Australian or Victorian databases.

The tables in the appendices to this paper provide a list of impacts and potential data sources we are considering, including the use of Quality Adjusted Life Year (QALY) and Value of Statistical Life Year (VSLY) indicators in the health sector, the cost of crime in the criminal justice sector, the Social Return on Investment (SROI) in the social housing sector and values derived from Australian and UK studies on the value of mobility and ecosystem services to value environmental capital in the transport sector.

We have also commissioned a primary valuation study on valuing Victorian amenities using hedonic pricing — with the aim of strengthening CBA in the transport sector. These amenity valuations and parameter values will be presented in our next paper.

Valuing economic, social and environmental impacts for cost benefit analysis

OVERVIEW

Cost benefit analysis can be used across all sectors to appraise projects, programs and policies consistently.

There is currently no uniform approach to project appraisal across the social housing, health, criminal justice and transport sectors. Each of these sectors has developed different approaches, tools and databases for assessing projects and programs.

Some existing evaluation instruments and databases used to measure the impact of proposals in non-monetary terms could be used to ascribe monetary values to economic, social and environmental impacts.

We have focused on improving CBA in the following four key infrastructure sectors in Victoria:

- **Social housing**
- **Health**
- **Criminal justice**
- **Transport.**

There is currently no uniform approach to project appraisal across the social housing, health, criminal justice and transport sectors. Each of these sectors has developed different approaches, evaluation instruments and databases for assessing or quantifying the non-monetary impacts of projects and programs. There are also some parameter values, such as Value of Statistical Life Year (VSLY), that can be used consistently regardless of sectors. Using CBA across these and other sectors will ensure a more consistent approach to appraising projects, programs and policies.

We have identified opportunities in the housing and health sectors to use many of the existing evaluation instruments and databases which demonstrate the impact of investment proposals as a starting point to assign monetary values. This means the next step is identifying parameters or unit costs to value these economic, social and environmental impacts in monetary terms. This will help extend and strengthen the use of CBA in these sectors.

Across all sectors, we have also identified new economic, social and environmental impacts that could be incorporated into CBA. This means both identifying ways to quantify and measure impacts and identifying parameters or unit costs to value them in monetary terms.

Over the next four sections, we outline:

- How project appraisals are currently undertaken in Victoria.
- What economic, social and environmental impacts should be captured for CBA and why these impacts are important.
- What existing tools, databases and evaluation instruments can be used to determine the monetary value of these impacts (by providing the base data for the benefit transfer method). We also provide examples of existing indicators and parameter values.
- How Victorian or Australian parameters can be developed to enhance the accuracy of CBA.

While we have focused on a limited number of sectors, many of our findings are relevant and hold true for other infrastructure sectors, particularly in relation to labour market and social impacts on the wider economy and society. This will help Victoria extend and expand the use of CBA; it could also help the use of CBA in other jurisdictions.

The appendices to this paper describe the impacts identified for each sector in greater detail, review the methodologies and supporting data available to estimate these impacts and propose existing indicators and parameter values that can be used in considering these impacts for CBA.

SOCIAL HOUSING SECTOR

Overview

Social housing carries significant non-market or 'intangible' benefits that are yet to be consistently 'priced' for cost benefit analysis.

The Social Return on Investment (SROI) method is a well-established technique to identify the economic and social impacts of social housing interventions. While this technique has been adopted by non-government organisations, government agencies are yet to use it properly for project appraisals.

We are exploring how the SROI method, as well as international databases, such as the Social Value Bank, can be used to monetise economic and social impacts in the social housing sector.

How is project appraisal practised in the Victorian social housing sector?

The primary types of economic evaluation used in the social housing sector are cost effectiveness and cost benefit analysis. In each of these assessments, the cost per unit of service (such as the cost per household/tenant) is compared with indicators around social housing program effectiveness and, to some extent, tenant wellbeing.

The biggest challenge in social housing evaluation is measuring social benefits or disbenefits that are mostly considered 'intangibles' and do not have market prices. Many economic, social and environmental impacts tend to be omitted due to the lack of appropriate monetary values to price these social impacts. This is the main reason why the Social Return on Investment (SROI) method (see Box 4 overleaf) is crucial for this sector as it provides a surrogate for representing social impacts in financial terms.

Internationally, governments and non-government organisations have been using the SROI method since the turn of the century. In Australia, academic institutions and non-government organisations, such as the Australian Housing and Urban Research Institute (AHURI), have embraced the SROI method. However, its use by government agencies is still very limited. Consequently, the absence of an Australia-wide guideline to determine appropriate pricing parameters using the SROI method means that some valuations rely upon the subjective judgment of those carrying out the assessment.

Nevertheless, work is currently underway in valuing the economic, social and environmental impacts in the social housing sector to improve project appraisal, and the output of our work is positioned to complement this work.

BOX 4: SOCIAL RETURN ON INVESTMENT

What is SROI?

Social Return on Investment (SROI) is a method for measuring and communicating a broad concept of value that incorporates social, environmental and economic impacts. SROI is distinct from other approaches in that it places a monetary value on outcomes, so that they can be added up and compared with the investment made. Both NPV and BCR can be estimated using this approach.

How should SROI values be interpreted?

While SROI articulates values in financial terms, the social value calculated should not be understood as a financial return of investment, but rather as a financial representation of value added. As explained by Ravi and Reinhardt (2011), SROI evaluation "is best understood in the context of an endeavour to value wellbeing through measures other than classic economic indicators such as Gross Domestic Product (GDP)".

What impacts should be considered within the social housing sector?

In *Victoria's draft 30-year infrastructure strategy*, we have recommended that investing in social and affordable housing should be one of the top three actions by the government. Social housing has the potential to result in a wide range of positive social outcomes. This includes improved family wellbeing, improvements to an individual's health and employability, a reduction in crime, strengthening community cohesion and avoiding social costs to government. In addition, the Victorian Government is investing heavily in improving the quality of social housing which has significant benefit to both the tenants and the broader community. These impacts are significant, but many of these benefits are yet to be assessed for inclusion in CBA.

The quantum of these impacts is also influenced by the demand for affordable housing — as experienced in Victoria through the state's strong population growth. Accordingly, quantifying the economic, social and environmental benefits for a CBA of social housing interventions is imperative for understanding the priority of investing in social housing infrastructure.

A list of economic, social and environmental impacts that are important for social housing CBA is set out in Table 1. **Appendix B** provides more detail on the avoided costs/savings to government, reduced social burden and improvements in social benefits.

Table 1 Economic, social and environmental impacts – Social housing sector

Economic	Social	Environmental
Project related costs • Investment and ongoing project expenditure, e.g. operating expenditure, maintenance costs, decommissioning costs • Residual asset values and asset disposal values • Tenant compensation • Tenant relocation costs • Sale of surplus assets up-front • Sale of residual assets from wind up **Avoided costs/savings to government** • Avoided social and health related payments • Avoided cost of crime and victimisation • Reduced utility costs rebate claimed by concession holders	**Increased social burden** • Reduced housing opportunity **Improvements in resident's benefits** • Increased education attainment • Improved workforce participation • Support for family life • Improved health and wellbeing of occupants • Development of social networks **Impacts to surrounding communities** • Improved urban and living environment	**Infrastructure emissions** • Changes in environment externalities associated with the use and/or improved energy efficiency of social housing – such as changes to noise and local air pollution, greenhouse gases (e.g. carbon dioxide, methane, nitrous oxide)

What is our main focus in valuing economic, social and environmental impacts for cost benefit analysis in the social housing sector?

Identifying and valuing social housing impacts using the SROI method

Our main emphasis is exploring how economic, social and environmental impacts can be valued for social housing CBA. Given that social housing's impacts are largely intangible non-market impacts, the SROI method can be helpful in ascribing monetary values against these impacts through economic proxies. However, while SROI has been the generally used approach in Australia in valuing many social impacts, consistency in the choice of economic proxies and parameter values for CBA is yet to be established in Victoria.

A more detailed discussion on the various economic, social and environmental outcomes and impacts that could be considered for CBA is set out in **Appendix B.1**.

What existing methodologies and parameter values could be used?

Social housing value databases

A number of international databases have been developed to value social housing impacts. These databases can be adopted using the unit value transfer method to strengthen CBA in the social housing sector in Victoria. For example, the Social Value Bank in the UK[6] provides parameter values against social and economic impacts for the social housing sector, which may be suitable for CBA in the Australian/Victorian context. Using primary research, social impacts such as improvements in employment outcomes, job security, safety, wellbeing and social cohesion were valued for inclusion in the Social Value Bank.

The Social Value Bank has been recognised by the UK Treasury in its Green Book guidance on CBA and is increasingly being applied by OECD governments seeking to assess the value of non-market social interventions.

The types of impacts that can be valued using various social housing databases are outlined in **Appendix B.2**.

Deriving Australian and Victorian values for social housing impacts

Australian or Victorian values for social housing impacts could be derived using the unit value transfer method by drawing on Australian databases, such as the Household, Income and Labour Dynamics in Australia (HILDA) survey and the National Social Housing Survey (NSHS) – particularly for measuring the impacts of employment outcomes and job security. Similarly, cost information could be drawn from the Australian and Victorian Governments to establish parameter values, particularly in measuring the impact of reduced demand for social welfare and potential avoided costs to government.

Drawing broader economic, social and environmental parameter values from reputable data sources such as HILDA and Australian/Victorian Government databases would provide consistency in valuing the impacts of projects across various government portfolios and sectors.

Details of the measurement units that could be ascribed against each economic, social and environmental impact are provided in **Appendix B.3**.

In considering our discussion in the social housing sector, we would particularly like responses to the following questions:

KEY QUESTIONS

1. **Have we missed any key economic, social and environmental impacts in the social housing sector that should be included in CBA?**
2. **Aside from the Social Value Bank, what other data sources can be used to monetise impacts in the social housing sector in Victoria?**
3. **Do you think the SROI method of applying economic proxies against each impact is appropriate for CBA? Are there other alternative approaches for deriving Australian/Victorian values?**

6 The Social Value Bank has been developed by the Housing Association's Charitable Trust (HACT) to value social impacts that emerge from the social housing sector in the UK.

HEALTH SECTOR

Overview

While the health sector has well-developed methodologies and instruments for cost effectiveness and cost utility analyses, these approaches are limited in their ability to appraise the broader economic, social and environmental impacts of projects in the health sector.

Currently, cost benefit analysis is the least-used approach in the health sector. There is scope for using cost benefit analysis to capture the broader economic, social and environmental impacts of health interventions.

We are exploring how evaluation instruments — such Quality Adjusted Life Year (QALY) and Value of Statistical Life Year (VSLY) — can be merged to 'price' or monetise health impacts. This would be an important step forward in undertaking cost benefit analysis in the health sector.

How is project appraisal practised in the Victorian health sector?

The primary types of economic evaluation used in the health sector are cost effectiveness and cost utility analyses. These analytical methods are used to compare a specific health intervention with a potential alternative health approach.

The main technique used is cost effectiveness analysis, as there are major benefits from health interventions that are difficult to value in monetary terms. The cost effectiveness analysis method measures health outcomes (for example, life-years gained or cases of illness prevented) against program costs. With the exception of life-years gained, the problem with cost effectiveness outcome measures is that no consensus has been reached as to the appropriate level of expenditure per unit of health benefit.

Cost utility analysis involves assessing health outcomes measured in Quality Adjusted Life Year (QALY) and Disability Adjusted Life Year (DALY).[7] This method aims to measure the effects of an intervention on both survival and quality of life; that is, interventions that improve quality of life can be compared with interventions that extend life by reducing the outcome to a single health utility index, which enables comparisons of interventions with multi-dimensional outcomes. For example, cost utility analysis is used to evaluate whether a hospital should invest in a new cancer-screening machine or to invest in hiring additional oncologists — by measuring the total amount of QALY gained per dollar of investment for each program. However, programs can only be compared if they are directly measured by the same utility index. In addition, neither QALY nor DALY fully captures the wider impacts that arise from interventions, such as impacts on carers and family or non-health economic consequences (such as loss of employment).

7 QALY and DALY are measurements that calculate the health of an individual or a general population in time (life years). QALY is a measure of years lived in perfect health gained; DALY is a measure of years in perfect health lost. DALY is primarily a measure of disease burden (such as a reduction in full health or even premature death), while QALY measures a health state (from death to full health).

CBA in the health sector is the least-used approach. However, CBA for the health sector has a strong parallel with cost utility analysis. The main difference is that the subjective judgments regarding the value of health outcomes are converted from utilities (QALY, DALY) to commensurate monetary values. To convert utilities into monetary terms, patients (or their family members and service providers) are asked to express the maximum amount of money they would be willing to pay to see the same outcome measured in utilities. As all costs and benefits are monetised, this provides the advantage of being able to evaluate and rank health programs along with projects in other sectors.

Because past analyses and decisions in the health sector have been based predominantly on cost effectiveness and cost utility analysis, academics and government agencies are more familiar with these methods and may consider them as best practice approaches. In addition, community concerns to placing monetary values on (statistical) life is sometimes claimed to be an impediment to the use of CBA in the health sector. However, we already use monetary values of statistical life in the transport sector.

What impacts should be considered within the health sector?

The economic and social benefits of the health sector are recognised and well established in the health economics literature. Just as economic growth, income, investment and employment are functions of the performance and quality of the economic system, investment in health and the actual performance of health systems have similar positive impacts on the economy and society.

The effects of health on overall economic development are clearly established internationally. Societies with poor health conditions find it harder to achieve sustained growth.[8] Economic evidence shows that improvement in health and life expectancy is associated with a rise in economic growth.

Illnesses and diseases also have significant impacts on individuals and the society. Lower life expectancy has negative impacts on capacity to work and damages productivity. Medical costs and time loss from productive activities also have negative impacts on wealth and human capital accumulation.

While there are significant economic, social and environmental impacts from health interventions (listed in Table 2 overleaf), current project appraisal methodologies do not properly account for a majority of these impacts.

8 Julio (2004).

Table 2 Economic, social and environmental impacts – Health sector

Economic	Social	Environmental
Improved patient experience • Reduced waiting time of care • Improved timeliness and quality of care • Reduced length of hospital stay • Benefit from better management of chronic disease **Improved productive capability** • Improved healthcare facility operation efficiency and performance • Reduced and/or avoided resource costs (operating and capital) from providing appropriate care in a lower cost setting (e.g. avoided treatment costs, delayed capital costs) **Improved patient outcomes** • Increased productivity • Increased capacity to work / labour supply • Increased non-market production and consumption • Increased capacity to save and invest in physical and intellectual capital (human capital) • Improved health outcomes (such as reduced mortality and improved quality of life) **Avoided costs / savings to government** • Avoided social and health-related payments	**Social burden** • Reduced burden of disease • Reduced cost from re-admittance to hospital or other healthcare facility • Reduced demand for social welfare	**Traffic-based impacts** • Changes in environmental externalities as a result of improved proximity to healthcare facilities, such as reduced noise and vibration, local air pollution, greenhouse gases (e.g. carbon dioxide, methane, nitrous oxide) **Infrastructure emissions** • Environmental impacts from the use of healthcare infrastructure, such as local air pollution, greenhouse gases **Health care waste** • Hazardous material that may be infectious, toxic or radioactive

What is our main focus in valuing economic, social and environmental impacts for cost benefit analysis in the health sector?

Existing health evaluation instruments (such as QALY and DALY) have been developed for quantitative assessments, but have not been 'priced' or monetised for CBA in Victoria.

These instruments have been designed to evaluate the effectiveness of health programs in increasing both quality and length of life. The benefit of using these indices is their relevance across a wide range of health programs, treatment types and population groups. This means that a wide range of health projects can be appraised using a consistent approach.

Given the usefulness of these instruments, the main focus of our research is to identify how CBA in the health sector can be strengthened by monetising these indices.

Nonetheless, the health sector also has broader social and environmental impacts that should be considered — such as the impact on workforce participation, labour supply, investment in physical and human capital, as well as traffic usage and congestion. Most of these impacts cannot be captured within existing health evaluation instruments, but can be captured in CBA.

A more detailed discussion on the various economic, social and environmental impacts that could be considered for CBA is set out in **Appendix C.1.**

What existing methodologies and parameter values could be used?

Merging existing health evaluation instruments

Both QALY and Value of Statistical Life Year (VSLY) are internationally recognised indices and are governed by guidelines in Australia for use in project appraisals. These instruments can be used for monetising impacts for CBA, as outlined in Abelson's working paper[9] and as adopted in practice in NSW.

The VSLY is often used to approximate how much a society is willing to pay to add on the value of an 'additional year of healthy life'. Numerous studies have estimated the VSLY, and the Department of Prime Minister and Cabinet has set out a comprehensive guidance note on how VSLY can be ascribed for CBA.

The monetary benefits of health programs can be estimated for CBA by multiplying the additional QALYs gained by VSLY, and benefits measured for future years can also be discounted using an appropriate discount rate.

Several of the impacts identified in this paper can be valued using the VSLY, as discussed in **Appendix C.2.**

The Commonwealth Government has recommended guidance on how QALY and VSLY should be applied during the project appraisal process. Given this guidance, decisions made on health sector appraisals can be made transparently.

9 Abelson (2008).

Deriving economic, social and environmental parameter values using Australian/Victorian database

Australian or Victorian values can be derived using the unit value transfer method by drawing on Australian databases, such as the Household, Income and Labour Dynamics in Australia (HILDA) surveys, particularly those related to improved workforce participation and productivity. Similarly, cost information can be drawn from the Australian and Victorian Governments to establish parameter values, particularly in measuring the impact of reduced demand for social welfare and the associated potential avoided cost to government.

Drawing broader economic, social and environmental parameter values from reputable data sources such as HILDA and other Australian/Victorian Government databases would provide consistency in valuing the impacts of projects across various government portfolios and sectors.

A detailed table setting out the measurement units that can be ascribed against each economic, social and environmental impact is provided in **Appendix C.3.**

In considering our discussion on the health sector, we would particularly like responses to the following questions:

KEY QUESTIONS

1. **Have we missed any key economic, social and environmental impacts in the health sector?**
2. **Asides from Quality Adjusted Life Year (QALY) and Value of Statistical Life Year (VSLY), are there other valuation instruments that can be used to monetise economic, social or environmental impacts?**
3. **What other reputable databases can be used to derive parameter values to measure the health sector's economic, social and environmental impacts?**
4. **Do you think the use of QALY and VSLY to measure benefits is appropriate for health CBA? Are other approaches available?**


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CRIMINAL JUSTICE SECTOR

Overview

While appraisal tools are being used in the Victorian criminal justice sector, the absence of specific appraisal guidelines related to the justice system and crime prevention means that the use of cost benefit analysis is ad-hoc and inconsistently applied. There is also limited data available to monetise the impacts to victims of crime, such as loss of productivity, pain and suffering, and lost quality of life.

The Australian Institute of Criminology's cost of crime database provides some parameter values on the cost of crime and the cost of society's response to crime. We are using this database and Victorian-specific cost of crime estimates, being developed by the Department of Justice and Regulation, to establish an appropriate method and parameter values to monetise the economic, social and environmental impacts associated with project appraisal in the criminal justice sector.

How is project appraisal practised in the Victorian criminal justice sector?

The use of CBA has been increasingly embraced in the criminal justice sector and crime prevention field in Australia and internationally.

The Victorian Department of Justice and Regulation (DJR) has been using a mix of appraisal tools, such as cost effectiveness and cost utility analyses. However, due to the absence of appraisal guidelines specific to the justice system and crime prevention, the use of CBA is ad-hoc and inconsistently applied in Victoria.

While there are initiatives underway in Victoria's criminal justice sector to improve project appraisal, there are debates about the subjectivity of monetising intangible impacts, such as pain and suffering. There are also impacts beyond criminal justice that needs to be better understood and monetised, such as system costs to the social housing and health sectors.

What impacts should be considered within the criminal justice sector?

In undertaking project appraisals in the criminal justice sector, the typical impacts considered are the cost of crime and the cost of society's response to crime. The list of impacts is set out in Table 3 below. The classification and finalisation of impacts and their values will be developed taking into consideration DJR's paper — *Estimates of the Costs of Crime in Victoria, October 2016* — on estimating Victorian cost of crime parameter values. **Appendix D** provides indicators and parameter values of economic, social and environmental impacts based on a specific example of a crime. A more comprehensive list will be developed in consultation with DJR.

Table 3 Economic, social and environmental impacts – Criminal justice sector

Economic and Social	Environmental
Cost in anticipation of crime • Insurance costs • Security-related costs • Other precautionary expense as a result of fear of crime **Cost of society's response to crime** • Criminal justice cost (police, courts, corrections, Victorian Legal Aid, Office of Public Prosecutions, and the like) • Victim services • Other non-criminal programs **Cost as a consequence of crime** • Property loss or damage • Medical care • Loss productivity • Legal costs • Pain and suffering • Quality of life • Other intangibles	**Infrastructure emissions** • Changes in values associated with environmental externalities associated with the operation of an infrastructure, including noise and vibration, local air pollution, greenhouse gases (e.g. carbon dioxide, methane, nitrous oxide)

What is our main focus in valuing economic, social and environmental impacts for cost benefit analysis in the criminal justice sector?

Our main focus in relation to the criminal justice sector is to value most, if not all, the impacts listed in Table 3. An understanding of the values of all these impacts is critical to ensuring that projects, programs and policies are assessed systematically through the use of CBA.

The cost of crime and crime prevention is also a significant cost to Australian economy. The Australian Institute of Criminology (AIC) has estimated that the cost of crime in Australia in 2011 was $4.7 billion or 3.4 per cent of Gross Domestic Product (GDP).

The AIC's cost of crime database provides key parameter values on the cost of crime and the cost of society's response to crime. Our next paper will include a proposed methodology and parameter values to monetise impacts from AIC's database, along with cost of crime estimates recommended by DJR.

What existing methodologies and parameter values could be used?

The AIC's cost of crime database is a key source of information that can be used to monetise the impacts of crime for CBA. DJR has a good understanding of the cost of crime in Victoria and has developed parameter values in 2011, and more recently updated these values in 2016. We are working with DJR to understand the cost of crime which takes into account impacts on the criminal justice system and to victims of crime, such as loss of productivity, fear of crime, suffering and lost quality of life. The unit of measure used by AIC and DJR is *average cost per incident*.

Cohen (2000) provides another source of parameter values. The study provided estimates by type of crime, accounting for similar impacts on the criminal justice system and on victims of crime as identified in AIC's work. However, it differs with AIC on its unit of measure used, as it estimates the cost of crime *per criminal victimisation*.

Examples of parameter values from both sources which can be used in CBA in criminal justice are presented in **Appendix D.**

In considering our discussion on the criminal justice sector, we would particularly like responses to the following questions:

KEY QUESTIONS

1. **Aside from the Australian Institute of Criminology database and the Cohen study, are there other data sources that can be used to monetise criminal justice impacts in Victoria?**
2. **Are there any issues we need to be aware of in using the parameter values recommended in the two studies?**


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TRANSPORT SECTOR

Overview

The transport sector has a good understanding of transport impacts and an established methodology for valuing impacts and defining the parameter values used in cost benefit analysis. Opportunities exist to improve the understanding of the impacts of transport on amenity.

We are exploring how transport cost benefit analysis in Victoria can be improved in two areas:

- Undertaking valuation of natural and urban amenities
- Valuing impacts on biodiversity and the ecosystem.

How is project appraisal practised in the Victorian transport sector?

The transport sector uses CBA as the primary appraisal tool from the strategic and options assessment stages to the business case development stage. Current practice in Victoria mainly follows the Australian Transport Assessment and Planning (ATAP) Guidelines[10], which set out a comprehensive framework for the appraisal of transport projects. The ATAP Guidelines include an extensive list of parameter values that can be used in the appraisal process. The ATAP Guidelines are currently being updated to monetise other impacts, and update methodology and parameter values.

The ATAP Guidelines are complemented by the Economic Evaluation for Business Cases – Technical Guidelines issued by the Victorian Department of Treasury and Finance in 2013.These guidelines summarise concepts and key issues to be considered when undertaking project appraisals and outline a recommended approach to issues, such as valuation techniques and the valuation of impacts.

Beyond the conventional benefits identified from transport interventions, Wider Economic Impacts (WEIs) have also been estimated on major projects. This is a developing area of knowledge and these wider impacts have yet to be applied consistently across projects and jurisdictions. The ATAP Guidelines include a discussion about wider economic benefits, but note that the concept is relatively new to the practice of transport project appraisal in Australia and that there are currently measurement difficulties in Australia due to limited data availability.

A process is underway nationally to address the measurement difficulties and data gaps to improve WEI in Australia.

10 Transport and Infrastructure Council (2016).

What impacts should be considered within the transport sector?

In undertaking transport project appraisals, the typical impacts considered are direct benefits or disbenefits that impact users of transport infrastructure – although wider impacts are sometimes considered in major transport projects. Currently, most impacts of transport projects are monetised and included in CBA.

A list of transport-related economic, social and environmental impacts is set out in Table 4. Indicators and parameter values for measuring these impacts are provided in **Appendix E.**

Table 4 Economic, social and environmental impacts – Transport sector

Economic	Social	Environmental
Improved accessibility • Changes in travel times such as in-vehicle time and out-of-vehicle time (e.g. wait, access and transfer/boarding) • Road network decongestion • Reliability — changes in unscheduled delays **Improved comfort/quality of transport amenity** • Other quality measures — changes in crowding (rolling stock and platform) and amenity (e.g. station, rolling stock) **Changes in cost/revenue** • Changes in vehicle operating costs (perceived and unperceived) • Expenditure avoided (e.g. savings in operating, maintenance, compliance and investment costs) • Incremental farebox/toll revenue **Wider Economic Impacts** • Agglomeration benefits • Labour market deepening • Increased outputs in imperfectly competitive markets	**Improved safety** • Reduced accidents • Changes in personal safety (actual and perceived) **Improved health outcomes** • Changes in active travel	**Traffic-based impacts** • Changes in values associated with environmental externalities, including noise and vibration, local air pollution, greenhouse gases (e.g. carbon dioxide, methane, nitrous oxide) **Non-traffic based impacts** • **Changes in amenity values – either from the creation or destruction of amenities** • **Impact on biodiversity and the ecosystem**

Source: Adapted from Australian Transport Assessment and Planning (ATAP) Guidelines

What is our main focus in valuing economic, social and environmental impacts for cost benefit analysis in the transport sector?

While the sector has a good understanding of transport impacts and a comprehensive list of impacts that are currently monetised, there are still some additional impacts that are worth including in CBA. In particular, the sector would benefit from improving its understanding of the transport impacts on amenity, biodiversity and the ecosystem — as highlighted in Table 4. Accordingly, we propose to focus our research on valuing these impacts.

A key challenge in transport planning and appraisal is understanding the cost and benefits of damaging or protecting existing amenities. This is a particular issue when comparing design or alignment options for rail grade separations or building new freeways that would have an effect on local amenity. This impact is dealt with during the statutory planning and environmental approval processes.

The focus of our work is to consider the amenity impacts in the early stage of project development by monetising the benefits/disbenefits of protecting or reducing amenities.

What existing methodologies and parameter values could be used?

We are exploring two areas where transport CBA in Victoria can be improved: valuing amenity, and valuing biodiversity and the ecosystem as highlighted in Table 4.

Valuing amenity

Research into the value of amenity has been undertaken in Victoria, other states and internationally. Most recently, Deloitte[11] completed a work valuing open spaces. We are keen to progress this work by expanding it to include valuation of natural and urban amenities through the application of hedonic modelling. This research project will estimate amenity values by assessing their contribution to lifting property prices across Victoria. We have engaged a consultant to undertake the study.

Valuing biodiversity and the ecosystem

While hedonic pricing is a good technique to monetise amenity benefits, it will not capture the non-use values of amenity. To complement the work on hedonic pricing, existing parameters on the value of ecological services compiled by Ecological Services Partnership (ESP)[12] provide examples of non-use value of the asset or amenity using an environmental accounting approach[13].

In considering our discussion in the transport sector, we would particularly like responses to the following questions:

KEY QUESTIONS

1. **Are there any issues we need to consider when hedonic modelling is used to determine the use values of amenity?**
2. **Do you consider the use of environmental accounting an appropriate approach to estimate non-use amenity values?**
3. **Are there any issues with the use of the Ecological Services Partnership (ESP) database?**

11 Deloitte Access Economics (2015).

12 ESP is a worldwide network of individuals and organisations that promotes the science and practical application of ecosystem services. It hosts the Ecosystem Services Valuation Database that provides monetary value estimates of ecosystem services.

13 Environmental accounting is the practice of accounting for all the contributing factors that result in an existing or potential impact on the environment.

How you can help us

We are seeking your feedback on our proposed lists of economic, social and environmental impacts identified across the social housing, health, criminal justice and transport sectors, as well as our approach to monetising these impacts.

We are particularly interested in responses to the following key questions:

1. Have we missed any economic, social and environmental impacts that can be ascribed monetary values using the benefit transfer method?
2. Are there other or more appropriate methods to value economic, social and environmental impacts that do not require primary valuation research?
3. Are there any other sources of information or data that provide guidance on valuing economic, social and environmental impacts?
4. What social or environmental impacts are the most important to be valued from your perspective and why?
5. Should we incorporate, if possible, the distributional impacts into traditional CBA?

For each of the individual sectors explored in this paper, we are also interested in seeking feedback on how sector specific data sources and evaluation instruments can be used to value impacts within each sector. Questions we are particularly interested for each sector are:

Social housing

6. Have we missed any key economic, social and environmental impacts in the social housing sector that should be included in CBA?
7. Aside from the Social Value Bank, what other data sources can be used to monetise impacts in the social housing sector in Victoria?
8. Do you think the SROI method of applying economic proxies against each impact is appropriate for CBA? Are there other alternative approaches for deriving Australian/Victorian values?

Health

9. Have we missed any key economic, social and environmental impacts in the health sector?
10. Asides from Quality Adjusted Life Year (QALY) and Value of Statistical Life Year (VSLY), are there other valuation instruments that can be used to monetise economic, social or environmental impacts?
11. What other reputable databases can be used to derive parameter values to measure the health sector's economic, social and environmental impacts?
12. Do you think the use of QALY and VSLY to measure benefits is appropriate for health CBA? Are other approaches available?

Criminal justice

13. Aside from the Australian Institute of Criminology database and the Cohen study, are there other data sources that can be used to monetise criminal justice impacts in Victoria?
14. Are there any issues we need to be aware of in using the parameter values recommended in the two studies?

Transport

15. Are there any issues we need to consider when hedonic modelling is used to determine the use values of amenity?
16. Do you consider the use of environmental accounting an appropriate approach to estimate non-use amenity values?
17. Are there any issues with the use of the Ecological Services Partnership database?

Your inputs and suggestions will strengthen our evidence base to improve cost benefit analysis for these key sectors.

What happens next?

This paper is the first in a series on improving project appraisal to be released as part of Infrastructure Victoria's research program.

Following the consultation period, a report will be published by mid-2017. It will incorporate responses to this paper, further evidence gathered by Infrastructure Victoria and the results of research we have undertaken or commissioned. It will also present a comprehensive list of economic, social and environmental impacts to be considered in CBA undertaken for project appraisal in Victoria, as well as appropriate methodologies and parameter values that can be used. We will seek your feedback on this as part of our second consultation.

Building on the list of impacts and parameter values, we will work to develop a spreadsheet-based rapid CBA tool that can be used as a cost-effective way of initially assessing and prioritising project options of infrastructure projects. The spreadsheet tool and user guide will be released in the second half of 2017.

The release of these papers and spreadsheet tool are outlined in Figure 5.

Figure 5 Timeline

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APPENDICES

APPENDIX A: FRAMEWORK AND TOOLS FOR PROJECT APPRAISAL

Appendix A.1: Overview of project appraisal approach in Victoria

Project appraisal[14] is a systematic process that helps government to make informed decisions on projects, programs and policies that can lead to better outcomes. The process involves setting clear objectives, defining the problems, identifying policy and investment options to address the problems, and recommending the solution that will deliver the best outcomes.

Where the project appraisal process determines that intervention is required to address the identified problem, the best solution may be increased capital investment (to provide new infrastructure, or to expand or upgrade existing infrastructure) or a policy reform. Reform options may include regulatory reform (such as introducing new standards, policies or regulations, or changing existing regulatory regimes), changes to land use and planning controls, governance initiatives (such as better coordination and integration processes) or measures that make better use of existing infrastructure (such as technological innovations, economic pricing or charging, or initiatives designed to influence people's behaviour). A combination of different options packaged together — or sequenced one after another — may also be identified as the best solution to a particular problem.

The Victorian Government uses an investment lifecycle framework to help assess investment proposals in Victoria, as outlined in the Figure 6 below.

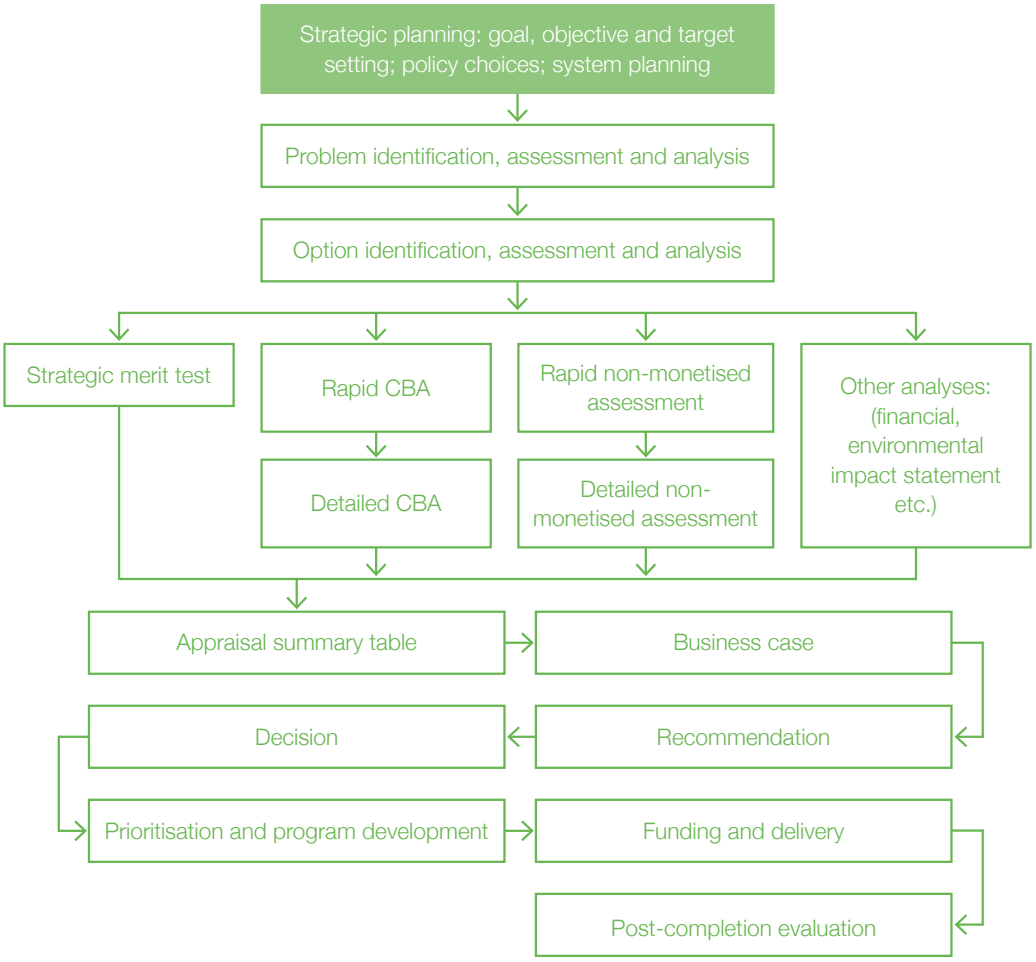
Figure 6 The five stages of DTF Investment Lifecycle Framework

Source: Victorian Department of Treasury and Finance (2013).

14 Project appraisal in this context also includes program and policy appraisal.

The transport sector applies this approach in assessing options whereby a rapid CBA is used to undertake option assessment and analysis before proceeding to a more detailed CBA. Figure 7 below shows the steps involved in project appraisal of transport initiatives.

Figure 7 Appraisal methodology flowchart – transport initiatives



Source: Transport and Infrastructure Council (2016).

Appendix A.2: Overview of the different tools used for project appraisals

Each tool has its strengths and weaknesses. The tool chosen is determined by the investment outcomes a government seeks to achieve (such as minimising expenditure or maximising particular outcomes) or the limitations facing decision-makers (such as a lack of quantifiable data).

Multi-criteria analysis

This is the most basic and subjective method of project appraisal. It is used when assigning monetary values is not possible to all the impacts being assessed. This is undertaken by assigning scores and weights to a set of criteria that are linked to the project objectives. Its key limitation is the subjectivity in attributing the weighting to each criteria and scoring impacts. The score and weights may not be reflective of the stated objectives of the project.

Cost minimisation analysis

This analysis is used to determine the cheapest intervention by comparing the costs of achieving a given outcome (for example, comparing the cost of constructing new housing stock or re-purposing existing housing to accommodate a number of additional occupants). The outcomes of the intervention by government have to be known to be the same. This makes it possible to focus on identifying the least costly option without having to worry about measuring and comparing outcomes. However, this approach is one-dimensional because it only considers the costs of the initiatives, making it impossible to compare projects with different or multiple impacts.

Cost effectiveness analysis

This analysis method compares the cost per unit of outcome among alternative interventions that produce the same or similar effect. A cost-effective intervention is one where there are more positive outcomes than alternative interventions. It is calculated by dividing the net cost of an intervention by its net effectiveness. The results are often tabulated to rank their cost effectiveness rates, allowing the decision-maker to rank projects from least effective intervention to most effective. This ranking also allows decision-makers to see if a number of interventions can be covered within a defined budget. Sometimes cost effectiveness analysis will compare the outcome of an intervention to a 'do nothing' scenario — for example, when measuring the effectiveness of solutions designed to prevent a particular outcome from occurring in the future.

Similar to the cost minimisation analysis, cost effectiveness analysis measures only one outcome, making it impossible to measure projects with varying outcomes. It is also not useful in assessing a single initiative in isolation because there are no established financial decision rules to inform whether the project should proceed or not.

Cost utility analysis

This adaptation of cost effectiveness analysis is applied largely in the health sector to measure an intervention's effect. Cost utility analysis focuses on measuring cost per unit of 'utility', such as cost per Quality Adjusted Life Year (QALY). Cost utility analysis produces a number that indicates the size of utilities gained from an intervention.

The advantage of cost utility analysis is that it can be applied to more varying interventions. In the case of health, utilities (such as QALY) can be measured for every form of injury, disability or illness. However, like cost effectiveness analysis, cost utility analysis is applied in circumstances where the available budget is fixed and maximum benefits are sought, or when the objective is fixed and the minimum cost method of achieving the objective is sought.

Nevertheless, cost utility analysis can only be used where interventions and programs can be measured in the same unit of utility. For example, health initiatives or programs can be measured using QALY as the common unit of utility. As such, it is impossible to evaluate programs with different sets of outcomes.

APPENDIX B: SOCIAL HOUSING SECTOR

Appendix B.1: Economic, social and environmental impacts identified for cost benefit analysis

Impacts	How these benefits impact
Increased education attainment	Inadequate or poor housing has negative consequences on children's education outcomes, as measured by accessibility to high quality schools, attendance and academic achievements. Children who experience homelessness or who are living in overcrowded, doubled-up situations may lack the necessary tools to do well in school.[15] Parents experiencing homelessness or residential instability may not be able to prioritise helping children with their homework or be involved in school activities.[16] These factors are likely to impact negatively on children's educational performance and attainment, which are important for their future development.
Improved workforce participation	Homelessness increases the difficulty of job training, or getting and keeping a job. The provision of social housing, particularly to the homeless and low-income earners provides the opportunity to participate in the workforce or hold on to a job, and increases workforce participation. However, the link between social housing and labour market outcomes is tenuous, as some studies have also shown that housing measures can contribute to unemployment/poverty traps.[17]
Support for family life	Housing is critical to family wellbeing even if they do not own the house in which their family lives. The provision of stable, secure and quality housing promotes a fully functioning parent-children relationship, reducing issues such as child neglect or abuse and family conflicts, which are detrimental to family wellbeing.
Improved health and wellbeing of occupants	Housing is an important determinant of health, and the absence of housing or living in substandard housing is a major public health issue. An increasing body of evidence associates housing quality with morbidity from infectious diseases, chronic illnesses, injuries, poor nutrition and mental disorders.[18] Hence, the provision of healthy and affordable housing can reduce disease incidence and increase overall household health, wellbeing and quality of life.
Avoided cost of crime and victimisation	The establishment of community partnerships, community centres, social and recreational activities and social enterprise development that come with social housing has a link to the reduction in the incidence of crime. As social housing addresses both the situational and psychological causes of crime, there are positive impacts derived from avoided costs of crime and victimisation.[19]
Avoided social and health related payments	Provision of social housing significantly reduces health service use. Studies have found the provision of social housing has significantly reduced the proportion of people presenting to an ICU and psychiatric care, having contact with mental health services or developing drug dependence. In addition, the frequency and duration of health service declines for people who access social housing.[20] Social housing recipients are also likely to claim less from a wide range of social assistance programs, such as crisis or pension payments, utility allowances and low income and single income family support.[21]
Development of social networks	Social networks refer to social connections between individuals and are an important element of social capital. Social housing strengthens this network by strengthening the ties between friends, family, neighbors and acquaintances. These social networks are important as they assist with employment, create role models for employment behaviour, and facilitate skills development and confidence building.[22]
Reduced utility costs claimed by concession holders	The improvement of energy rating through the renewal or redevelopment of existing social housing can significantly reduce energy and water usage. Given the state is responsible for direct provision of gas (in high-rise social housing buildings) and energy concession programs, reduction in energy usage provides immediate savings to the government.
Improved urban and living environment	The renewal or redevelopment of existing social housing stock has immediate benefits to surrounding communities. This brings benefits in terms of an improved perception of safety and security of those living in and around the social housing, and improved property values in surrounding vicinity.
Changes in environment externalities associated with the use and/ or improved energy efficiency of social housing	The operation and/or energy efficiency improvement of social housing stock can impact the level of greenhouse gas and pollution emitted by social housing infrastructures. The benefits of reduced environmental pollution from investing in improved energy efficiency have significant long-term environmental benefits that should be included in cost benefit analysis.

15 Dworsky (2008).
16 Cunningham, Harwood, & Hall (2010).
17 Bridge, Flatau, Whelan, Wood, & Yates (2003).
18 Krieger & Higgins (2002).
19 Samuels, Judd, O'Brien, & Barton (2004).
20 Wood, et al. (2016).
21 ibid.
22 Ravi & Reinhardt (2011).

Appendix B.2: Review of estimation methodologies and supporting data sources in estimating economic, social and environmental impacts in Australia

Impacts	Existing study estimating these values	Potential estimation methodology	Supporting database / sources
Increased education attainment			
Improved educational outcomes from social housing	Ravi and Reinhardt (2011) have estimated the value of enhanced education performance among children, and the likelihood of tenants pursuing educational and training opportunities that impact on employment.	Hedonic modelling can be used to model the monetary impact of social housing on educational outcomes. Additionally, revealed preference approach using Social Return on Investment (SROI) can also provide monetary valuation of improved educational outcomes.	Household, Income and Labour Dynamics in Australia (HILDA) National Social Housing Survey (NSHS) Housing Association's Charitable Trust (HACT) Database (UK)
Improved workforce participation			
Improved opportunities to participate and hold on to a job	Bridge et al (2003) have estimated the links and value of housing on labour market outcomes; however, it is noted that the labour market impacts can be tenuous.	Hedonic or Maximum Likelihood modelling to estimate the impact of social housing on labour force participation. Revealed preference approach, such as SROI, can also be used to estimate the monetary value of improved employment opportunities from social housing.	HILDA NSHS HACT Database (UK)
Support for family life			
Achieving stable, secure and quality housing	Ravi and Reinhardt (2011) estimated the value of residents having more control of their residential and personal life.	Revealed preference approach such as SROI is the most commonly used methodology.	NSHS HACT Database (UK)
Improved health and wellbeing			
Improved wellbeing and reduction in morbidity incidence	Ravi and Reinhardt (2011) estimated the value of improved health and wellbeing, such as reduced stress, enhanced ontological security, greater access to critical support services and health facilities.	Revealed preference approach such as SROI.	HILDA NSHS HACT Database (UK)

Impacts	Existing study estimating these values	Potential estimation methodology	Supporting database / sources
Avoided social and health-related payments			
Avoided medical and social assistance costs to the state, due to improved health status	Kliger et al. (2011) estimated the avoided and reduced costs of corrections and prison, alcohol services and transitional housing, and future welfare savings through the prevention of intergenerational poverty.	Victorian specific cost estimates could be derived from the Victorian Department of Health and Human Services (DHHS), and the Commonwealth Department of Health (DOH) and Department of Human Services (DHS) (i.e. Centrelink).	
Reduced utility costs rebate claimed by concession holders	Victorian Government concession program costs could be derived from DHHS. The potential savings in the government concession program from improved 'energy star' rating could be estimated for every level of increased energy efficiency.		
Development of social networks			
The development of social connections that build social capital	Ravi and Reinhardt (2011) estimated the value of support networks emergence that foster self-reliance and independent communities.	Revealed preference approach such as SROI is the most commonly used valuation methodology.	NSHS HACT Database (UK)
Improved urban and living environment			
Improved land value from social housing renewal	The impact of social housing renewal on improved surrounding land values can be estimated using hedonic price modelling. Victorian specific values could be derived by modelling the impact of increased land / property values following a social housing renewal project.		
Environmental impacts			
Changes in values associated with environmental externalities (such as changes in traffic congestion)	Weller, Hafeez & Kellett (2015) have estimated the social cost of carbon in Australia using the Dynamic Integrated model of Climate and the Economy (DICE) model.[23] The Climate Institute (2014) has also published several values for the social cost of carbon in the absence of a carbon trading market based on estimates from the UK and the USA.		

23 The DICE model is an assessment model that estimates the cost and benefit of slowing greenhouse warming. It estimates the social cost of carbon by examining the feedbacks between the climate and the global economy from carbon reduction initiatives to derive the social price and cost of carbon.

Appendix B.3: Impacts and parameter values that can be applied to cost benefit analysis in the social housing sector

Impacts	Indicator	Measurement unit	Parameter	Year	Potential sources
Increased workforce participation	Workers entering into employment (full-time)	Growth in output / employment	TBD		HILDA
	Workers entering into employment (part-time)	Growth in output / employment	TBD		HILDA
	Early retirement due to ill health	Growth in output / employment year	TBD		HILDA
Increased education attainment	Participation in education and training (i.e. apprenticeships, vocational education, higher education)	Growth in income (by each qualification level) / employment	TBD		National Centre for Social and Economic Modelling (NATSEM) HILDA
	Increased education attainment in education	Growth in income / employment	TBD		NATSEM HILDA
Support for family life	Improved family relations	Costs associated with apprehended violence / household	TBD		HILDA NSHS HACT Database (UK)
	Reduced child abuse and neglect	Social cost associated with child protection / household	TBD		NSHS HACT Database (UK)
	Reduced delinquency / recidivism	Cost of correction / incident	TBD		NSHS HACT Database (UK)
Improved health and wellbeing	Reduction in drug / alcohol problems	Average cost of rehabilitation / household	TBD		HACT Database (UK)
	Changes in life expectancy	Additional VSLY (measured by QALY) / person	TBD		DPMC estimates of VSLY
	Improved quality of life				
Avoided social and health related payments to the government and state	Reduced cost of illness, injuries and other health-related payments	General Practitioner rebate / visit Average cost of hospitalisation / household	TBD		Australian Medical Association (AMA) Commonwealth Department of Health
	Avoided cost of corrections	Average cost of prison stay / incident	TBD		Department of Justice and Regulation (DJR)
	Savings on future social payments	Avoided cost of future welfare payments / household	TBD		DHHS

Impacts	Indicator	Measurement unit	Parameter	Year	Potential sources
Development of social networks and engagements	Access to community network	TBD	TBD		HACT Database (UK)
	Interaction with neighbours and neighbourhood	TBD	TBD		HACT Database (UK)
Reduced utility costs rebate claimed by concession holders	Reduction in energy cost for every unit of increased energy efficiency	Average rebate savings per household / increased energy efficiency	TBD		Commonwealth Department of Human Services and DHHS Energy Rating Regulator
Improved urban and living environment with social housing renewals	Increase in land value	Average gain in value / land or property	TBD		Hedonic modelling studies
Changes in values associated with environmental externalities	Social cost of carbon (non-traded market)	$ / tonne of CO_2	USD$18 / tonne £30 / tonne - Low £61 / tonne - Mid £90 / tonne - High	2015 2014	Weller, Hafeez, & Kellett (2015) The Climate Institute (2014)

APPENDIX C: HEALTH SECTOR

Appendix C.1: Economic, social and environmental impacts identified for cost benefit analysis

Impacts	Importance of these impacts
Improved productivity and work performance with improved health outcome	Improved health conditions have been attributed to increasing worker productivity.[24] A physically and mentally healthy workforce increases workers' productivity, given the same amount of inputs/capital. Within the workplace, improved health conditions contribute to reduced absenteeism and the need to replace the workforce.
Increased capacity to work/labour supply	Improved health is observed to increase labour supply (through labour force participation, number of days or hours worked and reduction in early retirement for health reasons).[25]
Increased non-market production and consumption	Diseases and injuries can take away the opportunity to produce or consume non-market goods and services. Time spent by the patient or carer providing informal and financially uncompensated care to a sick person could have been spent on other productive activities or in leisure, while time spent accessing and receiving health care could have been alternatively spent on non-health related activities. In addition, ill health can impact on the non-market assets of a household, including social networks and family quality time. The relevance of non-market production to ill health needs to be understood in terms of its potential contribution to changes in consumption possibilities. Possible ways in which ill health might change consumption opportunities via non-market production include: • Reduction in time spent in non-market production because of illness, including travel time to seek or use medical services. • Time spent by the patient and household member caring for a sick person at the expense of other productive activities.
Increased capacity to save and invest in physical and intellectual capital (human capital)	Diseases and injuries have negative impacts on household accumulation of physical and financial capital — as household's health expenditure may be paid from savings, loans or the sale of assets. Combined with the reduced savings associated with lower income, this has damaging consequences, not only in terms of the elevated risk of impoverishment or indebtedness, but also in terms of reduced opportunities to generate the stock of financial and physical capital that will enable the household to maintain or increase its consumption possibilities in the future.[26] Over and above reduced expenditures on education in the short-term, there are potentially significant longer-term consequences to a child/person being out of school due to ill health. The reduction of illness and diseases reverses these negative impacts, increasing a household's capacity to save and invest in both physical and intellectual capital.
Improved health outcomes (such as reduced mortality and improved quality of life)	The benefits of health in improving quality and quantity of life are well documented and measured by the Quality Adjusted Life Year (QALY) indicator. As all health treatment is aimed at reducing morbidity and mortality of illness, economists have measured the marginal increase in QALY for each health treatment. By measuring QALY in commensurate monetary terms, improved health outcomes can be measured in cost benefit analysis.

24 Bloom, Canning & Sevilla (2004).
25 Suhrcke, et al. (2005).
26 World Health Organisation (2009).

Impacts	Importance of these impacts
Reduced cost from re-admittance to hospital, other healthcare facilities, and other associated costs	The reduction in re-admittance of patients reduces current and future spending on health. This includes a reduction in not only the main categories of health services (including inpatient and outpatient hospital care, primary health care, ancillary care, medical equipment, devices and consumables, diagnostic tests and prescription drugs), but also non-patient cost components, ranging from the planning and administration of health programs through to training, health education, and health prevention and promotion activities. Government expenditures on a particular disease or on health generally have a clear opportunity cost with respect to non-health consumption possibilities. As such, reduction in current and future spending of health increases spending opportunities on non-health services or goods.
Reduced demand for social welfare	The range of government expenditures for a particular disease or injury may also extend beyond the conventional boundaries of the health system to include related welfare costs such as social services (e.g. for elderly people disabled by disease), education (e.g. for special needs children) or criminal justice services (e.g. for people with substance use disorders).
Traffic based impact on the environment	The introduction of health infrastructure or improvements in the way health services are delivered impact on travel patterns for direct and indirect users of the systems (e.g. patients, carers, healthcare providers and visitors). Changes in the uptake of public transportation and private mode of travel generate environmental externalities and impact on road congestion, which can be accounted using the same approach used in the transport sector.
Release of hazardous material that may be infectious, toxic or radioactive	The disposal of hazardous medical waste carries direct and indirect costs. The direct cost relates to the transport, treatment and disposal of medical waste – which are significant costs given the cost of treatment required to neutralize infectious, toxic or radioactive materials. However, medical waste also has significant indirect costs – such as costs associated with regulating and administering hazardous wastes; cost of injuries and illnesses to workers who handle hazardous wastes; and residual environmental and social externalities associated with hazardous waste disposed to landfills.
Changes in environment externalities associated with the use and/or improved energy efficiency of health facilities	The operation and/or energy efficiency improvement of infrastructure can impact the level of greenhouse gas and pollution emitted by health infrastructure. The benefits of reduced environmental pollution from investing in improved energy efficiency have significant long-term environmental benefits that should be included in cost benefit analysis.

Appendix C.2: Review of estimation methodologies and supporting data sources in estimating economic, social and environmental impacts in Australia

Impacts	Existing study estimating these values	Potential estimation methodology	Supporting database / sources
Increased productivity			
Improved productivity and work performance with improved health outcome	Bloom, et al. (2004) estimated the increase in worker productivity due to improved health conditions. Bloom et al. found a healthier workforce enjoys greater physical and mental ability to produce more with the same amount of input.	Hedonic or Maximum Likelihood modelling to estimate the benefits of health on labour force participation.	Household, Income and Labour Dynamics in Australia (HILDA)
Increased capacity to work / labour supply			
Increased labour force participation	Cai and Kalb (2005) have estimated and valued how improved health levels increase the probability of labour force participation.	Hedonic or Maximum Likelihood modelling to estimate the benefits of health on labour force participation.	HILDA
Increased non-market production and consumption			
Time spent by patient seeking treatment, which otherwise can be used for other productive means / leisure	Berg et al. (2013) estimated the monetary value of patient's time spent for treatment, which includes admission, travel time, waiting time and treatment time.	Contingent Valuation Survey, measuring patient's willingness to pay for the reduction of time spent on treatment.	Surveys
Time spent by formal and informal carers / relatives to support and provide care, which otherwise can be used for other productive means / leisure	The Commonwealth Department of Social Services (2011) estimated the indirect costs (measured by opportunity costs) from reduced employment, leisure and other activities to provide care, the time devoted to caring and the impact caring has on the informal carers' physical and mental health.	Contingent Valuation Survey, measuring informal carers' willingness to pay for the reduction of time spent caring. Average income lost for time spent to provide care.	DSS (2011) estimated the 'time cost signature' provided by carers, which is equivalent to a part-time job providing informal care a week. HILDA
Increased non-market production and consumption			
Reduction in the loss of non-market assets – such as knowledge and social networks	International studies have measured non-market assets / impacts of health through using the willingness to pay approach. Most of these measures are estimated based on Value of Statistical Life Year (VSLY) and Quality Adjusted Life Year (QALY). See Lindgren et al. (2007) and Roberts et al. (2009).	Non-market assets are usually measured using contingent valuation surveys. Contingent Valuation Survey is the most common valuation approach, measuring the willingness to pay for an increased quality of life.	DPMC (2014) has estimated the Australian Value of Statistical Life (VSL) is $4.2million, and the Value of Statistical Life Year (VSLY) is $182,000 in 2014 dollars. Based on DPMC's estimates of VSLY, the monetary value of QALY can be measured based on this measure.

Impacts	Existing study estimating these values	Potential estimation methodology	Supporting database / sources
Increased capacity to save and invest in physical and intellectual capital (human capital)			
Increase in savings and wealth accumulated from expenditure that would be spent on treatment	Bloom et al. (2003) demonstrated the substantial positive impact of health improvement on the savings rate across all ages of demography, even for those in retirement.	Most studies have used hedonic modelling to estimate the impact of health on savings, as demonstrated by Bloom, Canning and Sevilla (2004) and Bonnel (2000).	Total expenditures spent on treatment and the potential savings from health expenditure can be derived from Household Expenditure Surveys (ABS) and HILDA.
Increased opportunities to generate the stock of financial and physical capital to maintain or increase consumption possibilities in the future	Bloom et al. (2003) also estimated the impact of health improvement in reducing old age dependency.	Most studies have used hedonic modelling to estimate the impact of health on savings, as demonstrated by Bloom, Canning and Sevilla (2004) and Bonnel (2000).	Potential increase in capital and investment can be estimated from HILDA, along with proxies for health.
Increased investment in education in the short-term, and consequences to a child / person being out of school due to ill health	Jukes et al. (2008) have demonstrated how improving health and nutrition brings the greatest education benefits, particularly for the lower socioeconomic class and the most vulnerable.	The impact of poor health on education can also be estimated using hedonic modelling.	The prevalence of illness and disabilities on educational uptake can be measured through HILDA.
Reduced cost from re-admittance to hospital or other healthcare facilities			
Reduction in expenditure from re-admittance or re-lapse of treatment	Graves et al. (2009) have estimated the reduction in the risks of emergency re-admission, and the potential reduction re-admission costs to the public system.	The average cost of re-admittance can be derived from cost information captured by DHHS.	DHHS health expenditure database
Reduction in non-patient cost components (i.e. planning and administration of health programs, training, health education, and health prevention and promotion activities)	The Australian Institute of Health and Welfare (2014) estimated how the increasing prevalence of preventable disease has increased the cost of non-patient expenditures.	The average cost of non-patient expenditure can be derived from the AIHW, while cost information captured by DHHS.	AIHW Health Expenditure Reports DHHS health expenditure database
Reduced demand for social welfare			
Reduction in additional welfare costs from related health programs	The Australian Institute of Health and Welfare (2014) estimated the cost of pension, income support, disability payments, and other social welfare payments due to ill health, disability or disease.	The average population cost of social welfare expenditures is estimated by the AIHW. Related health expenditure information can also be derived from DHHS.	AIHW Welfare Expenditure Reports DHHS welfare expenditure database

Impacts	Existing study estimating these values	Potential estimation methodology	Supporting database / sources
Environmental impacts			
Traffic based impact on the environment	Australian Transport Assessment and Planning Guidelines (ATAP) (2016) estimated the environmental impacts from greenhouse emissions, noise and water pollution from different forms of private transportation.	ATAP (2016) provide parameter value estimating the impact of congestions and environmental impacts suitable for road project evaluation. Similar proxies can be used to estimate the price of environmental impacts. Indicators and parameter values are outlined in Appendix sections B3 and C1.	
Medical waste	The Department of the Environment (2014) has estimated the total direct and indirect cost of medical waste cost.	Victorian specific parameter value could be derived from the Department of the Environment database.	
Changes in values associated with environmental externalities	Weller, Hafeez, & Kellett (2015) estimated the social cost of carbon in Australia using the Dynamic Integrated model of Climate and the Economy (DICE) model. The Climate Institute (2014) has also modelled the price of the social cost of carbon in the absence of a carbon trading market based on estimates from the UK and the USA.		

Appendix C.3: Example of existing parameter values that can be applied to cost benefit analysis in the health sector

Impacts	Indicator	Measurement unit	Parameter	Year	Potential sources
Increased workforce productivity	Absenteeism cost	Loss of productivity / day	$340 / day	2014	Absence Management Survey, by Chartered Institute of Personnel and Development
	Presenteeism cost	Value of lost working days / year	$1,697 / year	2007	Econtech (2007)
Increased capacity to work / labour supply	Workers entering into employment (full-time)	Output / employment	TBD		HILDA
	Workers entering into employment (part-time)	Output / employment	TBD		HILDA
	Early retirement due to ill health	Output / employment year	TBD		HILDA
Increased non-market production and consumption	Travel time seeking treatment by patients and uncompensated carers	Value of time / hour	$15 / hour	2015	Proxy from transport sector
	Loss in leisure / recreational time by patients and uncompensated carers	Value of time / hour	TBD		
Increased capacity to save and invest in physical and intellectual capital (human capital)	Reduced health expenditure per household	Health expenditure / household	TBD		HILDA
	Opportunities gained to generate financial and physical capital	Average capital ROI / household	TBD		HILDA
Reduced cost from re-admittance to hospital or other healthcare facilities	Cost of inpatient care	Average cost / admittance	TBD		DHHS AIHW Expenditure Publications ABS Health Care Delivery and Financing
	Cost of outpatient care	Average cost / visit	TBD		
	Primary health care cost	Average cost / visit	TBD		
	Ancillary health care cost	Average cost / visit	TBD		
	Medical equipment cost	Average cost / admittance	TBD		
	Devices and consumables	Average cost / admittance	TBD		
	Diagnostic tests	Average cost / test	TBD		
	Prescription drugs	Average cost / prescription	TBD		

Impacts	Indicator	Measurement unit	Parameter	Year	Potential sources
Reduced demand for social welfare	Disability payment	Disability expenditure / patient	TBD		DHHS AIHW Expenditure Publications ABS Health Care Delivery and Financing
	Sickness allowance	Allowance / patient	TBD		
	Carer payment	Income / carer	TBD		
	Education support	Average expenditure / patient	TBD		
	PBS / Medicare allowance	Average expenditure / patient	TBD		
Environmental externalities	Reduced greenhouse emission	$ / 1000 passenger kilometres (pax-km) car $ / 1000 pax-km bus $ / 1000 pax-km rail	$4.02 $1.92 $0.45	2013 2013 2013	Australian Transport Assessment and Planning (ATAP) Guidelines (ATAP 2016)
	Reduced noise, air, water pollution	$ / 1000 pax-km car $ / 1000 pax-km bus $ / 1000 pax-km rail	$9.81 $10.46 $6.00	2013 2013 2013	ATAP 2016
	Reduced road congestion	Average cost of congestion: Passenger car unit per km (pcu-km)	$16 / pcu-km	2015	Bureau of Infrastructure, Transport and Regional Economics
Changes in values associated with environmental externalities	Social cost of carbon (non-traded market)	$ / tonne of CO_2	USD$18 / tonne £30 / tonne - Low £61 / tonne - Mid £90 / tonne - High	2015 2015	Weller, Hafeez, & Kellett (2015) The Climate Institute (2014)
Medical waste	Direct cost of waste disposal	$ / tonne of waste	TBD		Department of the Environment
	Indirect cost of waste disposal	$ / tonne of waste	TBD		

APPENDIX D: CRIMINAL JUSTICE SECTOR

Example of existing parameter values that can be applied to cost benefit analysis in the criminal justice sector

Impacts	Indicator	Measurement unit	Parameter	Year	Potential sources
Cost in anticipation of crime (assault)	Insurance costs	Average $ / incident	$572	2011	Australian Institute of Criminology (AIC), 2011
	Security related costs	Average $ / incident	$2,900	2011	AIC
	Precautionary expense	Average $ / incident	$2,013	2011	AIC
Cost as a consequence of crime (assault-hospitalised)	Property loss or damage	$ / victimisation	$26	1993	Cohen, Measurement and Analysis of Crime and Justice, 2000
	Medical care	Average $ / incident	$11,600	2011	AIC
		$ / victimisation	$1,560	1993	Cohen
	Lost productivity	Average $ / incident	$32,300	2011	AIC
		$ / victimisation	$3,100	1993	Cohen
	Intangibles (pain and suffering/quality of life)	Average $ / incident	$13,100	2011	AIC
		$ / victimisation	$7,800	1993	Cohen
Cost of society's response to crime (assault)	Criminal justice cost	Average $ / incident	$13,866	2011	AIC
	Victim services	Average $ / incident	$1,601	2011	AIC
Environmental externalities	Reduced greenhouse emission	$ / 1000 passenger kilometres (pax-km) car	$4.02	2013	ATAP (2016)
		$ / 1000 pax-km bus	$1.92	2013	
		$ / 1000 pax-km rail	$0.45	2013	
	Reduced noise, air, water pollution	$ / 1000 pax-km car	$9.81	2013	ATAP (2016)
		$ / 1000 pax-km bus	$10.46	2013	
		$ / 1000 pax-km rail	$6.00	2013	
	Reduced road congestion	Average cost of congestion: Passenger car unit per km (pcu-km)	$16 / pcu-km	2015	Bureau of Infrastructure, Transport and Regional Economics

Note: 1. Parameters from AIC are derived by dividing total cost by the total number of incidents.
2. Example above only shows one type of crime (assault). A more comprehensive cost of crime by type is available from both sources (AIC and Cohen).

APPENDIX E: TRANSPORT SECTOR

Example of existing parameter values that can be applied to cost benefit analysis in the transport sector

Impacts	Indicator	Measurement unit	Parameter	Year	Potential sources
Economic					
Improved accessibility	Travel time savings	Value of time / commuter	$15 / hour (Vic)	2013	ATAP (2016)
		Value of time / businesses	$49 / hour (Vic)	2013	ATAP (2016)
	Improved punctuality (unexpected wait time)	In-vehicle weighting	3		ATAP (2016)
	Reduced road congestion	Peak – heavy: Vehicle kilometres travelled (vkt)	$0.90 / vkt	2004	Department of Infrastructure, 2005
		Peak – medium: vkt	$0.64 / vkt	2004	Department of Infrastructure, 2005
		Peak – light: vkt	$0.17 / vkt	2004	Department of Infrastructure, 2005
		Off-peak: vkt	$0.17 / vkt	2004	Department of Infrastructure, 2005
		Average cost of congestion: Passenger car unit per km (pcu-km)	$16 / pcu-km	2015	Bureau of Infrastructure, Transport and Regional Economics
	Reduced crowding	In-vehicle weighting	Between 1-2		ATAP (2016)
Reduced travel cost	Vehicle operating cost (VOC) savings	VOC / vehicle-km per type of vehicle and road type and speed	Various		ATAP (2016)
Social					
Improved health outcomes	Walking	km	$2.77 / km	2013	ATAP (2016)
	Cycling	km	$1.40 / km	2013	ATAP (2016)
Improved safety	Reduced accidents: - fatal accidents - serious injury - slight injury - property damage	 per crash per crash per crash per crash	 $2.4 million $630,000 $23,000 $9,000	2013	ATAP (2016)

Impacts	Indicator	Measurement unit	Parameter	Year	Potential sources
Environmental					
Traffic-based impacts	Reduced greenhouse:				
	- Passenger transport	$ / 1000 passenger kilometres (pax-km) car	$4.02	2013	ATAP (2016)
		$ / 1000 pax-km bus	$1.92	2013	
		$ / 1000 pax-km rail	$0.45	2013	
	- Freight transport				
		$ / 1000 pax-km light vehicle	$11.38	2013	
		$ / 1000 pax-km car heavy vehicle	$2.60	2013	
		$ / 1000 pax-km car heavy rail	$0.48	2013	
	Reduced noise, air, water pollution:				
	- Passenger transport	$ / 1000 pax-km car	$9.81	2013	ATAP (2016)
		$ / 1000 pax-km bus	$10.46	2013	
		$ / 1000 pax-km rail	$6.00	2013	
	- Freight transport	$ / 1000 pax-km light vehicle	$35.61	2013	
		$ / 1000 pax-km car heavy vehicle	$14.78	2013	
		$ / 1000 pax-km car heavy rail	$4.61	2013	
Environmental capital	Biodiversity, nature and landscape, urban/barrier effect, upstream and downstream (passenger transport)	$ / 1000 pax-km car	$6.69	2013	ATAP (2016)
		$ / 1000 pax-km bus	$2.96	2013	
		$ / 1000 pax-km rail	$8.78	2013	
	Biodiversity, nature and landscape, urban/barrier effect, upstream and downstream (freight transport)	$ / 1000 pax-km light vehicle	$19.46	2013	ATAP (2016)
		$ / 1000 pax-km car heavy vehicle	$4.38	2013	
		$ / 1000 pax-km car heavy rail	$6.78	2013	

Impacts	Indicator	Measurement unit	Parameter	Year	Potential sources
Ecosystem services Provisioning services	Food Fuel and fibre Fresh water and supply	$ / hectare of forest TBD $ / hectare of water purification	US$72 / hectare / year $85 / hectare / year	2007 1999	Ecosystem Services Partnership (2016)
Provisioning / cultural services	Wild species diversity	TBD			
Cultural services	Recreation	$ / hectare of grassland $ / hectare of forest	US$0.80 / hectare / year US$80 / hectare / year	1994 2001	
	Aesthetic value	$ / hectare of woodlands	US$3,312 / hectare / year	2003	
	Cultural heritage	$ / hectare of wetlands	US$793 / hectare / year	2007	
Regulating services	Climate regulation	$ / hectare of grassland	EU99 / hectare / year	2006	
	Hazard regulation	$ / hectare of temperate forest	US$70 / hectare / year	2001	
	Disease and pest regulation	$ / hectare of temperate forest	CAD$22 / hectare / year	2002	
	Pollination	$ / hectare of tropical forest	$8.45 / hectare / year	2002	
	Water quality regulation	$ / hectare of tropical forest	$2.58 / hectare / year	2002	
	Air quality regulation	$ / hectare of temperate forest	EUR$700 / hectare / year	2006	

Note: This work is not designed to replace existing impacts and parameter values recommended in the ATAP Guidelines.

GLOSSARY

Term	Definition
Appraisal	The process of defining objectives, examining options and weighing up the costs, benefits, risks and uncertainties of those options before a decision is made.
Assessment	Generic term to describe quantitative and qualitative analysis of data to produce information to aid decision-making. This can either be an appraisal or an evaluation, or both.
Benefit Cost Ratio (BCR)	An indicator used to estimate the overall value-for-money of a project or proposal. A BCR greater (or less) than one means the net present value of all benefits exceed (or is smaller than) the net present value of costs.
Benefit transfer	A technique for obtaining non-market values by adapting an existing willingness to pay amount from one study to another (hence 'transfer').
Consumer surplus	An economic term for the excess that someone is willing to pay to obtain a good and/or service, above what they actually are required to pay in a market setting. Consumer surplus is considered a benefit in cost benefit analysis.
Cost benefit analysis (CBA)	A structured method that quantifies in monetary terms as many of the costs and benefits of a proposal as far as possible, including items for which the market does not provide a satisfactory measure of economic value.
Cost effectiveness analysis	An economic evaluation technique that compares the costs to an alternative means of achieving the same objective, which may be expressed in quantitative (not monetary) terms.
Cost of capital	The cost of raising funds (expressed as an annual percentage rate).
Cost utility analysis	An economic evaluation technique which compares the cost of an alternative means of achieving the same amount of 'utility', which usually measures the value of money per unit of wellbeing.
Disability Adjusted Life Year (DALY)	A measure of overall disease burden, expressed as the number of years lost due to ill health, disability or early death. One DALY can be thought as one lost year of 'healthy' life.
Discount rate	The annual percentage rate at which the present value of a future dollar is assumed to fall away through time.
Discounting	A process of determining value of future costs or benefits in today's price using a discount rate.
Distributional impacts	Refers to how costs and benefits would be distributed across individuals with high or low incomes, the young or the elderly, members of different ethnic groups, or residents of particular geographic areas.
Ecosystem	A system of plants, animals, fungi, microorganism communities, and their associated non-living environmental interactions.
Ecosystem services	A concept that defines the benefits and services people obtain from the ecosystem. Examples of ecosystem services include the provision of food and water, the regulation of flood and disease control, and the provision of recreational, spiritual and cultural services.
Evaluation	The process of reviewing the outcomes and performance of an initiative after it has been implemented.
Evaluation instruments	Tools used to assign quantitative or monetary values to measure specific outcomes or performance of a program. Each sector is likely to have its own evaluation tool (for example, the use of Quality Adjusted Life Year (QALY) within the health sector).
Existence value	The value placed by people on the continued existence of an asset for the benefit of present or future generations. The latter is sometimes referred to as bequest value. See also *Use value*.

Term	Definition
Externality	The impacts of an intervention or activity which are not borne by those who generate them, such as noise pollution from vehicles.
Gross Domestic Product (GDP)	A monetary value of all final goods and services produced in the country.
Hedonic pricing	The price of goods determined by its characteristics, usually determined by regression analysis. For example, the hedonic pricing approach will capture the relationship between the price of the property and characteristics such as access to amenity.
Impacts	The positive or negative effect resulting from the delivery of a government program or policy on individuals, businesses, environment or society in general.
Intangible impact	See *Non-market impact*.
Implementation	The activities required during the period after appraisal to put in place a policy, or complete a project or program, at which point 'normal' service is achieved.
Labour productivity	A measure of the amount of good and services produced by one unit of labour — often measured by one hour of labour.
Market behaviour	Broad economic term that refers to the behaviour of consumers and businesses in a given market.
Monetising impacts	Assigning unit values in dollar terms to a specific impact.
Net Present Value (NPV)	The discounted value of a stream of either future costs or benefits. The term Net Present Value is used to describe the difference between the present value of a stream of costs and a stream of benefits.
Non-market impact	The positive or negative effect of a program or policy on a good or service that is not tradable or available in a market.
Non-market values	Values which are held by individuals or the community at large but are not expressed in a market and hence do not have a price from which to derive a value.
Non-use value	Value that people assign to an economic good even if they will never or have never used it.
Opportunity cost	The cost of an alternative that is foregone when another option is chosen. See also *Resource cost*.
Outcomes	The achievement occurred as a result of an activity, plan, process or program.
Parameter value	Quantitative unit cost of impacts applied consistently in appraisals.
Passenger car unit (pcu)	A measure used primarily to assess highway capacity for transport modelling purposes. Different vehicles are assigned different values according to the space they take up.
Purchasing power parity	An index that is used to adjust valuations based on the differences in currency exchange rate between countries. This ensures equal purchasing power of each country.
Present value	The future value expressed in present terms by means of discounting.
Productivity	An average measure of the efficiency of production. It measures the quantity of output produced by one unit of input in the production process. See also Labour productivity.
Proposal	An idea for a policy, program or project that is under appraisal.

Term	Definition
Quality Adjusted Life Year (QALY)	An index that measures the quality and quantity of a person's life in a particular year. One QALY equates to one year in perfect health. To be dead is associated with 0 QALY.
Resource cost	The value foregone by society from using a resource in its next best alternative use. See also Opportunity cost.
Revealed preference method	Method to estimate non-market values using observations from how much consumers spend on goods and services in similar or related markets.
Risk	The likelihood, measured by its probability, that a particular negative event will occur.
Sensitivity analysis	Analysis of the effects on an appraisal of varying the projected values of important input variables and assumptions.
Social benefit (or disbenefit)	The total increase (or decrease) in the welfare of society from an economic action - the sum of the benefit (or disbenefit) to the agent performing the action plus the benefit (or disbenefit) accruing to society as a result of the action.
Social exclusion	The situation where barriers exist which make it difficult or impossible for people to participate fully in society.
Social cost	The total cost to society of an economic activity - the sum of the opportunity costs of the resources used by the agent carrying out the activity, plus any additional costs imposed on society from the activity.
Social Return on Investment (SROI)	A form of evaluation method that measures non-market values in monetary terms. SROI is often used to monetise social and environmental impacts by using existing market proxies to 'price' non-market impacts.
Social Time Preference Rate	Preference for consumption (or other costs or benefits) sooner rather than later, expressed as an annual percentage rate.
Stated preference method	Methods to estimate non-market value for non-market impacts to be delivered / avoided from survey respondents' willingness to pay for a particular outcome.
Strategic merit test	A qualitative project appraisal tool used to check if the project aligns with the objectives, policies and strategies of the government.
Use value	Value of something which is non-marketed provided by people's actual use of it. See also Existence value.
Value of Statistical Life Year (VSLY)	The financial value society places on reducing the risk of premature death by one (statistical) life year.
Vehicle kilometres travelled (vkt)	Number of kilometres travelled by all vehicles.
Wider Economic Impacts	Impacts that are not captured in standard cost benefit analysis, including effects relating to returns to scale, agglomeration, increasing employment and market power, as well as business and individuals' behavioural adaptations to policy changes.
Willingness to pay	The maximum amount that consumers are willing to give up or pay to acquire a particular good or service.

About us

Infrastructure Victoria is an independent advisory body, which began operating on 1 October 2015 under the *Infrastructure Victoria Act 2015*.

It has three main functions:

- preparing a 30-year infrastructure strategy for Victoria, to be refreshed every three to five years
- providing written advice to government on specific infrastructure matters
- publishing original research on infrastructure-related issues

Infrastructure Victoria will also support the development of sectoral infrastructure plans by government departments and agencies.

The aim of Infrastructure Victoria is to take a long-term, evidence-based view of infrastructure planning and raise the level of community debate about infrastructure provision.

Infrastructure Victoria will not directly oversee or fund infrastructure projects.

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