BUILDING QUEENSLAND

BUSINESS CASE DEVELOPMENT FRAMEWORK

COST BENEFIT ANALYSIS GUIDE

SUPPORTING BUSINESS CASE DEVELOPMENT

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BUILDING QUEENSLAND BUSINESS CASE DEVELOPMENT FRAMEWORK

This document forms part of the Building Queensland Business Case Development Framework, as follows:

GUIDANCE MATERIAL
Strategic Business Case
Preliminary Business Case
Detailed Business Case

SUPPLEMENTARY GUIDANCE MATERIAL
Cost Benefit Analysis
Social Impact Evaluation

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CONTENTS

ABBREVIATIONS

BCR	Benefit Cost Ratio
BCDF	Business Case Development Framework
CAPM	Capital Asset Pricing Model
CBA	Cost Benefit Analysis
CEA	Cost Effectiveness Analysis
CI&I	Continuous Improvement and Innovation
CGE	Computable General Equilibrium
CUA	Cost Utility Analysis
DBC	Detailed Business Case
DCF	Discounted Cash Flow
EIS	Environmental Impact Statement
FTE	Full Time Equivalent/s
GOC	Government Owned Corporation
GST	Goods and Services Tax
ILM	Investment Logic Mapping
IRR	Internal Rate of Return
MIRR	Modified Internal Rate of Return
NBIR	Net Benefit Investment Ratio
NPV	Net Present Value
PAF	Project Assessment Framework
PBC	Preliminary Business Case
QTC	Queensland Treasury Corporation
RIF	Reform and Investment Framework
RIS	Regulatory Impact Statement
SBC	Strategic Business Case
SROI	Social Return on Investment
STPR	Social Time Preference Rate
TEV	Total Economic Value
WEB	Wider Economic Benefit

1. BACKGROUND

Building Queensland has been established under the *Building Queensland Act 2015* to provide independent expert advice to the Queensland Government about infrastructure. The preparation of business cases for infrastructure proposals over $100 million (or the equivalent net present value of financial commitments by the State) will be led by Building Queensland. Building Queensland will also assist in the preparation of business cases with an estimated capital cost of $50 million to $100 million.

In accordance with the Act, Building Queensland may determine the level of analysis required for a particular infrastructure project or proposal[1]. The remit of Building Queensland extends to 'infrastructure in which initial or further investment is likely to have a significant economic, environmental or social impact in the State or any region of the State'[2].

Further, the Act requires Building Queensland to provide infrastructure advice based on rigorous analysis, including cost benefit analysis and community benefits. This document has been developed to provide a framework for assessing the costs and benefits of infrastructure projects.

Building Queensland provides wide-ranging advice for infrastructure projects and investment proposals. These projects and proposals relate to reform, better use, improvement of existing infrastructure assets and new build solutions[3].

2. INTRODUCTION AND CONTEXT

Cost Benefit Analysis (CBA) is a methodical and logical approach that:

- is a widely used form of economic evaluation, offering a rigorous approach in assessing the economic viability of investment proposals
- has wide ranging applicability to project evaluation across many sectors
- has been refined to offer decision-makers additional evidence-based information upon which to justify investment choices.

In line with best practice project management, assessments and resources are to be proportionate to the size and nature of the project. An additional consideration is the stage of development of the proposal.

CBA is a widely used analytical technique applied routinely to investment decision making. CBA relies on the evaluation of cost and benefit streams associated with projects, driving consideration of the economic value of such proposals. It is used widely across project selection, prioritisation and justification. Ultimately, applying robust CBA helps solve the allocation problem—a core issue fundamental to the discipline of applied economics i.e. assigning scarce funding among competing investment choices.

1 Having regard to scope, cost, complexity, level of risk and sensitivity.
2 https://www.legislation.qld.gov.au/LEGISLTN/ACTS/2015/15AC022.pdf, page 32.
3 Reflective of the State Infrastructure Plan (SIP) released 16.03.16.

2.1. Purpose

The purpose of this guide is to provide government agencies, investment decision-makers and practitioners with a clear view of the CBA framework that Building Queensland applies to assess the economic viability of projects[4]. It is intended to:

- provide an approach and methodology for the CBA of significant Queensland infrastructure projects and investment proposals
- enable Building Queensland to meet its statutory obligations regarding the undertaking and reporting of project-based economic evaluation.

In keeping with continuous improvement and innovation (CI&I) practices, this framework will be amended over time to include practical experience and feedback from stakeholders. Government owned corporations (GOCs) are advised to engage with Building Queensland to determine appropriate economic assessment approaches for investment proposals.

2.2. Policy Context for this Guide

2.2.1. State Level

The Queensland Government has a number of frameworks, policies and guidelines to assist in the strategic development, selection, funding and delivery of projects. Under the Queensland Government's Project Assessment Framework (PAF)[5], CBA has broad application to a range of project types[6].

The PAF provides supplementary guidance on CBA[7], which supports the evaluation of options and can be used in preliminary evaluation and business case development[8]. PAF guidance states that to be complete and effective, CBA should:

- follow the process outlined in the PAF
- contain concise and relevant information that supports decisions about whether or not to implement a project
- use well-defined and consistent terminology
- include appropriate self-contained quantitative and qualitative analyses of financial, economic and social risks and impacts, along with other identified risks/impacts associated with the project
- state the assumptions on which the analyses are based, as well as the basis for those assumptions
- specify clearly referenced data sources for validation purposes
- indicate clearly the range of assumptions used in sensitivity testing of options
- provide detailed, clear and logical arguments to substantiate any conclusions and recommendations[9].

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4 Inclusive of infrastructure and non-infrastructure based solutions.

5 Developed in regard to project assessment and assisting decision making; www.treasury.qld.gov.au/publications-resources/project-assessment-framework/paf-cost-benefit-analysis.pdf, accessed 15.12.15.

6 Including information, communication and technology (ICT) policy development, business change, service provision and construction projects.

7 www.treasury.qld.gov.au/publications-resources/project-assessment-framework/paf-cost-benefit-analysis.pdf, accessed 19.01.16.

8 That is at the preliminary and detailed business case stages. While the thrust of this guide is in applying CBA to those business case stages, CBA can also be used as part of post-delivery review and benefits realisation processes. In this case, the conducted CBA is known as an ex-post CBA, and relies on measurement of benefit streams using actual, observed data sets, rather than expected benefit streams. Further advice on ex-post evaluation can be sourced from the Cost Benefit Analysis Manager within Building Queensland.

9 This list comes from page 2 of PAF supplementary information 'Cost-benefit analysis', and offering good general guidance on summarising essential CBA components.

In developing this guide, Building Queensland has adopted and adapted relevant elements of PAF materials. The guide has also sought strategic alignment with relevant government guidelines and policies. This ensures consistency with the government's overall approach to the economic appraisal of projects, while providing more specific guidance on the quality, appropriateness and robustness of information provided by agencies on significant infrastructure projects.

In delivering a CBA, PAF suggests applying the following steps are applied:

- Step 1: identify outcomes
- Step 2: develop options
- Step 3: preliminary evaluation of options
- Step 4: detailed option evaluation
- Step 5: recommendation.

This five-step approach to CBA, reflective of PAF guidance materials, is further expanded in Sections 5 to 7.

2.2.2. Federal Level

Building Queensland notes Infrastructure Australia's Reform and Investment Framework (RIF) provides guidance on information requirements for CBAs submitted to it as part of business cases[10]. Relevant elements of that framework have been considered in developing this guide to ensure analyses conducted or overseen by Queensland Government are readily adaptable where funding applications for significant infrastructure proposals to Infrastructure Australia are made.

2.2.3. Further Context

In drawing this guide together, Building Queensland has considered a wide range of established and well recognised frameworks to understand how CBA has been addressed and implemented. These include:

- Queensland Government Project Assessment Framework (2015)[11]
- Infrastructure Australia cost benefit analysis template (2016)[12]
- Commonwealth of Australia (2006), *Handbook of Cost Benefit Analysis*[13]
- Austroads project evaluation series[14]
- Australian Transport Council (2006), *National Guidelines for Transport System Management in Australia*[15]
- Australian Productivity Commission (2010), Valuing the Future: the social discount rate in cost benefit analysis[16]
- Victorian Department of Treasury and Finance (2013), *Economic Evaluation for Business Cases–Technical Guidelines August 2013*[17]
- Queensland Department of Transport and Main Roads (2011), Cost-benefit Analysis Manual[18]

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[10] For example, Templates for Stage 7, Solution Evaluation, (Transport Infrastructure), at www.infrastructureaustralia.gov.au/projects/files/Infrastructure_Priority_List_Submission_Template_Stage_7_Transport.pdf, accessed 21.01.16.

[11] www.treasury.qld.gov.au/publications-resources/projects-queensland/policy-framework/project-assurance-framework/paf-cost-benefit-analysis.pdf, that is the full scope, application and context of PAF approaches were considered.

[12] www.infrastructureaustralia.gov.au–see for example, Proforma 1 Economic appraisal

[13] www.finance.gov.au/sites/default/files/Handbook_of_CB_analysis.pdf

[14] www.onlinepublications.austroads.com.au/items/AGPE

[15] www.transportinfrastructurecouncil.gov.au/publications/ - see especially the National Guidelines for Transport System Management in Australia (2006), and often known as the 'NGTSM'.

[16] www.pc.gov.au/research/completed/cost-benefit-discount

[17] www.dtf.vic.gov.au/Publications/Investment-planning-and-evaluation-publications/Lifecycle-guidance/Technical-guides-Stage-2-Prove

[18] www.tmr.qld.gov.au/business-industry/Technical-standards-publications/Cost-Benefit-Analysis-Manual.aspx

- HM Treasury (2011), The Green Book–appraisal and evaluation in central government[19]
- The Treasury (2015), *Guide to Social Cost Benefit Analysis*[20]
- Productivity Commission (2014), *Public Infrastructure*, Inquiry Report No. 71[21].

A number of Queensland agencies have developed specific CBA manuals and approaches that provide significant supporting information. These approaches are considered key inputs for reviewing CBAs which Building Queensland may lead or assist. These manuals address:

- specific classes of infrastructure
- cost and benefit estimation techniques relating to those asset classes
- relevant engineering and technical information along with standard economic values.

2.2.4. Key Concepts

In harnessing key concepts outlined in reference materials, a broad-based, best practice CBA methodology may be defined by the following steps:

1. Identify the objectives of a proposal and undertake a strategic assessment of service requirement.
2. Establish a base case and identify potential project options.
3. Identify potential benefits and costs under the base case and options.
4. Determine an appropriate evaluation period for the analysis and an appropriate set of discount rates.
5. Calculate key economic indicators such as Net Present Value (NPV[22]) and Benefit Cost Ratio (BCR).
6. Conduct sensitivity analysis on key assumptions, including both parameters and variables in the analysis.
7. Use decision criteria to identify preferred option/s and inform decision making.

While the primary application for CBA is in the early stages of the project lifecycle, CBA can be continually refined throughout the project life as new data is acquired and analysed. CBA techniques may also be applied in assessing actual benefit and cost streams following project delivery and finalisation. This is known as ex-post evaluation.

2.2.5. Materiality

A key concept guiding the scope of any CBA that Building Queensland leads is materiality. Materiality is a measure of whether an impact is both significant and relevant. A cost or benefit impact is material where its inclusion or exclusion could reasonably be expected to change the results of the analysis in a significant way. The impact also has to be relevant in the sense that it arises as a result of the option being proposed rather than as a result of the status quo or some other action independent of the option.

[19] www.gov.uk/government/uploads/system/uploads/attachment_data/file/220541/green_book_complete.pdf
[20] www.treasury.govt.nz/publications/guidance/planning/costbenefitanalysis/draftguide
[21] www.pc.gov.au/__data/assets/pdf_file/0003/137280/infrastructure-volume1.pdf, accessed 20.01.16.
[22] The term NPV has been used throughout this document and refers to the net present value calculated specifically during an economic CBA, and has the same meaning as the term 'ENPV' used in the PAF.

2.3. Structure

The rest of this guide is structured as follows:

- Overview—which looks at infrastructure, the purpose and application of CBA and a total economic valuation framework.
- CBA in Business Cases—sets out the role of CBA in Building Queensland's Business Case Development Framework (BCDF) and how CBA is integrated into that framework.
- Identify Outcomes and Develop Options—provides information on how the initial elements of identifying a problem should be addressed through a strategic business case, particularly in focusing on the identification of potential and preferred outcomes from a strategic assessment.
- Preliminary Evaluation of Options—considers the development of options for economic appraisal, including the importance of specifying the base case, and how the project options are evaluated.
- Detailed Option Evaluation—looks at how detailed option evaluation is undertaken, including applied methodologies to estimating benefits and costs as well as the application of sensitivity analysis.
- Select Preferred Option—addresses the decision criteria used in the selection of a preferred option.
- Recommendation—provides information on how conclusions from the CBA can be documented, and recommendations identified along with a checklist.

Additionally, a References section containing a list of relevant guidelines, publications and supporting background material provides an additional technical resource complementary to this guide. Finally, a series of appendices provide more detailed information around associated themes, including contingent valuation approaches, social impact evaluation and common technical issues arising in the use of CBA.

2.4. Precaution against Misuse

2.4.1. Scalability

CBA is scalable in the sense that it may be applied with increasingly detailed levels of rigour as initiatives and proposals move through the development phases including scope, option definition and refinement, evaluation and selection of options, and detailed project evaluation. Throughout this process, CBA relies upon escalating levels of data collection and analysis.

2.4.2. Modularity

CBA is **not** however modular in the sense that component benefit streams can subsequently be excluded from analysis with the aim of achieving 'reasonable' results. That is, all benefits that are measureable and are attributable (i.e. material) to the project, should be included in the CBA.

3. OVERVIEW

3.1. Economic Evaluation of Infrastructure

In general terms, infrastructure refers to the fundamental facilities and systems serving a country, region or city including the services and facilities necessary for its economy to function. It can be defined as the physical components of interrelated systems providing commodities and services essential to enable, sustain, or enhance societal living conditions. The type of infrastructure, provisioning by public or private funding sourcing, funding, investment selection and decision-making, as well as timeliness and expected returns are all issues requiring consideration. Further discussions around these themes are contained in Appendix A.

Economic appraisal of infrastructure aims to provide an assessment of whether a project or proposal is justified on economic grounds. Clear context, outline of adopted approaches, communication of conclusion and any recommendations are essential. An essential technique is option appraisal through which:

- government intervention is validated
- objectives are set
- options are created, reviewed and compared by analysing their costs and benefits.

Infrastructure services to the Queensland community are being provided within an increasingly complex and challenging fiscal environment. Stakeholders require provision of high quality outcomes and value-for-money from the use of resources diverted to deliver those outcomes. Rigorous and robust infrastructure project evaluation, including the use of CBA, materially helps deliver on these requirements.

It is critical to apply the correct technique, tailored to the specifics of the identified problem due for analysis. In comprehending the role of specific analyses, it is important to also realise the scope of their application.

3.2. Total Economic Value Framework

A distinguishing feature of an economic CBA is the valuation framework within which quantitative and qualitative impacts are assessed. The application of this valuation approach provides the rigour to test options, and make recommendations. Total Economic Value (TEV) is the term used for describing the range of values of a resource, and divides values into two broad categories:

- use values—these can be extractive or *in situ*, and may also be differentiated depending on whether they are typically associated with markets
- non-use values—these are existence values which require non-market valuation.

CBA requires that all relevant costs and benefits are identified, whether they are readily quantifiable or not. Non-market impacts should be included. Such costs and benefits are not readily identifiable because they generally do not involve a clear transaction or market price. Such impacts may include:

- environmental externalities (e.g. increased pollution; reductions in native vegetation)
- social externalities (e.g. impact on heritage values; improving social cohesion).

Such impacts are typically valued using contingent valuation techniques, which are discussed further in Appendix B.

Costs and benefits can be further categorised according to those that can readily be assigned monetary values and those where this cannot be done robustly, or where the resources involved in doing so would be disproportionate given the likely impact. In the case of the latter, a qualitative description of the impacts, as well as the likely extent of such benefits should be provided. Consideration should be given to appropriate analytical techniques, including using contingent valuation techniques.

Appendix C highlights a decision tree approach to social and environmental values that should be considered in developing a CBA for significant projects.

3.3. Non-market Valuation

Market values can often be readily identified in CBAs for infrastructure. However, their applicability depends on whether these values reflect competitive market assumptions and comprise the full economic costs associated with private consumption and supply of infrastructure services.

There may be a range of significant non-market values that may need to be estimated and incorporated into an infrastructure CBA. Approaches to estimating non-market valuations are complex and typically revolve around the following approaches:

- hedonic pricing—based upon inferred pricing from observed near-market behaviours or proxies
- stated preference analysis—where consumers provide indicative price equivalents, often reliant on extensive survey work
- willingness to pay—revolving around demand compensation for avoided negative outcomes.

Further information on non-market valuation techniques and associated processes is provided in Appendix B.

It is important not only to distinguish between economic dollar values that can be attributed to streams of costs and benefits, but also between economic and financial values of costs and benefits. Appendix D contains a tabular comparison of economic and financial analyses, along with discussion around key differences and applicability.

3.4. Comparison with Financial Analysis

Financial analysis is sometimes viewed analogously with CBA. However, there are major differences in the accrual of benefit streams between these two analyses, their application, and their key outputs. Mixing economic and financial indicators can cause confusion amongst end-users, so it is vital to distinguish between financial and economic analyses, including considering who obtains benefit from the proposed project. This relates to broader concepts around the society adopted within a CBA Framework.

In selecting between potential project options, the private sector routinely undertakes detailed investment analyses using techniques—demand forecasting, investment scheduling, discounting, scenario analysis, and sensitivity testing—similar to those used in economic CBA. The project may also have wider implications like externalities or employment considerations, e.g. increases in taxation revenue from increased employment. Such economy wide considerations lie outside the private commercial interest of the entity undertaking the financial analysis[23] and do not affect the potential profitability of that private investment. Subsequently, such considerations are not included in private investment financial analysis.

CBA takes a wider, societal view, adopting a social perspective and considering the costs and benefits across all members of society.

It is in the respective breadth of consideration around benefit and cost accrual, as well as the treatments of benefit streams where major departures between the economic and financial analyses are witnessed. The entity undertaking financial analysis is considering the investment decision in terms of the likely privately captured benefit streams from potential project revenues. In summary, a financial analysis can be seen as a private CBA, focused upon costs and revenues, whereas the costs and benefits considered within this CBA Guide are at a societal level. Further discussion around the context and conduct of financial analysis is contained in Appendix D.

[23] Subject to regulatory requirements imposed on the private entity.

3.5. Comparison with Cost Effectiveness Analysis

Cost effectiveness analysis (CEA) requires supplementary techniques to weigh up costs and benefits that remain unvalued. That is, impacts can be quantified, but are not be able to be monetised.

CEA technique relies on the development of a metric involving the quantitative (un-monetised) benefit and total costs of those options being assessed. Proposals are then compared in terms of the developed cost-effectiveness criterion. For example, estimating the life time economic outcomes of providing primary school education by constructing a new school is extremely difficult. It is possible, however to relate such costings to the number of students that a school can educate. These outputs can be compared against the cost of providing the infrastructure and services to achieve this. Ultimately, CEA compares the costs of alternative ways of producing the same (or very similar) outputs[24].

4. COST BENEFIT ANALYSIS IN BUSINESS CASES

4.1. Role in the Project Lifecycle

CBA is a widely accepted form of appraisal for infrastructure projects. CBA structured approaches are applied throughout other elements of the Queensland Government, for example in assessing rural transportation and primary industry investment analyses.

CBA plays a critical role informing investment decision-making. It supports the evaluation of options and is to be applied across Building Queensland's BCDF. In assessing proposed projects, Building Queensland will apply best-practice techniques, including CBA. This approach ensures that different infrastructure classes are assessed on a consistent basis, particularly in terms of the methodological soundness of applied analytical technique.

Early stage analysis helps project decision-makers determine the preferred option for more detailed analysis and assess the ongoing viability of the project development and implementation phases. A complete and effective CBA, strategically aligned with government outcomes will:

- be consistent with over-arching Queensland Government approaches, including the PAF
- follow processes outlined in the BCDF
- contain concise and relevant information on which to base a decision on whether to implement the project
- use a well-defined and articulated economic methodology and terminology appropriate to the class of infrastructure assets being considered
- include appropriate self-contained quantitative and qualitative analyses of economic, social and financial risks and impacts and any other risks/impacts identified with the project
- clearly state the assumptions used in the analysis, as well as their justification
- clearly specify referenced data sources for validation purposes
- indicate and explain assumptions used in sensitivity testing options
- provide detailed, clear, logical arguments to substantiate conclusions and recommendations.

[24] Related to CEA, cost utility analysis (CUA) constructs an outcome measure to use as a proxy for changes in individuals' utility. Discussion around these methodologies is largely outside the scope of this guide, but may be worth consideration where benefits cannot be definitively monetised.

4.2. Role in the Business Case Development Framework

As noted in the introduction, the foundation of Building Queensland's BCDF is the Queensland Government PAF. In maintaining alignment with the PAF, Building Queensland's approaches will apply appropriate project assessment tools and techniques throughout the project lifecycle.

Key to the application of PAF stages are outputs that grow in detail, accuracy and applicability to market over time. In using PAF guidance as a foundational basis for developing procedures, Building Queensland has ensured that the development of business cases:

- remains strategically aligned
- is applicable to a Queensland context
- maintains compatibility with project and infrastructure proposals initiated within Queensland Government agencies.

The Building Queensland CBA Framework remains similarly aligned. Figure 1 provides an overview of the main stages in Building Queensland's BCDF, coupled with brief notes around CBA outputs. It highlights the type of economic analysis to be undertaken in each stage of the project lifecycle, key inputs, outputs and considerations, as well as where a CBA is performed. Where a CBA is to be conducted, an indicative level of depth in terms of analytical rigour is also identified.

In keeping with concepts of the character and purpose of CBA, it should be noted that the level of analysis conducted is dependent on the stage of the business case lifecycle, the primary purpose of the analysis undertaken and the required output of the specific business case development phase within which the CBA is contained.

Figure 1: Integration[25] of CBA with the Building Queensland Business Case Development Framework and Project Lifecycle

STRATEGIC BUSINESS CASE	PRELIMINARY BUSINESS CASE	DETAILED BUSINESS CASE
Purpose: Needs analysis.	**Purpose:** Option analysis.	**Purpose:** Project/option selection.
Application of CBA: No	**Application of CBA:** Yes	**Application of CBA:** Yes
Approach: Identify expected economic, social and environmental outcomes.	**Approach:** Preliminary (strategic) CBA of multiple options. Initial quantitative description of economic, social and environmental outcomes. Economic appraisal of direct costs, including direct project construction and operation costs for each option. Initial analysis of benefits of each option.	**Approach:** Detailed CBA, plus any initial market soundings. Highly detailed analysis of refined option. Estimate economic values for economic, social and environmental outcomes. Economic appraisal of all costs and benefits for the preferred option.
Output: Qualitative description of outcomes, with some quantification where available. Identifies options for Preliminary Business Case.	**Output:** Preliminary CBA, with some sensitivity analysis. Identifies preferred option for Detailed Business Case, justified on strategic benefits.	**Output:** Detailed CBA with sensitivity analysis. Describe net economic benefit and qualitative information. Net present value, benefit cost ratio and detailed breakdown of benefit streams identified. Identifies preferred option to go out to market.
	P50 estimates of material costs and expected benefits. Qualitative descriptions where this is not possible.	**P90 estimates** of material costs, especially lifecycle asset costs, as well as benefits. Qualitative descriptions where this is not possible.
Alignment: PAF Strategic Assessment of Service Requirement.	**Alignment:** PAF Preliminary Evaluation.	**Alignment:** PAF Business Case.

[25] Outside of assurance processes, including Gateway Review.

5. DELIVERING A COST BENEFIT ANALYSIS

This section adopts and expands the process proposed in CBA supplementary material to the PAF guidelines[26]. The steps applied are:

- identify outcomes
- develop options
- preliminary evaluation of options
- detailed option evaluation
- recommendation.

These are expanded and discussed in Sections 5.1 to 5.5.

5.1. Identify Outcomes

Key issues to be addressed in this step to ensure effective CBA approaches can be carried out. Detailed guidance is provided in the PAF–Strategic Assessment of Service Requirement[27] and Building Queensland's BCDF. This step corresponds to the Strategic Business Case (SBC) phase of the BCDF. Requirements include:

- a service need or opportunity is explored and clearly defined
- the basis for government intervention on efficiency or equity grounds has been well established
- the expected outcomes have been clearly identified
- both the service need and outcomes are described independent of any specific option or solution to enable a wider consideration of possibilities
- relevance to government policy is clearly identified and is high
- critical success factors relating to achieving the expected outcomes and addressing the service need have been identified
- potential options are described along with the expected benefits of each option, and compared to a designated base case
- potential costs are identified and include direct project costs as well as wider economic costs.

The identification of outcomes after wide-ranging consideration leads to analysis of costs and benefits at later project stages, after a suitable problem has been identified in the form of an identified infrastructure need. Although CBA does not have a direct role within the SBC stage, it may be useful for analysts to be involved in initial project team scoping meetings in order to orientate themselves to the project, guide scoping and begin considering possible applicable methodologies. Early in the project lifecycle (SBC), outcomes and proposals may be very broad in nature, and the use of an ILM workshop[28] aims to start a benefits conversation early in the process of developing potential options.

[26] The PAF-based five-step process has been adopted and expanded upon here. Additionally, there are numerous examples of the logical, staged approaching of applied CBA, the over-arching premise of all calling for an organised, expansive and robust approach to be used. An example is the widely cited Boardman, et. al. (2011); adopting a nine step framework for the conduct and interpretation of CBA.

[27] www.treasury.qld.gov.au/publications-resources/project-assessment-framework/paf-strategic-assessment-service-requirement.pdf, accessed 27.01.16.

[28] For further detailed information, see Building Queensland's Strategic Business Case Framework.

5.2. Develop Options

Development of infrastructure options is a critical element in determining the best solution for an identified need. Investments in infrastructure assets in isolation are rarely a complete solution.

Careful consideration of non-built solutions, including regulatory reform, demand-management policy options and operational changes can either yield innovative solutions that have higher economic returns or sharpen the analysis and justification for built asset responses. After due consideration of such options, any commitment of significant infrastructure investment is carried out with a view to achieving a desired level of service or to unlock the economic, social and/or environmental potential of an area or a region.

Building Queensland's Preliminary Business Case (PBC) outlines the process for developing an options long list and an options shortlist, and also emphasises the requirement for developing a robust base case.

5.2.1. Base Case

Development and analysis of a base case is essential as it is the **benchmark against which all other options are compared**. Consequently, it is important that the base case is tightly specified and modelled on a whole-of-life basis, including all expected expenditures[29].

For infrastructure projects, the base case invariably includes consideration of maintaining specified service levels provided by existing infrastructure and accounts for full lifecycle costs required to maintain those service levels.

Key characteristics of a base case scenario include:

- a description of what will occur should the proposed project not proceed, including implications for the expected level of service
- impacts of continuing an existing situation, with all relevant costs and benefits.

Importantly, the base case is not a 'zero spend' or 'dummy' option. It should include all expected actions to be taken if none of the project options are implemented. Decision-makers need to be advised of what situation will exist in the absence of the project being approved. Maintenance of budgeted patterns of expenditure may prove to be a viable alternative based on affordability or value for money considerations, especially where gains from project options are not significant relative to the capital and operating expenditure differences between the existing base case and project options[30].

A critical benefit of having a clearly defined base case is to highlight ongoing costs that would be incurred in the absence of any intervention. Ultimately, the cost of the identified problem or issue is valued during the valuation of the base case. Such information can then be compared (netted) against the incremental capital and operating costs of a proposed intervention, enabling that to be measured against the incremental benefits.

Base Case Representativeness

Rigorous CBA depends on proper specification of the base case. The base case must be presented as accurately as possible and be considered as a potentially viable option in its own right. Under-specification of the base case will lead to misguided comparison as expected spending patterns, level of service, and infrastructure performance will not be an authentic and accurate representation. Thus, where the base case is not representative, any comparison between such an (ill-defined) base case and project option/s will produce misleading results, and unsupported decision making.

[29] That is a detailed and articulated description of 'business-as-usual', and in the absence of the proposed project.
[30] This may be so where a comprehensive total asset management planning process has been undertaken, which would recognise the level of future demand for services.

5.2.2. Other Options

Potential options should be analysed in detail by direct comparison with the base case. These options should represent practically viable alternatives i.e. they should be inherently feasible in a technical sense.

As part of the option analysis, it is important to lift potentially arbitrary restrictions on the search for solutions:

- options identification should focus on goals being serviced rather than ways to improve or expand existing facilities
- infrastructure options should not be limited to the control of a particular agency or jurisdiction
- linking options to infrastructure capital improvements may serve to address asset operational opportunities, which are a subset of the potential set of solutions.

Without a clear understanding about the objectives and expected outcomes from the project it is difficult to develop options or create innovative solutions.

5.3. Preliminary Evaluation of Options

The primary purpose of a CBA during the PBC phase is to provide decision-makers with a focused, small set of options, including a preferred option (among all proposals) for detailed analysis in the DBC phase. In the PBC, the CBA can be strategic in nature. That is, the CBA provides an initial set of options, and may not be comprehensive of all expected project benefits in its assessment.

Typically at this stage, the CBA takes key engineering construction and operating information, including preliminary cost estimates (P50) into a discounted cash flow analysis. Initial streams of benefits that can be quantified and valued in economic terms are discounted to present day values and compared to expected project costs.

Typically these benefits comprise avoided future capital and operating costs that might be incurred in a 'business as usual' scenario as well as initial estimates of direct user benefits and other benefits that might be readily valued. Project options that show significant net economic dis-benefits are excluded from further consideration.

At this stage, more emphasis may be placed on direct costs and benefits, which is likely to be a function of available information and data. Indirect benefits and costs are more likely to be described in qualitative terms. In a detailed CBA, many quantitative direct benefits and costs are assigned economic values. Also, the earlier qualitative analyses of indirect benefits and costs are often refined to provide quantitative estimates as well as economic valuations, where possible, through a defensible applied methodology.

In identifying innovation options, the following questions[31] may assist in guiding the project team:

- Are all elements of the operation equally justified?
- Can the operation of the infrastructure be contracted out?
- Could the proposed infrastructure operations be scaled down or replaced?
- Is demand sensitive to the level and structure of infrastructure pricing?
- Could the pricing structure be varied instead of increasing expenditure?
- Can better staff training improve asset productivity or reduce labour needs from a non-infrastructure option?
- Will different potential design options expect to cost less or require less maintenance?
- What happens if the design life or timing of the proposed option is varied?

[31] Adapted from Queensland Treasury–Project Assessment Framework, Cost Benefit Analysis Guide.

- Can the infrastructure be delivered in stages?
- Can the project be bundled with other projects being considered across government?
- What alternative locations are available?
- Are there significant trade-offs between labour, capital, rehabilitation and maintenance costs?
- Can infrastructure asset operations be combined with another or divided into parts to advantage?
- What combination of proposed options maximises societal net benefit?

5.4. Detailed Option Evaluation

In identifying costs and benefits, it is useful to identify the people who are affected by a decision and whose costs and benefits should be taken into account in the CBA.

This guide focuses on delivering CBA from the perspective of Queensland society, rather than from a government-specific or departmental-specific perspective. Analysis from a departmental perspective is often termed a financial analysis or sometimes perhaps a financial CBA. For further discussion on the application of financial analysis in such context, please see Appendix D.

An analysis from a statewide perspective, often termed economic CBA, or social CBA, is preferred as the actions of one agency or department can impose costs or benefits on individuals or the state as a whole. For example, increasing the size of a capital works program operated by a particular department may assist the operation of the department but may require large increase in taxation as a revenue source. Such investment decision-making means reduced levels of expenditure available for alternate proposals competing for funding. The analysis should therefore look through entities, such as the government, to the people that are affected by decisions.

5.4.1. Isolating Impacts–Identifying Costs and Benefits

All people in Queensland affected by an infrastructure project should be recognised in the analysis, including people in their role as taxpayers. However, there are situations where the definition of who is a gainer or loser is not straight forward. Some of these are described here.

- The focus of the CBA should be on those ultimately affected rather than on intermediaries. However, the impact on intermediaries may be a reasonable proxy for the former[32].
- CBAs of public infrastructure projects in Queensland are intended to measure the benefit to people in Queensland.
- The current generation makes decisions that affect the welfare of future generations. Care about future generations is expressed through the current generation's willingness to pay. This needs to be measured empirically or through the political process. There is little justification for the analyst to override intergenerational preferences or predict future generations' preferences.

[32] For example, a better airport infrastructure that reduces freight costs may benefit a retailing business, but where there is competition, most or all of the benefit is likely to be passed on to consumers in the form of lower prices. The workers or shareholders of the retailing business may not benefit themselves, but freight reductions may be a reasonable proxy for the impact on the final consumers.

Costs and benefits need to be identified as comprehensively as possible, and are:

- characterised by impacts on people, rather than organisations or decision-makers[33]
- characterised by observable consequences that are measureable
- checked to ensure that there is no double counting.

As a general principle, only real costs and benefits, namely changes in real resources, should be taken into account:

- Payments to suppliers, while technically financial transfers, are proxies for the consumption of real resources.
- Accounting depreciation expenses should not be taken into account, since this would double-count the capital investment already incurred as a cost.
- Interest and capital charges are payments for the time value of money and should be ignored as the time value of money is represented by the discount rate. A large portion of rent or lease payments also compensate for the time value of money, so care needs to be taken when incorporating rental charges into a CBA.
- Welfare payments transfer resources from taxpayers via the government to welfare recipients but do not represent a change in real resources.

Only those costs and benefits directly attributable to the relevant option should be taken into account. If they would occur anyway, then they should be ignored. Avoided costs or benefits also need to be included, provided they are a consequence of the decision that is to be made.

Another common fault sometimes seen is to consider benefits and costs in real and nominal terms, with an intermingling of these two together, leading to faulty analysis. An example is expected traffic volume demand growth would be included in the CBA, but an inflation figure would not be applied to the analysis. This is because the process of discounting benefit and cost streams would cancel out the inflationary effect, thus making the process of adding in inflation—merely to just take it away again—superfluous. A superior approach is to simply use real (present day) amounts and a real discount rate.

5.4.2. Estimating Costs

Costs should be expressed in terms of relevant opportunity costs. It is important to explore what opportunities may exist. An example of an opportunity cost is to use land in a different, more valuable way than in its current use. Another is the alternative use of an employee's time. Full-time equivalent (FTE) costs should be used to estimate the costs of employees' time to the employer, and should include superannuation and allowances, as well as basic salaries.

Costs of infrastructure provision that have already been incurred and are irrevocable should be ignored in an appraisal; these are termed sunk costs. To aid in enhancing the amount of detail around cost structures in the analysis, it can be useful to distinguish between fixed, variable, semi-variable and step costs[34]:

- fixed costs remain constant over wide ranges of activity for a specified time period (e.g. a train station)
- variable costs vary according to the volume of activity (e.g. fuel for train services)

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[33] For example, in a proposal to increase the capability of an organisation, increasing the capability of the organisation may or may not help its clients. It would be better to identify directly the impacts on the clients, such as 'faster response times which save clients x hours of time, worth $y', or 'reduced weather forecasting errors, which save airlines $x in unnecessary fuel costs and $y in delays due to failure to re-route when they should have', or 'safer air transport services reducing accident investigation costs and therefore requirement for taxpayer support through an appropriation'.

[34] Categorising costs in this way can aid sensitivity analysis, but the categorisation should be used carefully. A cost that is fixed relative to one factor may change with another. More complex modelling may be required to describe how costs change over time and with different variables.

- semi-variable costs include both a fixed and variable component (e.g. maintenance is an example, where there is usually a planned maintenance program, and a responsive regime where costs vary in proportion to activity, such as responding to a severe weather event)
- semi-fixed, or step costs, are fixed for a given level of activity but they eventually increase by a given amount at some critical point (e.g. train control systems may need to be automated for higher service levels).

For substantial infrastructure projects, the relevant costs are likely to equate to the full economic cost of providing the associated goods and services over the lifecycle of the assets. For these proposals, the full economic cost should be calculated, net of any expected revenues, for each option. This includes direct and indirect costs, and attributable overheads.

A base case built up this way should also equal the total of the analysis of costs into their fixed, variable, semi-variable and stepped elements. This multi-cost approach enables opportunity costs to be fully considered, and sensitivity analysis to be conducted later on. This is because there will be a sufficient disaggregation of costs.

Cost estimation can be difficult, depending on the class of costs under consideration. It will normally involve input from accountants, economists, engineers and other specialists, notably expert cost estimators, depending on the type of appraisal. The appraiser needs to understand and clearly communicate the appraisal scope to ensure specialists provide relevant cost information, thus ensuring opportunities have been thoroughly explored. Within the Building Queensland BCDF, projects analysed at the detailed business case should be conducted using a P90 cost estimate[35].

Some projects expose the government to contingent liabilities–that is, commitments to future expenditure if certain events occur. These should be appraised (and monitored if the proposal goes ahead), as part of usual risk analysis procedures and articulated as a project risk as appropriate.

One class of contingent liabilities is the cancellation costs for which the government body may be liable if it terminates a contract prematurely. Such liabilities, and the likelihood of their coming about, must be taken into account in appraising the initial proposal. Redundancy payments fall into this category, but as the wider social and economic consequences of these should also be assessed, advice from economists should be sought.

5.4.3. Estimating Benefits

The purpose of estimating benefits is to consider whether an option's benefits are worth its costs. This allows alternative options to be systematically compared in terms of their net benefits or net costs. The general rule is that benefits should be valued unless it is clearly not practicable to do so.

In principle, appraisals should take account of all benefits to Queensland society. This means that as well as taking into account the direct effects of interventions, the wider effects on other areas of the economy should also be considered. These effects should be analysed carefully as there may be associated indirect costs, such as environmental costs, which would also need to be included in an appraisal. In all cases these wider effects, often described as spillover effects or externalities, should be clearly described and considered.

Productivity is the efficiency in which inputs are converted to economic value. Projects leading to more efficient asset use can result in productivity increases through enhanced competitiveness. For example, an efficient transport sector drives productivity benefits through reductions in freight transportation times, reductions in per tonnage freight costs, enhanced business opportunities, and increased firm profitability ultimately leading to cheaper goods and services.

[35] That is a risk adjusted cost estimate conducted to a probability level of 90%.

Real or estimated market prices provide the first point of reference for the value of benefits. There are a few exceptions where valuing at market prices is not suitable. If the market is dominated by monopoly suppliers, or is significantly distorted by taxes or subsidies, prices will not reflect the opportunity costs and adjustments may be required (e.g. the effect of subsidies, tariffs and taxes on certain markets).

The results of previous studies may sometimes be used to estimate the economic value of changes stemming from current programs or policies. There will be increasing scope for using this benefit transfer method as databases expand, though care must be taken to allow for different circumstances. The characteristics of the consumers or client group for which data exist may differ from those of the option under consideration. These factors can limit the extent to which values can be transferred or generalised.

All impacts (including costs and benefits, both direct and indirect) on non-Queensland residents and firms should be identified and quantified separately where it is reasonable to do so. Generally, proposals should not proceed if, despite significant identified benefits, there is a net cost to Queensland (for instance, after taking into account environmental costs).

In the absence of an existing robust (i.e. reliable and accurate) monetary valuation of an impact, a decision must be made whether to commission a detailed study incorporating further research. In consequence, decisions around the amount of project resources to dedicate to such a task must also be made.

Where it is concluded that a research project to determine valuations is not appropriate, a central estimate, together with a maximum and minimum plausible valuation, should be included. These figures should be included in sensitivity analyses to give assurance that the valuation of that benefit is not critical to the decision to be made. A plausible estimate of the value of a benefit or cost can often be drawn out by considering a range of issues.

Wider Economic Benefits

Concepts around the consideration of wider economic benefits (WEBs) should be noted. Widely cited examples include value uplift from enhanced property values following the delivery of public transport infrastructure, and reductions in business costs from agglomeration effects. WEBs continue to evolve as an area of economic research. Therefore, analyses where WEBs have been identified should have economic indicators presented with and without the effects of WEBs[36] as part of sensitivity testing. Additionally, extensive discussion of detailed methodologies adopted and applied in generating the wider economic benefits should also be presented.

5.4.4. Risk Consideration

All costs and benefits that go into a CBA are estimated forecasts of the future, meaning that there is risk of actual realised streams of costs and benefits deviating from expectations. A distinction is sometimes drawn between risk and uncertainty. Risk occurs where the probability distribution is known, and uncertainty where it is not. For the purposes of project evaluation, this distinction may be irrelevant because any analysis of uncertainty can be assigned a probability distribution. In the context of this guide, the two terms may be used interchangeably.

The main sources of risk for many public sector projects are:

- demand forecasts (and hence project benefits and some variable operating costs) that differ from expected, with increasing risk over time as future estimates become less certain
- environmental impacts that differ from expected or were unforeseen
- construction costs that differ from expected because of changes in input costs or unforeseen events such as labour disputes or wet weather, or unforeseen technical factors

[36] This approach is consistent with Infrastructure Australia guidance.

- operating costs that differ from expected because of changes in input costs or unforeseen technical factors
- network effects, where an asset is part of the network (e.g. an individual road) and decisions made elsewhere in the network impact on the project in question.

5.4.5. Sensitivity Testing

Sensitivity analysis examines how sensitive key economic indicators are within the conducted analysis. It examines how much results deviate as a consequence from changes in project driver/s, or combinations of drivers.

In accounting for risk across the project, the main purpose of a sensitivity analysis is to identify where the greatest uncertainty is in the CBA. Further work[37] may enable the confidence interval around a cost or benefit to be reduced, improving the robustness of the analysis. Several different approaches can be adopted, including single variable testing, scenario analysis, break even analysis and Monte Carlo analysis.

Single Variable Testing

One way of determining which cost or benefit most affects results is to vary each one at a time, holding all others constant. If variables are correlated, they may need to be varied together. Key drivers affecting project viability may be tested, e.g. an assumption around expected demand growth rates over the evaluation period.

Scenario Analysis

This involves preparing alternative situations where different combinations of input changes are examined. In some instances likely scenarios are built upon the base case. In other instances variations on particular options are modelled to allow relationships between different variables to be explored. Such an approach is reliant upon detailed examination of likely situations that may occur over time, e.g. provisioning for a range of community services following master planning designation of key housing developments.

Break Even Analysis

This approach tests changes in key variables, either one at a time or in different combinations to see what values attain an overall project NPV of zero. Such an approach helps highlight how much construction costs could vary before an option becomes unviable or the level of revenue that would need to be achieved to establish an option's viability. The 'Goal Seek' functionality in Microsoft Excel is often used within the spreadsheet model in arriving at the combination of input values calculating a single desired result. Similarly, the 'Solver' add-in is applicable where more than one input value is required to be considered.

Monte Carlo Analysis

This computer-based technique uses statistical sampling and probability distributions to simulate the effects of uncertain variables on model outcomes. It provides a systematic assessment of the combined effects of multiple sources of risk (represented by the confidence intervals) in each of the costs and benefits and can also allow for known or assumed correlations between these variables. Additional analyses using a Monte Carlo technique can consider multi-variable simulations, potential correlation of variables, and non-normal distribution of variables. During sensitivity testing, care must be taken to avoid the testing of dependent and correlated variables, without due regard for their effects on the modelled variable outputs.

5.5. Recommendation

After conducting economic evaluation of refined options, some options will appear to be more favourable than others in terms of economic performance. These outcomes should contribute towards the broader conclusion and recommendations of the relevant stage (PBC or DBC).

[37] Particularly the application of robust cost estimation in the case of the cost side of the project

A key element is the selection and application of effective economic decision criteria, upon which to base investment choices. Given the potential diversity of infrastructure investments that Building Queensland may consider, and the size of the capital programs that are likely to accompany each of these projects, consistent application of relevant decision criteria is important.

5.5.1. Decision Criteria

Net Present Value (NPV)

The valuing of NPV is normally undertaken from the perspective of an economy. Benefits are streams of economic gains that accrue to members of the economy, both direct users and third parties. Costs reflect the economic consumption of resources or imposts on third parties as a result of the proposed infrastructure intervention. As identified, these values may be reflected in market values where the relevant market captures the full economic cost in the transaction.

Projects with a NPV greater than zero should be accepted, with the present value of the stream of economic benefits exceeding the present value of the stream of economic costs. Projects with a NPV less than zero should be rejected[38] because economic welfare is being reduced[39].

Relevant cash flows in the NPV analysis should be reconcilable to the financial analysis because they are drawn from the same sources[40]. This is particularly relevant for infrastructure construction and operation costs, as well as infrastructure service revenue streams.

Benefit Cost Ratio (BCR)

The BCR divides the present value of estimated benefits by the present value of estimated costs. A ratio of more than 1 would indicate a project is economically viable. However, in a constrained budget environment not all projects where BCR > 1 can be accepted. Also, treatment of benefits and costs needs to be carefully considered[41].

The full resource costs of an option should be expressed in the denominator. In certain circumstances the cost of raising public funds needs to be taken into account, especially where this is likely to impose a significant cost.

Importantly, NPV and BCR should be used in a complementary way in order to guide investment decisions. Generally, a project with a higher BCR would be preferred. However, BCR tends to be biased towards projects with lower initial capital costs, so it would also need to be considered with the NPV in making project decisions. Given such shortcomings, the economic NPV approach is used as the primary method for valuing project benefits in economic CBA.

Other Indicators

While the key economic indicators to be calculated for Building Queensland business cases and publication requirements are net present value and benefit cost ratio, other economic indicators are worth considering and may be useful if applied at appropriate business case stages. For example, incremental benefit cost ratio (IBCR) calculates the increase in benefit from additional augmentations to the selected project option, including sub option combinations, and are extremely useful during options analysis in assessing options and selected combinations of proposed sub-components. Other economic indicators such as net benefit investment ratio (NBIR) could also be considered and applied throughout the analysis following informed judgement.

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[38] On purely economic grounds, the decision to invest is not efficient, as demonstrably superior investment choices are available.

[39] On very limited occasions, a project with negative NPV might be accepted were it likely that non-quantifiable benefits more than offset the NPV result. Similarly, sufficiently large non-quantified costs may lead to project rejection. Importantly, it has to be noted that such occurrences are relatively uncommon, and reliant upon decisions outside of strict adherence to economic viability.

[40] e.g. In terms of the expected demand for a project. For both financial and economic analyses, demand will be drawn from the same modelling predictions and processes. Critically though, in keeping with the application of real effects, CBA results will not include nominal (financial) effects such as escalation.

[41] For example, an avoided cost is considered to be a benefit.

6. INVESTMENT DECISION MAKING

Building Queensland will report results in the form of net economic benefit of project options in terms of economic NPV and BCR. These will be presented for a set of relevant discount rates in order to show how the timing of benefits and costs may affect the results. In general, projects with a NPV greater than zero and a BCR greater than 1 will be accepted and recommended as economically viable.

Project options with larger NPVs and higher BCRs are preferred over options with smaller NPVs and BCRs, due to their superior economic worth. On purely economic grounds, projects with NPVs less than zero should be rejected as net positive societal benefits are not accrued from investment into that project.

Where qualitative economic, social and environmental impacts are considered significant, these should be contrasted against the NPV result to determine whether the decision rule needs to be qualified.

7. CONCLUSIONS, RECOMMENDATIONS AND CHECKLIST

7.1. Modern Modelling Practices and Economic Reporting

Contemporarily, it is routine for CBA calculations to be conducted using modern spreadsheeting tools, typically with multiple sheets forming the model for the analysis undertaken, overlaid by an add-in to conduct probabilistic sensitivity testing. Such models should be structured using best practice[42]. Similarly, it is routine for the considerations, methodologies and results from the project CBA to form the basis of a formal written report, typically provided within business cases in its entirety as an Appendix.

A compilation of appropriate economic indicators, coupled with contextual project background and justified methodologies driving report recommendation are required to be reported with high levels of clarity and articulation. This allows a justified conclusion to be reached by the responsible and accountable decision-maker on whether the government should proceed with the project and, if so, which option should be progressed (if any).

Key CBA outputs inform investment decision making. Key indicators include:

- net present value (NPV)
- benefit cost ratio (BCR).

7.2. Reporting

In reporting CBA results, headings and themes will typically include: executive summary, description of outcome sought, options summary, detailed methodology, summary of evaluation, conclusion and recommendation. Ultimately, the CBA report seeks to inform project decision-makers, by providing appropriate levels of detail.

Executive Summary

The executive summary provides:

- an outline of the outcome sought
- a summary of options considered
- details of the recommended option, with the key supporting findings.

The executive summary forms the basis for Building Queensland's obligation to publish a CBA on the projects where it leads the Business Case.

[42] E.g. www.bpmglobal.com/, accessed 03.03.16.

Description of the Outcome Sought

Summarises the nature of the project, including:

- the outcomes which are desired, and the project's objectives and outputs
- strategic alignment in terms of governmental priorities and proponent roles, responsibilities and goals
- reasons for government intervention to achieve the objective (i.e. why the market is not providing the goods or services at the desired cost or quantity, and how this restriction can be addressed).

Base Case

A tightly-defined, well-articulated base case is essential as it informs decision-makers of the scope and spending expected in the absence of the proposed project.

Summary of Options

Summarises the options considered in detail, and describes briefly additional options which were identified but which did not progress to detailed consideration, including:

- key assumptions common to all options
- assumptions specific to an individual option
- each option assessed in detail, including how each option would address the outcome sought
- the extent of each option specified in terms of detailed project scope.

Data Sourcing

Consistent and transparent referencing of data used within the analysis is essential, inclusive of any required manipulation. For example, interpolation and extrapolation activities conducted to generate input data for economic modelling purposes.

Methodology

This includes the procedures and processes conducted in order to generate key economic indicators. Sufficient depth should be included to ensure comprehension of understanding in the conduct of the CBA, so that it may be understood and replicated as required. Sensitivity testing of key project elements is an essential part of any robust methodology. It is critical that a systematic, logical and disciplined approach is taken in developing methodology based upon reason and based on known, accepted and demonstrable interactions of the analysed variables. In this context, it is useful to bear in mind the maxim that 'results do not dictate methodology'.

Results and Outputs

It is recognised that data may initially inform the service gap problem during the identification phase. Data may be continually updated to reflect continued acquisition. However, a well-defined project scope should make continual revision and re-work of the CBA unnecessary. Ultimately, the results of the CBA should be presented at high levels of details, particularly where overall benefits are aggregations of benefits streams.

Additionally, it should be clear what inputs have generated the displayed results e.g. the various discount rate/s applied to the analytical results. Results should be shown in tabulated form, with clearly designated headings, and detailed breakdown of any aggregated results. Additionally, use of appropriate graphs, for example simple pie graphs, should be used to effectively convey information visually.

Summary of Evaluation

Summarise the key results of the CBA of each option, including text outlining positive and negative factors in each option:

- the impact of sensitivity analysis on the results for economic analysis for each option
- the risks associated with each option, measures to address these risks, and how the risks have been reflected in the values of the costs and benefits considered in the economic analysis
- key qualitative factors are discussed and contrasted, where significant, against the quantitative analysis.

Conclusion and Recommendations

A concise recommendation providing clear guidance on project economic viability should be provided, and be unambiguous within the context of the CBA. Identify from the evaluation the option/s which would meet the outcome sought, and achieve positive economic value. The reasons for recommending the preferred option are also set out in this section.

Even where the net financial impact is negative, there may still be a compelling case on economic (i.e. societal) grounds for undertaking the project as a public sector initiative. In such cases, the expected net economic benefits determined through a CBA would need to be sufficient to at least compensate for the net financial impost of the project.

The list of headings and themes to be included within CBA reports are considered within the context of the business case development phase the analysis is informing. For example, notable differences between preliminary and detailed analysis may be expected, given that differing levels of detail are required. Overall, a sufficient level of reporting should be generated, with the level of detail appropriate for the results to be clearly understood, replicated and potentially used for ex-post evaluation purposes. Under contemporary project management practices it is the responsibility of the project manager to designate technical streams of work analysis, including economic evaluation, in close consultation with relevant analysts.

Those undertaking CBA should be aware of reporting requirements in order to be able to tailor reported outputs into a suitable form. Highly detailed breakdown of benefits, by categories and the reporting of economic indicator results and sensitivity testing at different levels of discount rates are routinely required. A key example remains the reporting proformas for Infrastructure Australia, requiring a central case with a discount rate of seven per cent applied, as well as sensitivity testing conducted at discount rates of four and 10 per cent. Again, it remains the responsibility of the project managers in specifying the extent and depth of specialist work streams, thereby ensuring adequate reporting.

7.3. Results, Dissemination and Discussion

In terms of verifying the worth of the analysis and its quality, the following questions could form part of an interrogation of the reported information. It is a typical approach for the analyst to provide support to the project manager by driving discussion, which may be framed by the following thematic question series.

Ultimately, the results of the CBA should be summarised in the form of a written report. The following questions align with the PAF and provide a useful checklist for assessing the quality and rigour of a CBA:

- Does the analysis develop a logical argument towards substantiated conclusions?
- Does the structure and quality of the information contained in the CBA comply with appropriate guidance material?
- Has the base case been well specified and a reasonable set of options been incorporated?

- Is the information and data provided in the CBA internally consistent?
- Has an appropriately detailed and tailored methodology been applied?
- Does the depth of analysis offer assurance that generated results are credible?
- Does the structure and presentation of the CBA allow easy interpretation and validation of the information and data provided?
- For each option analysed, is the NPV calculation sound, that is:
  - capital expenditure estimates are justifiable
  - all legitimate costs and benefits have been included
  - no invalid costs and benefits (e.g. multiplier effects) have been included
  - all costs and benefits have been valued at their market value or economic value where appropriate and are based on reasonable and verifiable assumptions
  - an appropriate evaluation period has been used for the project
  - costs and benefits have been forecast reasonably and transparently over the project life?
- For all options, has appropriate sensitivity testing been conducted?
- Does the language and terminology used throughout the reporting give confidence that the analysis is sufficiently informed and authoritative?
- Is an adequate level of detail reported?

8. REFERENCES

Australian Transport Council (2006), National Guidelines for Transport System Management in Australia, 2nd edition, available at: www.transportinfrastructurecouncil.gov.au/publications/

Austroads, 'Guide to Project Evaluation', available at: www.onlinepublications.austroads.com.au/collections/agpe/guides

Boardman, A.E., Greenberg, D. H., Vining, A. R., and Weimer, D. L. (2011), Cost-Benefit Analysis: Concepts and Practice, 4th Edition, Prentice Hall.

Bureau of Transport and Regional Economics (2005), Risk in cost-benefit analysis (Report 110)

Campbell, H.R. and Brown, R.P.C. (2003), Benefit-Cost Analysis: Financial and Economic Appraisal using Spreadsheets, Cambridge University Press.

Campbell, H.R. (2013), Cost Benefit Analysis of Forest Investment Projects Using a Spread Sheet Approach, presentation to European Forestry Institute, 21 May 2013, available at: www.eficent.efi.int/files/attachments/eficent/news/cbapresentationefi2013.pdf

Commonwealth of Australia (2006), Handbook of Cost-Benefit Analysis, available at: www.finance.gov.au/publications/finance-circulars/2006/docs/Handbook_of_CB_analysis.pdf

European Commission (2008), Guide to cost-benefit analysis of investment projects, available at: www.ec.europa.eu/regional_policy /sources/docgener/guides/cost/guide2008_en.pdf

Helfert, E.A. (2001), Financial Analysis Tools and Techniques: A Guide for Managers, McGraw-Hill.

NSW Government, Treasury (2007), Guidelines for Economic Appraisal, available at: www.treasury.nsw.gov.au/__data/assets/pdf_file/0016/7414/tpp07-5.pdf

NZ Treasury (2015), Guide to Social Cost Benefit Analysis, available at: www.treasury.govt.nz/publications/guidance/planning/costbenefitanalysis/guide

Perkins, F. (1994), Practical Cost Benefit Analysis: Basic Concepts and Applications, MacMillan, Melbourne.

Productivity Commission (2014), Public Infrastructure, Inquiry Report No. 71, Canberra.

Queensland Government (2016), State Infrastructure Plan, available at: www.dilgp.qld.gov.au/resources/plan/sip/sip-part-a.pdf

Queensland Government, Department of Environment and Heritage Protection (2000), Environmental Economic Valuation: an introductory guide for policy makers and practitioners

Queensland Government (2000), Guidelines for Financial and Economic Evaluation of New Water Infrastructure in Queensland, available at: www.treasury.qld.gov.au/office/knowledge/docs/water-infrastructure/

Queensland Government, Department of Infrastructure (2007), South East Queensland Regional Plan 2005 –2026, Implementation Guideline No. 5 Social Infrastructure Planning

Snell, M. (1997), Cost-Benefit Analysis for Engineers and Planners, Thomas Telford.

State of Queensland (Queensland Treasury), Project Assessment Framework–Supplementary Guidance Material, Cost-benefit analysis, July 2015.

United Kingdom Government, HM Treasury (2003), The Green Book, Appraisal and Evaluation in Central Government, available at: www.hm-treasury.gov.uk/d/green_book_complete.pdf

United Nations, UN Industrial Development Organization (1972), Guidelines for Project Evaluation, Project Formulation and Evaluation Series, No. 2, UNIDO.

US Government, Environmental Protection Agency (2000), Guidelines for Preparing Economic Analyses, available at: www.sra.org/ebasg/docs/EPA%202000%20Guidelines.pdf

Victorian Government, Department of Treasury and Finance (2013), Investment Lifecycle Guidelines–Economic Evaluation for Business Cases Technical guidelines, available at: www.dtf.vic.gov.au/Publications/Investment-planning-and-evaluation-publications/Lifecycle-guidance/Technical-guides-Stage-2-Prove

Victorian Government, Department of Treasury and Finance (2008), Investment Lifecycle Guidelines–Business Case, available at: www.lifecycleguidance.dtf.vic.gov.au/admin/library/attachments/ILG%20Business%20Case%20v1.0%20web.pdf

Western Australian Government, Department of Treasury and Finance (2010), Strategic Asset Management Framework–Options Analysis, 2010, available at: www.treasury.wa.gov.au/uploadedFiles/Treasury/Strategic_Asset_Management/19_SAMF-Options_Analysis.pdf

Young, R.A. (2005), 'Determining the Economic Value of Water: Concepts and Methods' in Resources for the Future, Washington DC.

APPENDIX A—INFRASTRUCTURE AND INVESTMENT DECISION-MAKING

Infrastructure can be defined across:

- economic infrastructure
- social infrastructure.

Economic infrastructure typically refers to assets that provide broad scale services that are direct inputs to the production processes and systems of an economy. It is usually characterised as technical structures including built assets such as roads, bridges, tunnels, airports, seaports, railways, water supplies, sewerage systems, electrical grids, and telecommunications networks. In many cases these assets contain significant economies of scale and raise monopoly pricing issues.

Social infrastructure refers to community facilities and physical networks that help individuals, families, groups and communities to meet their social needs, maximise their potential for development and enhance community wellbeing. These include built assets such as schools, universities, hospitals, prisons and community housing. Social infrastructure does not typically extend to the provision of social services but they are critical enabling assets.

Traditionally, a key role for government includes providing publicly-funded infrastructure where some sort of market failure exists, and an identified need for intervention to invest in the provision of infrastructure exists. In parallel, private investment in infrastructure also takes place, recognising that within market-based economies, rates of return must be sufficient to offer adequate returns on investment to infrastructure funders[43].

A time lag between investment timing and the accruing of project benefit streams remains a key characteristic of many infrastructure projects[44]. This arises because investment expenditures are often significant and occur early in the project life cycle. Ongoing annual operating costs are typically small in comparison. Maintenance and rehabilitation costs are usually episodic, preserving the service delivery capacity of the infrastructure asset.

In contrast, returns on infrastructure investments—in the form of project benefits—are realised over long time periods. Benefits that accrue in each year are typically small relative to both the proposed capital outlay and ongoing costs of infrastructure. These benefits are typically driven by underlying social, economic and demographic trends as well as the cost of service provision.

Additionally, many infrastructure services are characterised by relatively inelastic demand. That is, they are essential services and significant changes in the price of service delivery does not lead to as significant level of change in the quantity demanded.

[43] That is, rates of return in terms of expected benefit streams are sufficiently attractive compared with other investment choices. This fundamental extends across both private and public sectors.

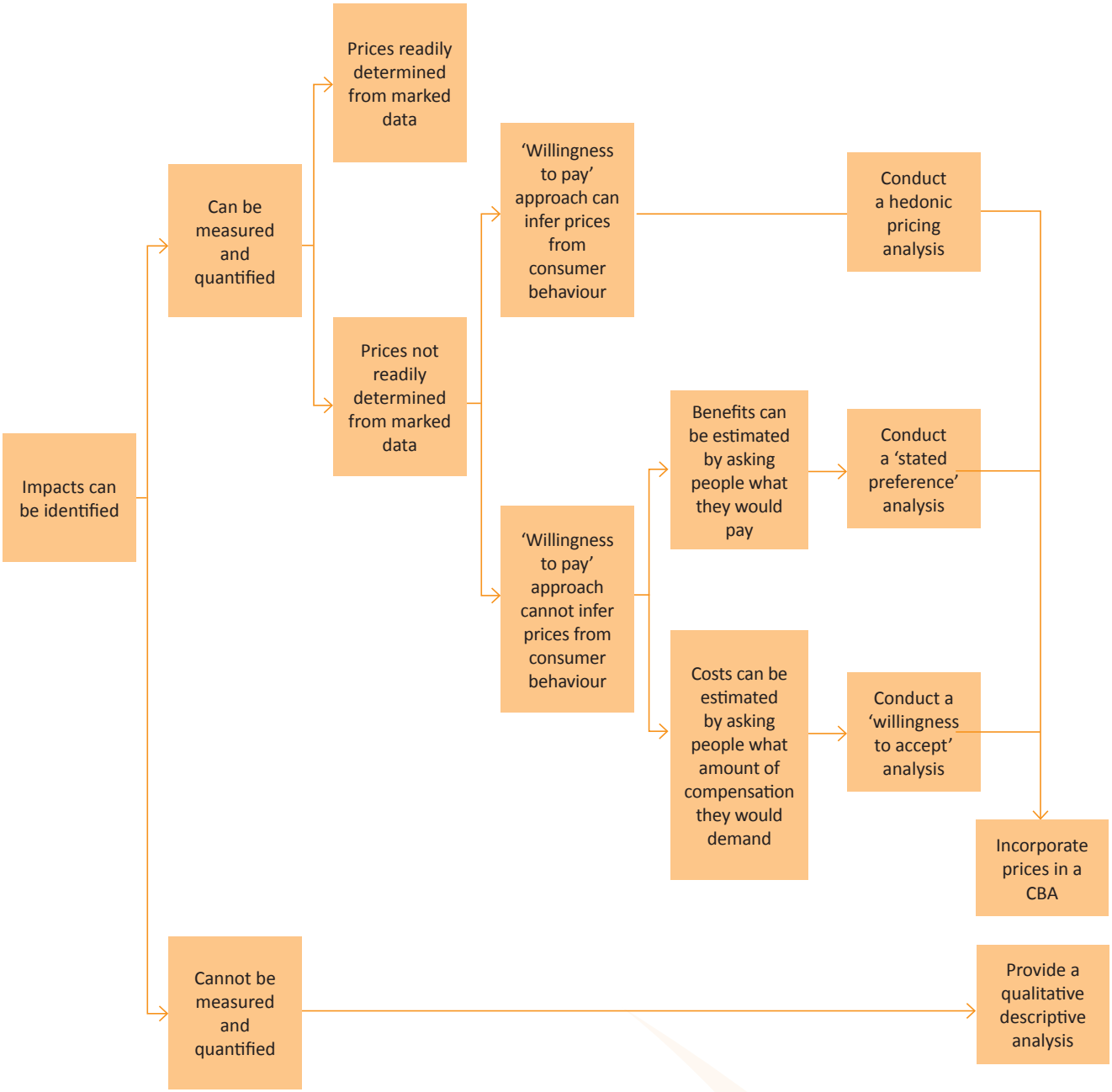
[44] Such time lags in the accrual and capture of benefits also work against the apparent attractiveness of many such projects. Noteworthy is that such projects need to generate competitive rates of return on investment, coupled with appropriate pricing models and risk levels to be considered for private commercial investment ventures purposes.

APPENDIX B–VALUATION APPROACHES

Assuming impacts can be identified, there are a range of economic approaches that can be used to estimate the value of these impacts. The following diagram provides a logic map for the circumstances in which an approach might be relevant. Many of these approaches are time and resource intensive. Judgment about whether to undertake them will depend on whether the values obtained are likely to be material to the overall analysis.

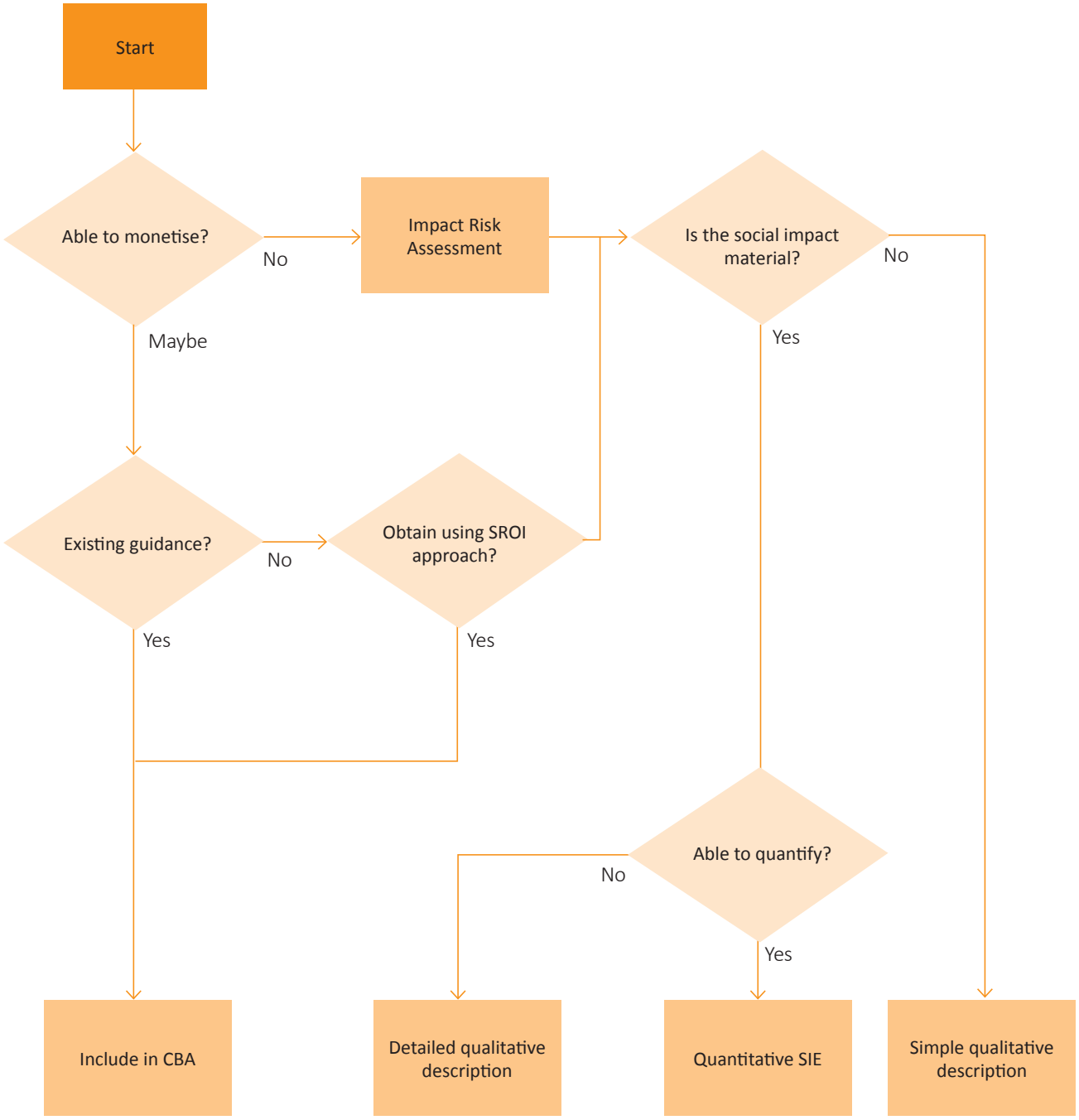
Use of the approaches shown in Figure 2, including valuation of project benefits using hedonic, stated preference and willingness to pay, is an area where extensive consultation, survey work or research component is likely to be required for reasons of credibility of project monetised benefits.

Figure 2: Economic Valuation Method Logic Map



APPENDIX C–SOCIAL IMPACT EVALUATION DECISION TREE

Figure 3: Social Impact Evaluation Decision Tree



Source: Social Impact Evaluation Framework, Building Queensland (2016)

APPENDIX D–COMPARISON OF ECONOMIC AND FINANCIAL ANALYSIS

The FNPV analysis is normally undertaken from the perspective of a government department or agency, a government owned corporation or a private, commercial business. Financial analysis develops cash flows where benefits are defined in terms of revenues and costs by the net expenditures incurred by the entity. In subjecting cost and benefits streams to these considerations, financial analysis may also include a range of costs and benefits that are simply transfer payments within the economy—including items such as accounting depreciation, interest payments and some types of rents.

Once candidate projects cost/benefit streams have been identified and tabulated, typically within a spreadsheet environment, cash flows are discounted to present values through the application of appropriate discount rates. Within Queensland Government, discount rates are sourced from Queensland Treasury Corporation (QTC), and reflect a rolling average of the opportunity cost of capital funding.

Projects with a FNPV greater than zero are potential candidates. This is where the present value of the stream of financial benefits exceeds the present value of the stream of financial costs. However, a wider check of economic costs and benefits is still required to ensure that externalities, spillover and impacts on society and environment are not negative. In very limited circumstances, a project with a negative FNPV might be accepted if the related NPV was positive or non-quantifiable economic benefits more than offset a negative NPV result. Obviously, given the make-up of the qualitative data around such decisions, a high degree of judgement in making such decisions would be necessary.

Table 1 highlights key differences between economic and financial analyses in terms of background setting and application, inclusions and exclusions, as well as the period of the respective analysis.

Table 1: Economic and financial analysis—Key points of difference

	ECONOMIC ANALYSIS	FINANCIAL ANALYSIS
Purpose and Context	Relative contribution of option/s to net social welfare compared to a base case.	Affordability of options from a cash flow perspective for the organisation.
Inclusions	All allocative resource flows including non-monetised costs and benefits.	Direct financial and accounting impacts including cash flows from user charging. Capital and operating costs separately analysed.
Exclusions	Taxation inclusive of Goods and Services Tax (GST) ▪ Depreciation ▪ Capital charges ▪ Interest and financing costs ▪ Transfer payments ▪ Project escalation	Taxation inclusive of Goods and Services Tax (GST) Depreciation Capital charges Interest and financing costs
Period of Analysis	Economic life or service term, and often designated in infrastructure evaluation guidance materials.	Service term or period sufficient to consider whole-of-life impacts.

Importantly, an economic CBA differs from a financial analysis in four key ways:

- Economic CBA includes effects on all sectors of the economy, while a financial analysis typically only considers the government sector and designated private partners in terms of equity/cash flows.
- Economic CBA uses discounting and considers time frames longer than budget forward estimate periods, while a fiscal/budget impact analysis typically run over the budget period and a short forward estimates time frame.
- Economic CBA reflects real resource use within the economy, while a fiscal/budget impact analysis include transfers and accounting items such as depreciation and capital charges.
- Economic CBA does not readily distinguish between capital and operating costs (particularly in terms of applied accounting conventions).

Table 2[45] summarises the choice on proceeding with projects for given combinations of financial and economic benefits.

Table 2: Economic and Financial Outcomes

	POSITIVE FINANCIAL BENEFIT	NEGATIVE FINANCIAL BENEFIT
Positive Economic Benefit	Proceed with project option, as it is economically and financially viable	Could proceed with the project option if the economic NPV is sufficiently large
Negative Economic Benefit	Should not proceed, unless some economic costs can actually be mitigated	Should not proceed

[45] Reproduced from Treasury PAF guidance.

APPENDIX E–TECHNICAL ISSUES

Discounting Theory and Practice

CBA evaluates public sector projects from a societal perspective. To do this the costs and benefits of proposals are monetised and the values of costs and benefits occurring in different time periods are discounted to their present values. Expected costs and benefits should be displayed in the form of investment schedules for both base and project case in order to articulate the nature, structure and timings of investment spending patterns analysed within the CBA. Use of consistent discount rate allows direct comparison of projects, and are commonly designated by assessment bodies as part of funding applications, and may also be applied across project investments at a program level.

Discounting is the process of determining the present value of a benefit/cost stream to be accrued into the future, and is based on the concept of time preference. Time preference is reflected in positive market interest rates, which show that a future dollar is worth less than a current dollar. This occurs for several reasons: impatience, the expectation that wealth will grow over time, opportunities for productive investment, and uncertainty. Discounting acknowledges the opportunity costs of investing in a particular project by asking what return it would have otherwise produced in an alternative use.

Amongst a wide range of investments, people invest at fixed, low risk rates, hoping to receive more in the future (net of tax) to compensate for the deferral of consumption now. These real rates of return give some indication of their individual pure time preference rate, particularly where returns are relatively free of volatility and risk. Society as a whole also prefers to receive goods and services sooner rather than later, and to defer costs to future generations. This is known as social time preference. The social time preference rate (STPR) is the rate at which society values the present compared to the future. It is for this reason that STPR is a preferred concept for discounting in economic CBA.

As a result, the standard approach to valuing costs and benefits that occur at different times assumes that a dollar today is worth more than a dollar tomorrow. This approach reduces a future stream of costs or benefits to an equivalent amount in a specific price period. This is the period the dollar units all represent the same purchasing power. It is usually the same as the base period, which is usually the year for which the evaluation is conducted.

In preparing a CBA, this process is known as the Discounted Cash Flow (DCF) method and can be readily set up in spreadsheet software such as Microsoft Excel. The time period across which benefits and costs are analysed, commonly known as the evaluation period, will have an impact on the overall result of the CBA. However, toward the end of longer timeframes, the present value of costs and benefits will be less in present value terms.

The Australian Government borrowing rate is often used as a proxy for STPR (the yield is generally in the order of six per cent). Alternative measures exist, such as the Social Opportunity Cost (SOC) of Capital. This is determined by the equivalent return alternative public or private sector projects may generate. It is problematic to implement due to difficulties in identifying appropriate alternatives. It is generally higher than the government borrowing rate. Most state government treasury departments prescribe real discount rates to apply to economic evaluations. A market-based assessment of a project draws on the Project-Specific Cost of Capital (PSCC) rate. This applies the Capital Asset Pricing Model (CAPM), which is a measure of the non-systematic (e.g., business cycle) risk relationship between the market as a whole and the individual project. A market risk is a premium on the project's expected return that compensates investors for the volatility involved in their investment.

On the other hand, should the use of a real cost of capital rate be adopted, the true opportunity cost of capital would be reflected in project evaluation and that resources are used efficiently. Critically this depends on an assumption that capital markets efficiently allocate financial resources, and there are also efficient factor markets.

The preceding discussion dealt with some of the theoretical assumptions relating to discounting. In terms of designating the real discount rate to be applied as part of Building Queensland analytical procedures, it is far more likely that discount rates will be designated under existing funding arrangements. A prime example is for projects likely to be submitted to Infrastructure Australia for funding, which should have designated discount rates applied. These are currently CBA at a central discount rate of seven per cent, with four and ten per cent used during sensitivity testing. Proposals assessed for state-based funding are typically assessed using a discount rate of six per cent. However, any doubt should be addressed to the project manager early as part of economic evaluation processes, and may require advice from Queensland Treasury.

Negative Costs and 'Dis-benefits'

Some analysts treat certain costs as 'dis-benefits' and net them off the benefits. The converse also occurs. This distorts the BCR. Costs should be strictly in the denominator and benefits in the numerator.

Consider a port rehabilitation project, involving an initial capital expenditure, and maintenance cost savings in subsequent years. People sometimes put the capital expenditure in the denominator and cost savings (i.e. negative costs) also in the denominator. The numerator might include user benefits. As a result, the BCR can swing wildly. For example, it may be minimal where there are small amounts of user benefits and benefits in cost savings. Or it might be infinite if the denominator is zero as a result of the cost savings being deducted from the capital expenditure.

The solution is that the maintenance cost savings should not be put in the denominator as a negative cost, but should be put in the numerator as a benefit.

Avoidance of Double Counting

Every cost and every benefit should be measured once. However, double counting can arise mainly because of vague descriptions. Suppose a transport project was evaluated in terms of the following benefits:

- improves general traffic journey times
- impacts positively on wider network performance
- impacts positively on movement of freight
- facilitates economic growth
- is economically efficient
- is able to deal with peak period commuting passengers.

All of these benefits arise because of increased capacity and faster journey times. More specific definitions of benefits avoid double counting and are also easier to measure, such as:

- travel time savings multiplied by the number of vehicles
- vehicle operating cost savings
- induced traffic.

There is also a risk of double counting when considering depreciation charges, interest and cost of capital. For example, a depreciation charge is intended to reflect consumption of capital, or the reduction in the value of the capital investment over a specified period, but would double count the cost of an investment if the construction cost was already included in the CBA.

Accounting practice is to treat construction cost as capital expenditure and to recognise depreciation as an operating cost. The usual practice in CBA is not to distinguish between operating and capital. Capital expenditure is therefore recognised when it is incurred, and depreciation is ignored. While the opposite would also be valid, doing it this way simplifies the task of ensuring that the time value of money is properly taken account of.

Relative Price Changes

The valuation of costs or benefits should be expressed in real terms or constant prices (i.e. at today's general price level), as opposed to nominal terms or current prices.

If necessary, the effect of expected future inflation on the general price level should be removed by deflating future cash flows by forecast levels of the relevant deflator. Over a long-term period, the Reserve Bank of Australia's annual inflation target is an appropriate measure of prices to use as a general deflator.

Where particular prices are expected to increase at a significantly higher or lower rate than general inflation, this relative price change should be calculated. Examples where relative price changes may be material to an appraisal include:

- high technology products, prices for which may be expected to fall in real terms
- fuel prices, where the resource supply is scarce
- wages, where productivity growth leads to wage increases above general inflation.

It is helpful when anticipating relative price movements, to consider whether the value of a benefit or a cost will rise as incomes increase. The most direct evidence for this is evidence about how revealed preference or stated preference valuations of the benefit in question have increased with income over time.

In some cases there is reason to expect that the value of a benefit or cost will rise as incomes increase, e.g. because the good is in fixed supply (such as certain environmental assets) or because the units in which it is measured are such that its utility value can be expected to remain broadly constant, regardless of changes in income. In the absence of definitive data, the rate of increase in the real value of the benefit should be assumed to be positive, and only in unusual circumstances would it exceed the projected rate of increase of per capita real income. Where these assumptions are critical, they should be tested against any specific evidence.

For other costs and benefits, the factors listed below might be considered in determining whether their value would change by more or less than inflation:

- Scarcity—If a good is exhaustible, its relative price may be expected to rise at a faster rate than general prices, as it becomes increasingly scarce. Against this, developing technologies may enable more of a good to be extracted than initially thought possible.
- Substitutability—Where plenty of substitutes are available, any scarcity impact may be largely offset. Consideration should be given to whether substitutes are likely to develop over time, particularly in the case of exhaustible goods.
- Non-linearity—Some of the damage resulting from pollutants, for example, will be non-linear. If the quantity of a pollutant changes over time, this non-linearity will affect the rate at which its relative price changes.
- Increasing competition, or the removal of monopoly powers would increase the availability of goods and services, and relative prices may be expected to decline.
- Economies of scale–If the size of the market for a particular good or service increases, then there is a greater potential for economies of scale, and relative prices may then also be expected to reduce.
- Advice on likely relative price movements should be obtained from the appropriate expert bodies.

Common Pitfalls

Due to the nature of a CBA, there are some common pitfalls that agencies need to be aware of when identifying costs and benefits. These common mistakes can seriously undermine the robustness of the analysis as well as the professional reputation of organisations and individuals. Some of these include:

- Unanticipated impacts and ignoring non-market impacts—Many potential costs and benefits are unanticipated at the time of project evaluation. Non-market impacts are generally harder to anticipate and quantify and are much more likely to be overlooked. Listing and estimating all relevant costs and benefits early in the process, as well as all affected parties, should be attempted.
- Double counting and miscounting benefits, and optimism bias—Impacts can be double counted accidentally. This is usually because they are inherently reflected in the pricing of other benefits (e.g. the benefits from transport time savings from a project and resultant higher house prices near the project both represent time savings, therefore only one should be included).
- Another serious error is counting costs as benefits—For example, the use of resources such as labour is often counted as an employment benefit. However, this almost always has a cost (i.e. an opportunity cost) if such resources can be used elsewhere in the economy.
- Mixing real and nominal pricing—Due to operating within environments focused on resource use, CBAs should be conducted using real rates, thus enhancing the application of correct methodologies and avoiding erroneous modelled distortion.
- Applying novel, untested approaches—For example, the averaging of time periods, and muddling of items like salvage values of assets across time periods.
- Misuse of multipliers and the overestimation of flow-on effects—Input-output models are commonly used to determine the multiplier effects or the flow-on effects to the economy should a project be implemented. Input-output multipliers have various limitations, e.g. assumptions about resources being freely available to meet any increase in demand.
- Any CBA that includes multiplier effects should be used with care—If multiplier effects are to be included in the analysis, Building Queensland prefers that Computable General Equilibrium (CGE) modelling be undertaken because CGE models incorporate supply constraints.

Common Criticisms

There are a number of criticisms of the practice of CBA. This section sets out some common criticisms of CBA and explains why they should not preclude the dedicated application of CBA:

- 'CBAs produce false accuracy'—It is not unusual to see CBAs that state that the cost benefit ratio is 1.17. This is most likely to be spurious accuracy, caused simply by the calculation of BCRs being a by-product of simple mathematics. This problem of false accuracy can be overcome with the use of ranges and/or sensitivity testing.
- 'CBAs can't measure everything'—There are some intangible benefits that the analyst won't be aware of or that are too hard to measure. As for those that can genuinely not be measured, or where the analysis does not have an adequate approach to their measurement, such information should be provided qualitatively and drawn to decision-makers' attention alongside the results of the CBA of those benefits and costs that can be measured.
- 'CBA can be misused to produce self-serving analysis'—CBA is a tool, and like all tools it can be misused. This is not a reason to dismiss CBA in favour of some other tool or project evaluation approach.

- ‘CBA is too complex’—Expert advice should be obtained for CBAs of complex or large projects. The task may need to be contracted out to specialists. An important by-product of such an approach is production of an accessible report, consistent with accepted methodological approaches.
- ‘Information requirements are often too onerous’—CBAs can be carried out with whatever information is available. If the information is poor, then the confidence intervals will be larger. There are no other project evaluation methodologies that can produce better results from the same information base.
- ‘CBAs overlook equity considerations’—Due to the nature of CBA measuring societal-wide costs and benefits, any additional concerns, including equity considerations should be drawn to decision-makers’ attention along-side the results of the CBA.
- ‘The CBA is not likely to support our Minister’s objectives’—This comment ignores the fact that public servants have two distinct roles. The first is the provision of robust, technically sound advice on the likely consequences of decisions. Objective analysis, including CBA is necessary for this role. The second is to implement the Minister’s decisions, whether or not those decisions are consistent with the advice given.

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