

Making High Quality Infrastructure Investment Decisions

A guide for managing and reviewing economic analysis in planning, appraisal and selection of infrastructure projects in the Pacific





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Published June 2025
Photos courtesy of the Asian Development Bank, unless otherwise specified.
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Abbreviations

ADB	Asian Development Bank
BCR	Benefit-cost ratio
CapEx	Capital expenditure(s)
CBA	Cost-benefit analysis
CEA	Cost-effectiveness analysis
EIRR	Economic internal rate of return
ENPV	Economic Net Present Value
GDP	Gross domestic product
IRR	Internal rate of return
OpEx	Operational expense(s)
NIIP	National Infrastructure Investment Plan
NPV	Net present value
PEFA	Public Expenditure and Financial Accountability (program)
PVB	Present Value of Benefits
PVC	Present Value of Costs



Glossary of Terms

Base Case	The “do-minimum” or counterfactual case to the project. The base case describes what the world would look like if the project had never existed. This scenario serves as the basis from which the net costs and benefits of the project can be evaluated.
Benefits	The monetized incremental improvement in welfare achieved through an infrastructure project. Benefits can include consumer surplus (benefits to those who are using the infrastructure), producer surplus (benefits to the operators of the infrastructure), and externalities (external benefits not falling to producers or consumers).
Benefit–Cost Ratio	The ratio of total benefits to total costs. A value greater than 1 indicates that the benefits outweigh the costs, and that the project is therefore economically viable.
Consumer Surplus	The difference between what consumers are willing to pay for a good or service and the lower price they actually pay. It represents the additional value or benefit that consumers receive beyond the market price.
Cost-Effectiveness Analysis	An alternative evaluation method that compares the costs of different interventions or policies to achieve a specific outcome, without explicitly monetizing all benefits.
Discount Rate	The rate used to convert future costs and benefits into present values, reflecting the time value of money and allowing for meaningful comparisons across time.
Externalities	Costs or benefits that are not reflected in a market price. Externalities can be positive (e.g., improved air quality) or negative (e.g., increased pollution).
Evaluation Period	The number of years over which the benefits and costs of a proposed infrastructure project are assessed in a cost–benefit analysis. A default value of 30 operational years plus construction time is generally used for infrastructure proposals.
Internal Rate of Return	The discount rate at which the net present value of a project or investment becomes zero.
Market failure	A situation in which the market mechanism fails to allocate resources efficiently or fails to account for externalities, resulting in suboptimal outcomes. It may justify intervention to correct the market inefficiencies.
Market Prices	The prices determined by supply and demand and the competition structure in a market.
Monetize	Assigning a dollar value to the benefits or disbenefits considered in economic analysis.
National Infrastructure Investment Plan	A National Infrastructure Investment Plan (NIIP) identifies and consolidates a pipeline of infrastructure projects across all sectors into a single plan.
Net Present Value	The overall net present monetary value of the project after subtracting the net costs from the net benefits. A project with an NPV greater than \$0 represents a project with a net economic benefit.
Opportunity Cost	The value of the next best alternative that was not implemented. It represents the benefits that could have been obtained by choosing that alternative option.
Project Case	The scenario that includes the project infrastructure options designed to address the problem.
Producer Surplus	The difference between the market price and the minimum price at which producers are willing to supply a good or service. It represents the additional benefit or profit that producers receive beyond their costs.
P50 cost	The estimated cost that has a 50% probability of being equal to or higher than the actual cost. It is often used in project evaluations to represent the midpoint or most likely cost estimate.
P90 cost	The estimated cost that has a 90% probability of being equal to or higher than the actual cost. It represents a more conservative or high-end estimate, accounting for potential cost overruns or uncertainties.
Real cost	The actual cost of a project or policy, without adjustments for inflation or other economic factors. Typically represented in constant currency (e.g., 2023 dollars)
Sensitivity Analysis	An examination of how changes in key variables or assumptions affect the results of a cost–benefit analysis. It helps assess the robustness of the analysis and identify the most influential factors.
Shadow Prices	Assigning a monetary value to nonmarket goods or services to include them in the cost–benefit analysis. It allows for the comparison of diverse costs and benefits in monetary terms.
Welfare	In economics, welfare refers to the level of prosperity and well-being of an individual or group, encompassing both material wealth and overall quality of life. It often relates to the satisfaction derived from the consumption of goods and services and can also encompass broader aspects like health, education, and environmental quality.

Foreword

Quality infrastructure underpins sustainable development. Almost all critical public services depend on infrastructure being available and fully functional. For example, access to reliable energy requires a network of infrastructure assets to generate and distribute electricity to homes and businesses. The failure of any asset within that system will result in an interruption in service.

By their nature, most infrastructure assets require significant capital investment, generally have a long service life measured in decades, and require ongoing maintenance and periodic refurbishment to continue to perform. Therefore, capital budgets for expanding, upgrading, and renewing these assets cannot be set on a year-to-year basis, but instead require medium- to long-term planning.

Given the importance, high cost, and long service life of infrastructure, it is important that infrastructure investments be prioritized that support the development objectives and aspirations of the people of the Pacific. The long-term direction for these aspirations is provided through the 20- to 30-year vision statements by governments in the region, which lay out the development objectives for each nation. These generally cascade down to sector-level strategic plans targeted at more specific demands for services across transport, energy, water, waste, telecommunications, and other critical public service sectors supported by infrastructure.

The Pacific Region Infrastructure Facility works with member countries and development partners to improve the quality and coverage of infrastructure in the region, including through its support for the development of cross-sectoral National Infrastructure Investment Plans (NIIPs).¹ These NIIPs are used to identify the priority projects that contribute to national development and sectoral objectives and take economic, social, and environmental criteria into account. However, further evaluation will have to occur as projects progress from the “Identify” stage to the “Investment-Ready” stage of the project life cycle, so decision-makers can choose the best projects to invest in. This guideline is designed to inform the proper analysis of projects, particularly as they progress beyond the initial inclusion in a NIIP.

Economic evaluation is an important part of the infrastructure life cycle, as it gives those responsible for delivering infrastructure a tool for optimizing a project’s scope, quantifying the benefits it will deliver compared with the costs, and determining whether the project will provide a net benefit to society. It is also a useful tool for central government agencies and development partners that may need to prioritize between projects in an overall portfolio, which is essential in budget-constrained conditions. Strengthening the use of economic evaluation in the planning, appraisal, and selection of projects has been articulated as a goal of development partners and member countries alike.

Key Point

Economic evaluation is important to making good decisions on the provision and management of infrastructure throughout the infrastructure life cycle.

Given the importance of economic evaluation in project development, it is important that practitioners in key infrastructure sectors have a solid grasp of the components of economic evaluation, particularly those practitioners tasked with managing, reviewing, and making decisions

¹ PRIF’s Pacific member countries are Cook Islands, Federated States of Micronesia, Fiji, Kiribati, Nauru, Niue, Palau, Republic of the Marshall Islands, Samoa, Solomon Islands, Tonga, Tuvalu, and Vanuatu. Papua New Guinea is an associate member.

based on economic evaluations. This guide seeks to ensure that the infrastructure agencies of PRIF-member countries and their advisors apply the tools and best practices when evaluating and appraising investments, and that they make high-quality investment decisions as they develop infrastructure projects into the future.

About This Guide

A key operational principle of the Pacific Region Infrastructure Facility (PRIF) is to support member countries in their efforts to strengthen their decision-making processes and frameworks as part of the infrastructure life cycle. Economic evaluation is an important tool for this, particularly as part of the “Develop” stage of the infrastructure life cycle, leading to the final recommendation and decision to invest in a project.

The purpose of this guide is to provide practitioners with a greater understanding of the role, purpose, needs, and processes of an economic evaluation. It outlines the key activities that practitioners need to understand when managing, reviewing, and making decisions based on economic evaluations. This guide highlights the generally accepted best practices for each step in the process. It draws on and highlights case examples from economic evaluations and crosscutting studies.

The target audience for the guide consists of practitioners and managers in infrastructure agencies of PRIF-member countries and their technical advisers who are managing or reviewing economic evaluations as part of the broader project-development process. It is important to note that this is a *guide* and not a *guideline*, in that it aims to help practitioners navigate through the development and use of an economic evaluation. The focus is very much on how to *manage* the process, providing the user with awareness and knowledge of the key steps, as well as what to look out for during the process.

This guide should be read in conjunction with the associated short videos, PowerPoint presentations and other materials as part of this suite of guidance products. The videos are designed as an early introduction to concepts, while the PowerPoint presentations provide more information for those with interest. This guideline document is designed for practitioners that will be required to undertake an economic assessment of infrastructure projects or programs. In addition, the *Guideline to Preparing National Infrastructure Investment Plans*, published by PRIF in 2022 outlines the need for economic evaluation as a vital tool to assessment and infrastructure planning and investment. For technical economic guidelines, users should consult relevant sources on project appraisal (section 4.3).

Key point

This guide should be read in conjunction with the associated short videos, PowerPoint presentations and other materials as part of this suite of guidance products.

This guide is structured to empower those managing an economic assessment, so they can ensure that the appraisal team meets the needs of the member countries and development partners, and, ultimately, delivers better outcomes for the people of the Pacific region. Each section provides the “why” of an aspect of in the economic assessment process, and sets out the important considerations and key issues to watch out for.

The guide is divided into the following four sections:

Section 1: Introduction to Economic Analysis in the Infrastructure Project Life Cycle

This section explains the importance of economic assessment when developing infrastructure projects, the different types of assessment available, and how an economic assessment fits into the infrastructure project life cycle.

Section 2: Steps in Managing a Cost–Benefit Analysis

This section provides an overview of what a cost-benefit analysis is, including a detailed discussion of its key components and the key steps in developing one.

Section 3: The Outputs and Outcomes of a Cost-Benefit Analysis

This section discusses what the outputs and outcomes of a cost-benefit analysis process look like, and how the results should be interpreted and used in the infrastructure project life cycle.

Section 4: Best Practice Management of Cost-Benefit Analysis

This section offers practical tools, tips, and considerations when moving through the process and managing the delivery of a cost-benefit analysis.

Additional resources

Additional resources for managers and reviewers such as tools and checklists are also available from PRIF on request. These include:

- Cost-Benefit Analysis templates
- Cost-Benefit Analysis reviewer checklist
- Case Study review examples for different infrastructure sectors
- Practitioner notes for issues relevant for projects in the Pacific region, such as climate and disaster resilience, cost estimation, gender, disability and social inclusion, and local content.

Further information about these resources can be obtained by contacting enquires@theprif.org.



Source: Tonga National Infrastructure Investment Plan 2021-2030 Hunga Tonga-Hunga Ha'apai Volcanic Eruption and Tsunami update, 2023.

1 Introduction to Economic Evaluation in the Infrastructure Project Life Cycle

This section introduces the infrastructure life cycle, as well as the role that economic assessment plays in this. It will highlight the importance of using economic assessment to evaluate infrastructure and outline the types of assessment that may be used. The section will pay particular attention to the develop stage in the infrastructure life cycle, and will introduce the business-case framework and cost-benefit analysis (CBA) as the primary tools in determining the relative merits of each individual project.

This section includes the following:

1.1 Infrastructure Project Life Cycle

1.2 Introduction to Economic Evaluation in the Infrastructure Project

1.3 Different Types of Economic Analyses

1.4 Purpose of an Economic Evaluation in the Infrastructure Project Life Cycle



1.1 Infrastructure Project Life Cycle

To support best practices in infrastructure planning, investment, delivery, and management in the Pacific, the Pacific Region Infrastructure Facility (PRIF) developed and published a *Guideline to Preparing National Infrastructure Investment Plans* (NIIP guideline). The NIIP guideline includes a framework for identifying, planning, and prioritizing infrastructure investments, tailored to PRIF's member countries.

The process is designed to be country-led, consultative, and evidence-based. It has two key decision points that fit into the cascading development objectives of the infrastructure delivery life cycle. These are:

- Strategize, Initiate, Plan → Decision Point #1
- Develop → Decision Point #2

These key decision points are shown in Figure 1 below, aligned to the key stages of the infrastructure delivery life cycle.

Figure 1: Key Stages in the Infrastructure Delivery Life Cycle



Source: Pacific Region Infrastructure Facility (PRIF). 2020. *Guideline to Preparing National Infrastructure Investment Plans*. Sydney.

In the lead-up to Decision Point #1, the emphasis is on developing a NIIP. This involves undertaking a comprehensive stocktake of the existing infrastructure, assessing current and future infrastructure needs, identifying potential infrastructure projects, and engaging in prioritization to arrive at a list of priority projects for further development.

The focus to date in the NIIP process has been on getting to Decision Point #1 (sometimes called Gateway #1). This document now turns its attention to guiding the user to Decision Point #2 (Gateway #2), that is, through the Develop stage to a final investment decision. Typically this is undertaken after projects have been selected for further development as part of a NIIP process.

The Develop stage typically requires a feasibility study and/or project business case, supported by an economic evaluation, which may be a CBA or a cost-effectiveness analysis (CEA) (section 1.3).

This guide aims to help the user navigate the economic-evaluation components that may be undertaken throughout the Plan and Develop stages. This guide is also designed to complement the NIIP guideline and should be read alongside that document.

Key point

This guide focusses on economic evaluation of infrastructure projects and programs. This is typically undertaken for projects after their selection for further development in a NIIP.

1.2 Importance of Economic Analysis in the Infrastructure Project Life Cycle

An economic evaluation of infrastructure is an effective tool that assists governments in making informed decisions about investing in projects, programs, or policies to improve societal welfare, especially in a constrained budgetary environment.

Without economic frameworks for infrastructure evaluation, key stakeholders tasked with delivering infrastructure and services have no robust way to determine whether a project is the best available option for meeting national development objectives. This can prove costly, both in terms of lost opportunities and future liabilities, particularly when the required investments and life-cycle spending on infrastructure are large.

Economic evaluations provide a framework for gauging the expected costs, benefits, or impacts of an infrastructure project, program, or policy over its lifetime. Armed with this information, a government may be able to perform the functions listed below.

- Determine if a project is worthwhile:
 - Governments should only invest if the benefits to society are greater than the costs, so a CBA is widely used in economic assessments of infrastructure projects. When the monetary value of the expected benefits is not known, a CEA can be used to test whether the project is the least-cost way of achieving national or sectoral objectives. Both tools can be used to ensure that public resources are used efficiently and that investment decisions are based on economic merit.
 - Furthermore, governments should only invest in projects or policies that will provide the *greatest* benefit to society relative to the costs of delivery. Economic evaluation is a tool for assessing the *relative* merits of one project over another.
 - Economic evaluation can be used during the project's scoping stage to refine and optimize the proposed project solution. Results can help ensure that the nature, size, and timing of the solution best reflect the problem being addressed.
 - Economic evaluation is also useful in testing delivery approaches, that is, the timing and staging of a particular option.
- Gauge the likely impacts on the economy:
 - These impacts would include the macroeconomic outcomes, such as those concerning the gross domestic product (GDP) and jobs.
 - They would also include the broader economic impacts the infrastructure would have through its integration into urban or regional forms.
- Understand who would be the winners and losers of such a project:
 - Who are the key stakeholders?
 - Who would be affected on the ground from a welfare perspective?

- Determine the various fiscal considerations:
 - Would the project generate revenue?
 - How would the project affect taxation and public finances?

Key point

Economic evaluations assist decision makers answer questions like: is the project worthwhile?; which option is superior?; what would be the impact on the economy and jobs?; does the project create winners and losers? or; what are the impacts on the government budget?

There is no one-size-fits-all approach. Different types of economic analyses are required to answer these different questions, and they are discussed in the next section. However, it is also worth noting beforehand that CBA is the most important tool used for economic evaluation, and will thus be the focus of this guide from Section 2 onwards.

Box 1: Do Economic Evaluations Matter If Development Partners Are Financing the Project?

Economic evaluation considers how allocating a part of the government's limited resources to a project will impact the welfare of all the citizens. It is primarily concerned with whether a particular use of resources (e.g., land, labor, capital) would improve public welfare, regardless of where the funding comes from.

Many development partners conduct economic evaluations to determine whether a proposed loan or grant for a project is likely to improve the public welfare. It is important for recipient countries to participate in these evaluations and/or consider undertaking their own, for a number of reasons:

- Infrastructure projects are major investments that require a lot of resources. The recipient country should be confident that the project will be the best way to use its resources to achieve its policy objectives (e.g., that it would be better for workers and equipment to be deployed for building roads or new housing subdivisions).
- For investments financed by loans, the recipient country will be worse off unless the project produces net benefits that are larger than the cost of the loan.
- For investments financed by grants, the allocation of resources to a non-viable project will waste money from taxpayers and development partners, and can leave the recipient country worse off.
- For both loan and/or grant-financed projects, the ongoing operating and maintenance costs are usually not supported by external finance or funding. Projects that do not produce enough economic benefits to cover these ongoing costs will leave the recipient country worse off than before.
- An economic evaluation is usually undertaken from the perspective of the project overall. Not all the costs and benefits of the project will flow to the recipient country. The likely results should be thoroughly researched so that decision-makers and citizens can understand whom the costs and benefits flow to both inside and outside the recipient country.

Source: World Bank. 2010. Cost-Benefit Analysis in World Bank Projects. IEG Fast Track Brief. Washington, DC.

Key point

Economic evaluation matter, even if a project will be funded via a grant.

1.3 Different Types of Economic Analyses

There are several types of economic analyses, each providing a different perspective and output. The adoption of the appropriate one very much depends on what the user is aiming to address. It can be easy for a more general audience to mix up economic analyses and there have been many occasions when the wrong tool has been used.

This section aims to provide the user with a guide as to what they may encounter in the public sphere, as well as some background knowledge on what is more appropriate to use and when, particularly as it relates to the evaluation of infrastructure projects.

Box 2: Economic Analysis versus Financial Evaluation

Financial evaluation is carried out from the perspective of a project, and considers incremental cash flows (both revenues and costs) generated by the project. The purpose of a financial evaluation is to assess the ability of a project to generate adequate incremental cash flows, so that it can recover its financial costs (capital and recurrent costs) and/or to determine the net impact on a country or organization's financial position (budget and balance sheet).

On the other hand, economic analysis is carried out from the perspective of the entire economy, and it assesses the overall impact of a project on the welfare of all the citizens of the country concerned. The purpose of project economic analysis is to assess whether a project is economically viable for the country.

Source: Asian Development Bank (ADB). 2017. *Guidelines for the Economic Analysis of Projects*. Manila.

There are a number of alternative forms of economic evaluation that decision-makers can use to determine the impacts of various infrastructure and/or policy decisions. The type of analysis conducted depends on the type of decision that needs to be made, resources and capacity available, and data availability. Seeking expert assistance in deciding what type of analysis is more appropriate is advised. Table 1 below provides a comparison of these forms, their uses, advantages, disadvantages, and ultimate outcomes.



Key point

There are different types of economic and financial analysis. The type of analysis conducted depends on the type of decision that needs to be made, resources and capacity available, and data availability. Seeking expert assistance in deciding what type of analysis is more appropriate is advised.

Table 1: Types of Economic Analyses

Type of Analysis	Description	Outputs	Pros	Cons	Users
CBA	<p>A method of monetizing and comparing all of the costs and benefits of a project or policy, to determine the net incremental welfare change and, hence, economic viability of the project or policy</p> <p>When to use: Decision Point #2 when evaluating the economic viability of a project as part of the business case</p>	Key metrics that indicate whether the project or policy is economically viable (e.g., BCR, NPV, EIRR)	<ul style="list-style-type: none"> Measures the net incremental change in welfare as a result of a project Is the only analysis that can categorically determine economic viability Outputs relatively easy to interpret Comprehensive consideration of costs and benefits 	<ul style="list-style-type: none"> Requires economic specialists to perform the analysis Requires local data and a solid evidence base of which to understand demand and make assumptions Requires a large number of inputs into the analysis 	<ul style="list-style-type: none"> Policymakers Central government agencies (finance and treasury) Infrastructure departments and steering groups
Rapid CBA	Serves the same function and has the same outputs as a regular CBA, but promotes a <i>rapid</i> approach whereby only the most material costs and benefits are estimated, with less detail	Key metrics that indicate whether the project or policy is economically viable (e.g., BCR, NPV, EIRR)	<ul style="list-style-type: none"> Less complex than a regular CBA Higher-level assumptions allowed Lessened input requirements Good for evaluating a project with a longer list of options 	<ul style="list-style-type: none"> Less rigorous than a regular CBA 	<ul style="list-style-type: none"> Policymakers Central government agencies (finance and treasury) Infrastructure departments and steering groups
MCA	A decision-making tool that considers multiple criteria or factors, including economic, social, and environmental factors, and provides a framework for	Table or report ranking projects against each other according to their weighted scores	<ul style="list-style-type: none"> Gives different types of projects scores that can be compared Weights applicable to different criteria to suit the objectives of the project 	<ul style="list-style-type: none"> The weights applied possibly arbitrary Analysis possibly “gamed” Project benefits and costs only dealt within a qualitative sense 	<ul style="list-style-type: none"> Developers of the prioritization framework in the infrastructure life cycle (i.e., infrastructure departments)

Type of Analysis	Description	Outputs	Pros	Cons	Users
	<p>comparing different options.</p> <p>When to use: Decision Point #1 in the infrastructure life cycle to prioritize projects, reducing a long list to a short list</p>		<ul style="list-style-type: none"> • Relatively quick and simple to perform • Provides an opportunity for a range of stakeholders to be involved in the scoring process • Can overcome data limitations 		<ul style="list-style-type: none"> • Central government agencies (finance and treasury)
CEA	<p>Similar to CBA, but focuses on comparing the costs of alternative policies or projects with the same objectives, rather than comparing costs and benefits</p> <p>When to use: When benefits are constant, and the goal is to minimize fiscal impact</p>	Table or report ranking projects against each other according to their costs	<ul style="list-style-type: none"> • Is relatively quicker to conduct than a CBA • Provides a way of prioritizing project options in a more rapid manner • Can prevent the over-specification or gold-plating of projects (e.g., bus rapid transit versus light rail) 	<ul style="list-style-type: none"> • Does not consider the benefits of projects, so is not suitable for a full business case • Does not address the economic viability of projects 	<ul style="list-style-type: none"> • Developers of the prioritization framework in the infrastructure life cycle (i.e., infrastructure departments) • Central government agencies (finance and treasury)
Input-output analysis (of the economic contribution)	Evaluates the gross multiplier effect of a project or policy on the economy in the form of flow-on effects—not “net,” however, as it does not consider where inputs (labor, capital, etc.) would have otherwise been deployed	A set of macroeconomic indicators (such as jobs) supported during construction and operations, and changes to GDP	<ul style="list-style-type: none"> • Can be relatively simple to conduct if existing multipliers are sourced from the literature 	<ul style="list-style-type: none"> • Presents neither a net economic “impact” nor a net change in welfare associated with a project or policy • Can be misleading and is often misused 	<ul style="list-style-type: none"> • Government ministers • Communications teams

Type of Analysis	Description	Outputs	Pros	Cons	Users
	When to use: When looking to understand the gross contribution of an infrastructure project on jobs and GDP				
CGE model	<p>Evaluates the impact of a policy or project on the entire economy by considering changes in different sectors and the inter-dependencies between them; simulates the impact of different scenarios and can help policymakers assess the overall impact of a policy or project</p> <p>When to use: When requiring a more sophisticated computational measure of the net impact of an infrastructure project on the economy</p>	A set of macroeconomic indicators (GDP, wages, income, prices, etc.)	<ul style="list-style-type: none"> Provides a view of the overall macroeconomic impact of the investment Considers all of the inter-dependencies of markets in the economy Can provide policymakers with a “headline” set of good-news numbers 	<ul style="list-style-type: none"> Does not measure the overall net incremental welfare of a project Does not indicate if the expenditure would have been better off on another project Requires strong technical expertise Can be costly and time consuming to undertake May not be recognized by funding agencies Suitable models generally not available for PRIF-member countries 	<ul style="list-style-type: none"> Politicians Policymakers such as those at the treasury ministry, central bank
SCBA	Assesses the social costs and benefits of a policy or project, taking into account the externalities or spillover effects on different stakeholders, including society at large	Net benefits (or costs) and key stakeholders for each	<ul style="list-style-type: none"> Provides an indication of the distributional effect of the net benefit or cost (i.e., the beneficiaries) 		<ul style="list-style-type: none"> Community groups Environmental, health, and human-services departments

Type of Analysis	Description	Outputs	Pros	Cons	Users
	When to use: When seeking to understand the distributional and equity consequences of a project on different stakeholders in society				
Financial assessment frameworks <i>(for comparison purposes only)</i>	<p>Model the financial impacts of a project, including the financial viability (with all costs and revenues) and expected return and funding implications</p> <p>When to use: When seeking to understand (i) the propensity of a project to use generated cash flows to recover its financial costs, (ii) the fiscal ramifications for the government, and (iii) the best way to implement the project from a funding perspective</p>	Financial metrics such as IRR, NPV	<ul style="list-style-type: none"> • Help government agencies understand necessary funding commitments • Provide an indication of when a project could expect a financial return • Assist in developing funding models 	<ul style="list-style-type: none"> • Do not consider economic benefits and costs, so cannot indicate economic viability 	<ul style="list-style-type: none"> • Central government agencies (finance and treasury) • Project delivery partners and investors

BCR = benefit–cost ratio, CBA = cost–benefit analysis, CEA = cost-effectiveness analysis, EIRR = economic internal rate of return, GDP = gross domestic product, IRR = internal rate of return, MCA = multi-criteria analysis, NPV = net present value, PRIF = Pacific Region Infrastructure Facility, SCBA = social cost–benefit analysis.

Source: The authors.

1.4 Purpose of an Economic Evaluation in the Infrastructure Project Life Cycle

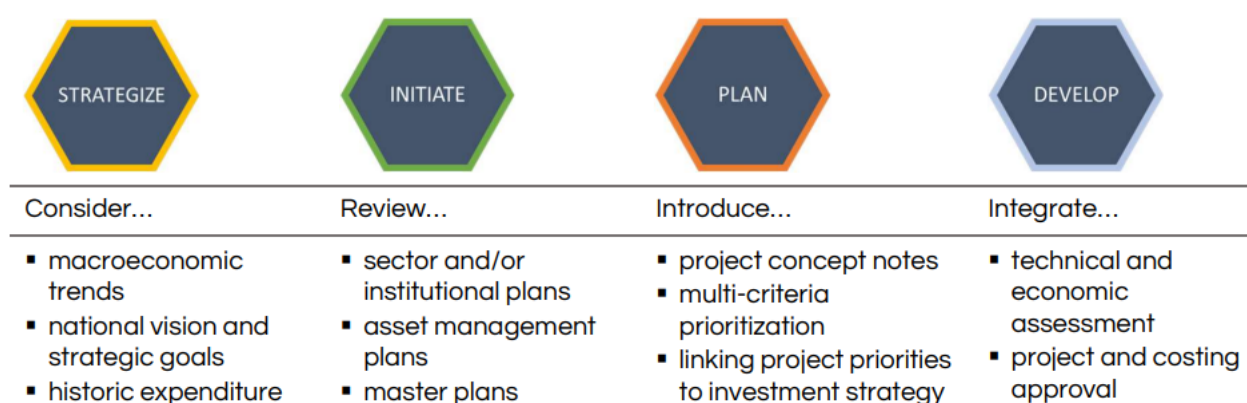
1.4.1 Where Does Economic Evaluation Fit into the Infrastructure Project Life Cycle?

The **plan** and **develop** stages of the infrastructure life cycle are when an economic evaluation is most critical. During these stages, an economic evaluation should inform key processes, such as the identification of viable project options, the ranking of those options, and the final investment decisions. The life cycle starts with an identification of the problem or issue to be addressed, in the context of strategic national objectives. The need for infrastructure investment to address this problem should be well established, alongside a short list of options, before proceeding through Decision Point #1 (the first gateway) and to feasibility studies.

Economic evaluation is critical at both the **plan** stage, leading up to Decision Point #1, and the **develop** stage, leading into Decision Point #2. A multi-criteria analysis is typically used to go from a long list of projects to a short list for Decision Point #1; and a more analytical and detailed economic assessment, such as a cost-benefit analysis (CBA), is a key supporting input for the feasibility study or project business case (the key component of the develop stage) leading into Decision Point #2. The multi-criteria analysis leading to Decision Point #1 may include economic criteria and/or tools such as a cost-effectiveness analysis (CEA) or rapid CBA, before more details become available during the feasibility study or business case development.

The reason for the inclusion of an economic evaluation in the business case is that it is the primary tool for determining the relative merits of each individual project. Without this tool, there would be no robust method for determining whether the project would indeed be beneficial to society. The need to integrate economic evaluation into the develop stage can be seen in Figure 2.

Figure 2: Arriving at the Develop Stage



Source: Pacific Region Infrastructure Facility (PRIF). 2020. *Guideline to Preparing National Infrastructure Investment Plans*. Sydney.

Key point

Economic analysis is typically used after potential infrastructure projects are shortlisted for inclusion in a NIIP. However, some economic analysis can sometimes be incorporated into earlier stages of the project cycle.

1.4.2 Level of Detail through the Infrastructure Project Life Cycle

Table 2 sets out the recommended levels of detail to include in the economic assessment at each stage of the infrastructure life cycle, and explains how the analysis is used in key decision-making. As the project moves through the life cycle, from *Plan* into *Develop* phases, the level of detail required in the economic assessment is expected to increase. It should be noted that the expectation of detail does also depend on data availability and the size of the project.

Table 2: Economic Details Required at Key Stages of the Infrastructure Project Life Cycle

Lifecycle Phase	Suggested Level of Detail		Decision-Making
PLAN	<ul style="list-style-type: none"> Project concept notes Qualitative discussion of project benefits Multi-criteria analysis Investment logic mapping, problem analysis 		Decision Point #1 Determining if a project meets national strategic objectives and provides an opportunity to address problem definition
DEVELOP	<ul style="list-style-type: none"> Small project Poor data availability Longer list of project options 	<ul style="list-style-type: none"> High-level cost estimates High-level demand profile Cost-effectiveness analysis; or rapid cost-benefit analysis Strategic (or rapid) business case 	Decision Point #2 Determining the economic viability of a project
	<ul style="list-style-type: none"> Large and complex project Good data availability Preferred option 	<ul style="list-style-type: none"> Detailed cost estimates Rigorous demand estimation (potentially with engineering support) Full cost-benefit analysis Full business case 	

Source: The authors.

Key point

Economic analysis becomes more detailed as a project progresses through the planning and development stages of the project cycle.

1.4.3 Develop Stage—Business Case Process

The business case process is used to provide a justification for a specific project, with rigorous arguments in favor of its funding. As part of this process, the project sponsor sources, reviews, and selects the project option that will ultimately provide the best solution to a problem, while falling within the financial capacity of the government.

The business case is submitted on behalf of the project sponsor or steering committee to the central government agency responsible for project funding, typically a finance or treasury department. It may also be used as part of an application for external donor funding. After the submission of the business case, the central government agency reviews it.

The first sections of a business case study should “set the scene” for the project. That is, it should outline the need for investment (tying it to the problem or issue that must be addressed), before

outlining all possible project options in detail, including the work needed to implement them. The aim of the economic evaluation is to combine these options into a preferred option and demonstrate whether this option is economically viable (i.e., a net positive for society). The subsequent sections of the business case explains how the preferred project option would be delivered from a financial perspective.

The sections of a business case, as outlined in the NIIP Guidelines are in listed in Box 3.

Box 3: Typical Components Of A Business Case

- Project description
- Project objectives and alignment with national development objectives
- Structure and organization (project components and institutional roles and responsibilities)
- Design (technical options and preferred approach)
- Project costing (capital and recurrent)
- Project viability (cost-benefit analysis or cost-effectiveness analysis)
- Project sustainability
 - Institutional (capacity of the implementing and operating agency)
 - Technical (appropriateness of technology)
 - Financial (ability to meet the costs of operation and maintenance)
 - Environmental (resilience, with particular reference to climate change and natural disasters)
 - Social inclusion (approach to gender equity and social inclusion)
- Compliance with relevant government regulations (spatial planning, environmental impact assessments, social safeguards, building codes, international obligations, etc.)
- Implementation plan (including approach to procurement and local content)
- Potential funding opportunities
- Arrangements for monitoring and evaluation

Source: Pacific Region Infrastructure Facility (PRIF). 2020. *Guideline to Preparing National Infrastructure Investment Plans*. Sydney.

As outlined above, project viability as demonstrated through a CBA (when benefits differ or can be quantified) or through a CEA (when the benefits are the same or cannot be quantified) are the preferred approaches to undertaking an economic evaluation of a project.

The next sections of this report focus on the CBA as the tool required to perform an economic evaluation of infrastructure projects.



2 Steps in Managing a Cost–Benefit Analysis

Section 2 will help the user navigate the key elements of CBA development. The focus is on how to *manage* the CBA process, providing the user with awareness and knowledge of the key steps, and indicating what to look out for in the process.

This section is not aimed to be a technical step-by-step of how to *perform* the economic CBA itself. That information can be found in other guidelines, such as the:

- Asian Development Bank (2017): *Guidelines for the Economic Analysis of Projects*;
- Infrastructure Australia (2021): *Guide to Economic Appraisal*; and
- World Bank (2001): *Economic Analysis of Investment Operations*.

Development partners and funding programs will often have their own guidelines or requirements regarding CBA, and a familiarity with these requirements is important. Further details on the guidelines relevant to PRIF development partners are included in section 4.3.1. These documents are more targeted at specialist project economists conducting CBAs.

The key elements of a CBA discussed in this section are:

2.1 What is Cost–Benefit Analysis?

2.2 Key Steps in the Cost–Benefit Analysis Process

2.3 Step 1: Articulating the Problems and Opportunities Being Addressed

2.4 Step 2: Identifying the Base-Case and Project-Case Options

2.5 Step 3: Identifying and Measuring the Costs and how they are measured

2.6 Step 4: Forecasted and impacts over the life of the investment

2.7 Step 5: Monetizing the Costs and Benefits

2.8 Step 6: Identifying Non-Monetizable Benefits

2.9 Step 7: Discounting the Costs and Benefits to Determine the Net Benefit

2.10 Step 8: Analyzing the Risks and Testing Sensitivities

2.11 Step 9: Reporting on Cost–Benefit Analysis Results

After being guided through the steps listed just above, the user should have an understanding of what needs to be managed as part of CBA delivery.

Key point

There are several steps in undertaking a cost-benefit analysis.



2.1 What is Cost–Benefit Analysis?

CBA is a tool used to evaluate the economic feasibility of a project or policy by comparing the associated costs and benefits in a consistent and systematic way. The point of a CBA is to determine whether the incremental benefits of a project or policy exceed the incremental costs, compared with the existing base case scenario (i.e., whether the project is economically viable and whether it should be pursued). CBA is also used to compare the economic merits of one project option with those of another.

2.1.1 What Is Included in a Cost–Benefit Analysis?

The subsections below outline the key components of a CBA. Each of these components is discussed in further detail throughout this guide.

2.1.1.1 The base and project cases

Before thinking about the costs and benefits, appropriate base and project cases need to be established.

- **Base case**—the “do-minimum” or counterfactual case to a project. The base case describes what the world will look like without the project. This forms the basis from which the net costs and benefits of the project can be evaluated (section 2.5).
- **Project cases, or options**—the interventions designed to address a problem and meet national objectives (section 2.6). The project cases or options describe what the world would look like if specific projects were implemented. Their costs and benefits are then compared with those of the base case.

Key point

It is vital to establish both a base case and project cases (options) to ensure the benefits and costs of the project case can be properly included.

2.1.1.2 Costs and benefits

The costs and benefits in both the base and project cases must first be identified.

- Costs can include initial direct economic costs and ongoing incremental costs over the life of the project over and above those expected in the base case. The costs referred to here are the economic resource costs (e.g., real construction costs), rather than financial costs (e.g., taxation, inflation, various transfer payments).
- An economic benefit is the monetized incremental welfare associated with an infrastructure project. Benefits can include the consumer surplus (benefits to those who are using the infrastructure), producer surplus (benefits to the operators of the infrastructure), and externalities (external benefits not falling to producers or consumers).

Section 2.5 details the different costs and benefits usually associated with different types of projects.

2.1.1.3 Bringing costs and benefits together

A key advantage of a CBA approach is that it uses a common unit of measurement to allow for the comparison of costs and benefits, keeping all other elements of the broader economic, societal, and government activities constant. All identified costs and benefits associated with the project are monetized and aggregated to determine the net benefit.

In addition, the time horizon is normalized using a social discount rate to convert all future costs and benefits into present values. This normalization process allows assessments to be made now about an infrastructure project that will have an impact well into the future.

By putting costs and benefits on a monetary basis, with future costs and benefits normalized to their value today, decision-makers can use CBA to compare the expected results of the investment in the future with the cost of that investment today. As there is only a limited budget from development partners and government for infrastructure (known as the “budget constraint”), the CBA can be used by decision-makers to determine which projects will give the best economic return on investment. This is usually done by using key metrics such as net present value (NPV), benefit–cost ratio (BCR), and economic internal rate of return (EIRR). The calculation of these metrics is discussed in more detail in section 2.9, as well as in section 3.1, which provides guidance on interpretation.

The following sections will provide guidance on each of the above components and how they fit together in the CBA process.

2.1.2 Challenges and Limitations

2.1.2.1 Challenges

There are a number of key challenges to be considered when undertaking a CBA process. At the start of the process, managers should seek to work with the team undertaking the CBA to address these challenges, and reviewers should be aware of these challenges and seek further details about them. Key questions to ask include:

- **What costs and benefits have been valued? How was a market value estimated?** One of the key challenges when undertaking a CBA is the difficulty, or effort required, in valuing certain costs and benefits. This is generally due to the absence of market prices, resulting in the need to adopt a “shadow” price, which is used to estimate what the market price should be. Other times benchmarks from studies in other countries or markets may have to be used; these are known as “value transfers.”
- **Are there important costs and benefits that cannot be valued, that decision makers should know about?** There are certain costs or benefits that cannot be valued, despite the acknowledgement that they will likely occur. Dealing with these qualitatively, potentially through a multi-criteria analysis framework, may be the only course of action.
- **What assumptions have been made in the base and project cases about the future? How reasonable are these assumptions?** Another key challenge is defining the counterfactual (base case), given the inherent uncertainty associated with looking many years into the future. CBA requires this base-case “forecast” to be able to evaluate the scope and scale of the net benefit delivered by the project. However, the base case is impacted by factors such as population and demographic changes, future policy decisions, technology advancements, and even climate impacts, all with their own inherent uncertainties. Managers and reviewers should check that these assumptions are reasonable, and consistent with the assumptions made in national and sectoral strategies, plans, and budgets.

- **How big is the impact of these assumptions on the results?** Every economic evaluation requires assumptions to be made. A key one for CBA is the time value of money, or discount rate, which governs the extent to which we value the future versus the present. This is quite contentious and often subjective. Agreement on an appropriate valuation for now versus in the future is an important consideration when conducting a CBA. Sensitivity and scenario analyses can help decision-makers understand how big an impact these assumptions will have on the results.
- **What data has been used? How was it sourced? How good and complete are the data?** Local data limitations exist in many PRIF-member countries. Obtaining data associated with demand, pricing (market and shadow), and behavioral parameters (consumption elasticities) will be challenging in many circumstances.

A more detailed checklist for managers and reviewers is provided in section 4.3.3.

2.1.2.2 Limitations

Although CBA is the best tool for evaluating the economic merits of an infrastructure project and for informing funding decisions, it does have some limitations:

- **It is mostly concerned with society overall.** CBA is not as powerful in determining distributional impacts (the winners and losers), unless additional data and analysis are used during the CBA process to specifically measure the impacts on different groups.
- **It is not concerned with job and employment impacts.** CBA is not a good tool for politicians and policymakers to use when gauging employment impacts or local industry participation.
- **The results of a CBA are only as good as the inputs that feed into it.** Demand forecasts (e.g., demographic projections, energy use), the estimated costs, and the quantification of benefits drive the results of a CBA. The results will only be as robust as the weakest component of all these inputs.

The following sections are designed to give the practitioner an understanding of the steps in the process of conducting a CBA.

Key point

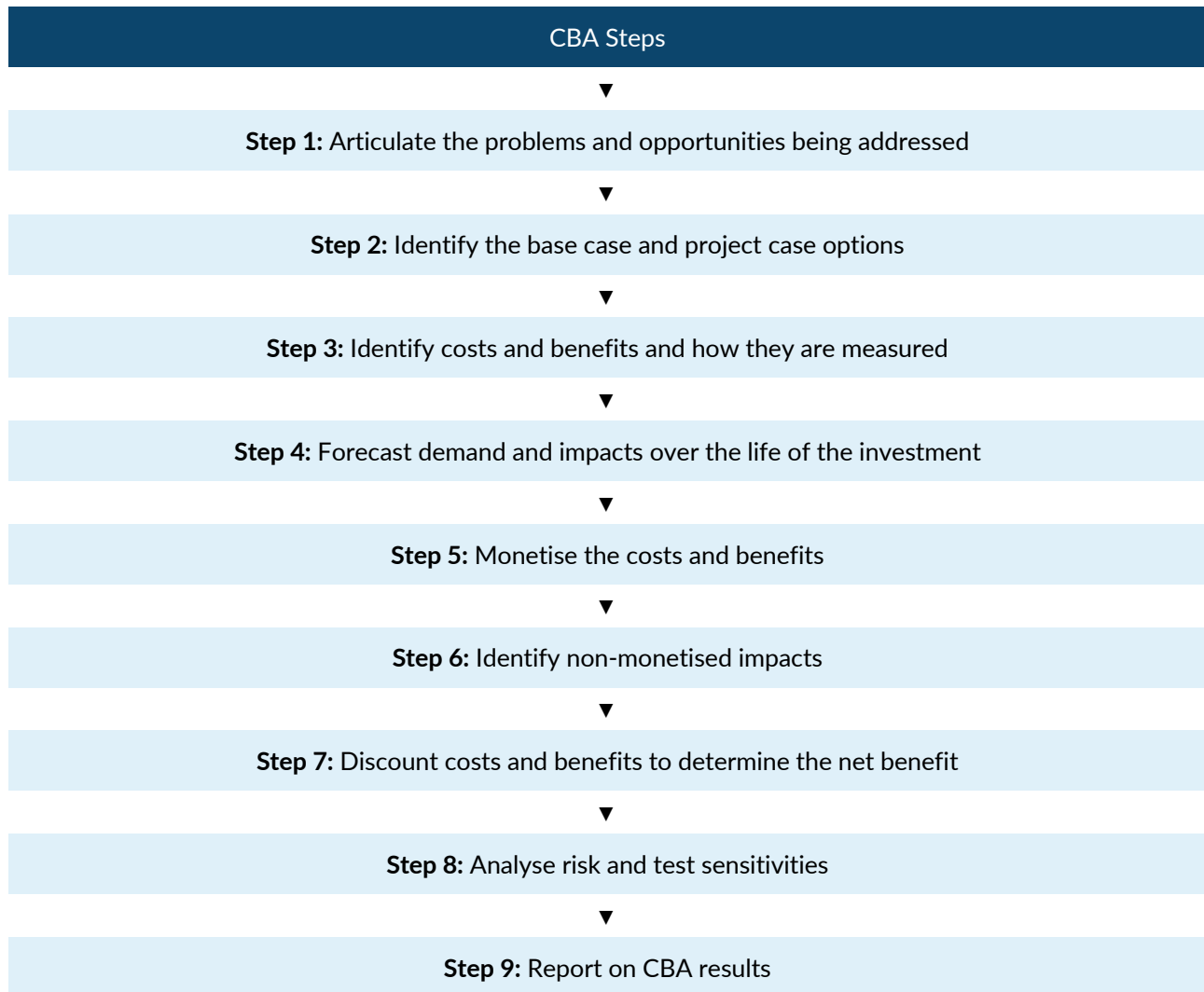
There are significant challenges and limitations to be considered and addressed in conducting a robust CBA.



2.2 Key Steps in the Cost–Benefit Analysis Process

Figure 3 presents an overview of the key stages and flow of a CBA. A manager's guide to each step is presented in the following sections.

Figure 3: The Key Steps in the Cost–Benefit Analysis Process



CBA = cost–benefit analysis.

Source: Adapted from Infrastructure Australia. 2021. *Guide to Economic Appraisal: Technical Guide of the Assessment Framework*. N.p.

Key point

There are several steps that should be undertaken in conducting a CBA. These are outlined below in detail.

2.3 Step 1: Articulating the Problems and Opportunities Being Addressed

Considerations for the manager:

- Has the problem statement that was developed during the Decision Point #1 process been carried through and refined?
- How can one ensure that the project options will continue to provide an opportunity to address the problem statement?
- How can one maintain a direct link between the problem and the project opportunity?

2.3.1 Re-establishing the Link between the Problem and the Project Opportunity

The first step of a CBA identifies the economic problem and how the project would provide an opportunity to address it. A problem statement should have been developed ahead of Decision Point #1 in the infrastructure life cycle. It is a good idea to test and refine the problem statement at this point, and confirm that it still defines the problem appropriately.

With a refined and confirmed problem statement in place, the ways in which the project will address the problem can be set out, covering *how* and *to what extent* the project would be able to alleviate the economic problem.

Explaining the problem in economic terms is often referred to as identifying the “market failure” that requires a public intervention to fix. Market failures can arise from the type of market (competitive or concentrated), the type of goods (public goods or goods with externalities), or the availability of information. For example, investing in new port infrastructure may be too risky (information availability), or recovering the costs may be too difficult for the local port operator (concentrated market). But the government may be better able to manage the risks through such means as planning approval, and it would prioritize the broader benefits to the economy (externalities), in contrast to the port operator, who would be seeking financial benefits.

The manager should ensure that the direct link between the problem and the project has been made explicit. This will help set up the CBA and the project for success.

2.4 Step 2: Identifying the Base-Case and Project-Case Options

Considerations for the manager:

- Is the base case representative of what would happen regarding the problem if the government maintained its *current level* or a *do-minimum* expenditure now and into the future?
- Have a range of options for the project been considered, including built and non-built options?

2.4.1 Establishing a Base Case

An economic CBA is incremental by nature; that is, the costs and benefits associated with a project are measured against those that *would occur without the project*. Defining this “counterfactual” or “base case” is therefore a critical step in the CBA process.

2.4.1.1 What should be considered in a base case?

A base case is most accurately defined as what would happen regarding a problem or issue if the government maintained its *current* (or *do-minimum*) level of expenditure, so that the current level of service provision is maintained into the future (i.e., minimum operational expenditure with no capital expenditure other than pre-approved works or works and costs required to maintain the asset over the evaluation period at its current standards and service levels).

It is important to note that any project infrastructure enhancements designed to improve service or increase capacity would not be included in a base case.

The base case needs to be considered over the full evaluation period. Therefore, not only should service levels be considered as they currently stand, but also what those service levels would look like under the continuation of a *do-minimum* approach into the future.

Generally, if the current business-as-usual service levels were to continue, they would become insufficient over time, particularly if the number of users or frequency of use of the infrastructure were to increase in line with population or economic growth, or if the impacts of the climate or environment were to change. Alternatively, a continuation of the business-as-usual state of the asset may result in the asset’s performance declining over time, as it comes to the end of its useful economic life.

2.4.1.2 Committed funding

Future funding that has already been committed to the infrastructure asset (but separately from the project), and that will have an impact on its service provision into the future, should also be considered when defining the base case. It may be that the government (or infrastructure provider or operator) is already committed to improvements of the asset that will impact its service provision over the evaluation period.

Funding committed to other projects that indirectly impact service provision may also be considered when defining the base case. An example might be a new road project that depends on traffic from a port upgrade project that has been approved, but not yet built. There may be a situation in which the benefits of pursuing a particular project depends on the other committed funding being delivered. If this is the case, it needs to be identified and made transparent within the CBA.

Key point

Establishing the base case is vital to undertaking a CBA. It helps analysts, decision-makers and funding bodies understand what would happen if the project is not undertaken, and enables them to understand what changes if the project is implemented.

Box 4: An Example of What a Base Case Might Look Like

The sealing of a rural gravel road

A government-operated rural gravel road is shared by freight trucks, light commercial vehicles, and private vehicles. In the absence of a project to seal the road, it remains an unsealed gravel road over the course of the evaluation period.

Over time, we expect an increase in the number of trips made on the road. This may be through:

- population growth, leading to more private trips;
- increase in the number of households with cars; and
- economic growth, leading to more commercial trips (freight and otherwise).

In the **base case**, the government implements the following *do-minimum* expenditures in order to maintain the current level of service provision:

- routine and periodic maintenance (e.g., fixing potholes),
- essential safety works (e.g., signage),
- asset renewal (e.g., refurbishing of road shoulder to meet original design standard), and
- any committed upgrade spending for the road outside of the project.

We would expect a deterioration in road conditions over the evaluation period through:

- congestion,
- greater wear and tear,
- lessened resilience, and
- higher vehicle operating costs.

The worsening conditions under the **base case** would lead to higher costs of travel—per individual trip and overall.

Source: The authors.

2.4.2 Defining Project Options

When defining the short list of project case options, each one needs to comply with the problem definition as set out in the plan stage of the infrastructure life cycle. That is, how is the project case going to address the problem? It is also important that a range of options be considered. At a minimum, it is recommended that at least two project case options be presented as part of the feasibility study or project business case and incorporated into the economic evaluation. Presenting a range of project case options helps decision-makers to understand the risks and uncertainties associated with the options proposed. This would be through:

- being able to demonstrate to the central government agencies in charge of allocating funding that a more complete options assessment has been undertaken;
- providing greater optionality for the economic assessment, as limiting the project to one proposed option reduces the prospect that an economically viable solution will be found (as determined by the CBA); and
- providing a secondary or fallback project option that can be viewed as the lower-cost and potentially lower-risk option in the event that a preferred option turns out to be unfeasible (maybe due to environmental or political reasons).

2.4.2.1 Project case options meeting the problem definition

When considering project case options, the investment logic for each should be mapped clearly to the problem definition. This linkage helps to prevent project options from becoming over- or under-

specified, or to prevent the project from addressing something outside of the identified problem. Using tools such as problem tree analysis, theory of change, or investment logic mapping are encouraged when defining the project options.

2.4.2.2 Built-form versus non-built-form options

Project options should not be limited to built-form options. Often there are non-built-form options that are not considered during the development phase that would be perfectly suitable for addressing the problem (or perhaps an acceptable proportion of the problem). Built-form options can cost more to implement and they need to be maintained, whereas non-built-form options may be a relatively cost-effective technology that augments the existing built-form infrastructure.

The case for the option that is ultimately presented for investment can be strengthened if one is able to demonstrate that both built-form and non-built-form options have been considered.

Table 3 presents examples of built-form versus non-built-form options that aim to address the problem of an undersupply of water for a town or village, given current projections of water use and population growth. Note how each option has the capacity to address the problem.

Table 3: Built-Form versus Non-Built-Form Project Options

Problem: Low Water Supply Requires Investment to Improve Water Supply/Productivity			
No.	Form	Name	Description
1.	Built form	Building or expansion of a dam	Increased capture and storage of water
2.	Built form	Construction of a desalination plant	Utilization of seawater through desalination of water supply
3.	Non-built form	Scientific management methods	Implementation of advanced scientific management methods to improve water-supply productivity
4.	Non-built form	Establishment of water resource management governance	Use of better governance to manage the water supply and consumption

Source: The authors.

Key point

Both built form and non-built form options should be considered to determine what are the possible ways to address the problem.

2.4.2.3 What should be included in the project case or option definition?

When presenting the project case, check that the following elements are included.

Option scope

A detailed explanation of the proposed scope of works over the complete project life cycle. It should describe the proposed option as precisely as possible, including the time frame for construction and beginning of operations. The incremental elements of each option should also be acknowledged if the various project options share some common components or build on earlier options.

Benefits

A description of all the anticipated monetized benefits. These should be part of the justification for the project, as they result from the project's ability to address the problem statement. Each benefit should be described as follows:

- how it arises;
- whether it is quantified and/or monetized;
- the expected beneficiaries; and
- the inputs required to calculate it (e.g., demand forecasts).

Costs

The estimated life-cycle costs of the project are typically provided as annual or monthly cashflows and should include:

- upfront costs, including for development, land purchases, and construction;
- operating and maintenance costs;
- periodic renewal costs; and
- end-of-life costs.

Other supporting materials

Other materials should be supplied which substantiate the sources, inputs and assumptions used to define the option scope, and identify costs and benefits. These may include:

- environmental and sustainability assessments;
- engineering assessments;
- cost reports (including all cost elements as outlined above);
- demand modeling;
- reports on safeguards; and
- monitoring and evaluation plans.

Key point

Defining the project case considers both the benefits and costs associated with the project to be compared against the base case. Defining the project case uses information from multiple sources.

2.5 Step 3: Identifying and Measuring the Costs and Benefits

Considerations for the manager:

- Do the costs span the full project life cycle (upfront and ongoing), and are they included in both the base and project cases?
- Have all the benefits and disbenefits been considered, including those concerning consumers, producers, and externalities?
- Are the identified benefits "economic" in that they arise directly from the project and generate true economic benefits, rather than just financial transfers?

2.5.1 Aligning Net Costs over the Whole Life Cycle to a Project or Program

As highlighted in previous sections, economic CBA is designed to measure the net benefit of a potential project, taking into account all the life-cycle net costs of the project.

2.5.1.1 Costs to include in an economic assessment

During the conduct of the economic assessment of a project, various capital and operational costs over the whole life cycle of the project are included for both the base and project cases. They are described in Table 4.

Table 4: Costs to Include in an Economic Assessment

Expenditure	Type	Examples
CapEx: costs relating to the physical construction of a project	Up-front costs of building the infrastructure. Other costs usually included in CapEx include those for land acquisition, relocation, planning, design, the commissioning of work, etc.	Cost of building a road, railway, school, or hospital
	Periodic renewal expenditures are required to restore the infrastructure to its original design capability.	Expenditure for replacing or repairing depreciated components in a planned manner (e.g., resurfacing a road or replacing the roof of a building)
OpEx: costs relating to the ongoing operation and maintenance of the infrastructure	Ongoing operational and maintenance expenses are required to operate the infrastructure on continual basis.	Ongoing expenses such as those for repairing road potholes, hiring maintenance staff, cleaning, etc.
End-of-life costs: expenses incurred when an infrastructure asset is no longer used	One-off expenditure to decommission or dispose of an asset, and to clean up or rehabilitate the site for other uses. Some assets can be sold, and have a positive residual value, rather than costs.	One-off costs such as shutting down a power station, removing its fuel and equipment, and making any remaining structures safe

CapEx = capital expenditure(s), OpEx = operating expense(s).

Source: The authors.

Further details on whole-of-life and maintenance-related costs can be found in the PRIF *Pacific Infrastructure Maintenance Benchmarking Report: 2021 Baseline Assessment*.

2.5.1.2 Costs treated as incremental

Costs should be treated as net incremental in an economic analysis, that is, they are net of the foregone expenditure that would have to be incurred as part of the base case.

By way of example, consider a project to seal a road. In the base case there would be a level of maintenance expenditure required to keep the unsealed road fit for purpose. Some of this maintenance is no longer required once the road is sealed, so this expenditure can be deducted from future operational costs as a cost saving.

Other common adjustments to costs used in a CBA may include excluding expenditures already incurred ('sunk costs') when not relevant to a forward-looking investment decision, and removing taxes, as they are treated as transfers.

Key point

CapEx, OpEx and end-of-life costs should all be included in the analysis. Care should also be taken to ensure that the incremental costs are included which may involve identifying any savings that may be attributable to the option proposed (e.g. reduced OpEx due to a change in infrastructure type).

2.5.2 Identifying Benefits

The aim of expenditure on an infrastructure project in a budget-constrained setting (i.e., when there is only so much funding available for infrastructure) is to generate a net economic benefit. We can say that if the benefits outweigh the costs, the project has economic viability and will result in higher net welfare for society.

In order to determine whether this is indeed so, the benefits must be identified and, to the best of the practitioner's ability, using best-practice methodologies and approaches, they must also be quantified (section 2.7).

2.5.2.1 What is an economic benefit?

An economic benefit is the monetized incremental improvement in welfare associated with an infrastructure project. In an economic CBA, all benefits should be able to be defined, described, and preferably quantified (monetized). Several important principles are to be considered before ascribing benefits to the project.

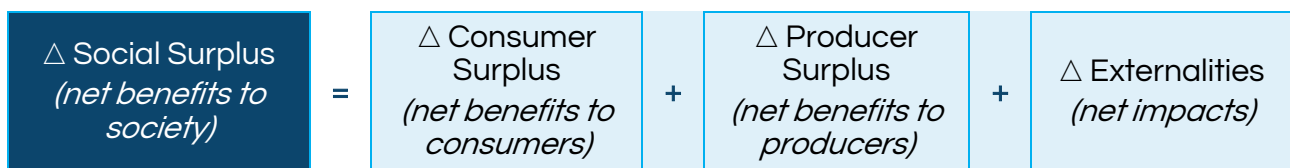
- **Are the benefits attributable to the project?** Benefits should arise from and be directly attributable to the project. In other words, the project needs to be the catalyst for the benefits, in that they would not arise in the counterfactual base case (i.e., without the project). In reality, there may be benefits that are partially or indirectly attributable to the project. If there is strong enough justification, these may be included.
- **Are there actually added benefits?** This refers to true economic benefits, rather than just financial transfers. For instance, additional government revenue from a road tolls is usually not a benefit, nor are taxes on road users; instead, they are simply financial transfers between parties (e.g. road users and the government). Thus, all monetized values should exclude taxes. Care should also be taken to avoid the double counting of benefits. An example of this is when travel-time savings from road projects overlap with market-access benefits, and the new business trips have already been counted in the traffic forecasts.
- **Will the project change people's behavior?** If a project results in new users, or in additional consumption, the increased benefit from the additional use will usually be smaller than the previous benefit for existing users, and may even create disbenefits for existing users (e.g., traffic congestion on new roads). Some users may value infrastructure service improvements more than others (known as "willingness-to-pay"). For example, businesses that rely on electricity might be more likely to increase or decrease their use in response to changes in availability or cost (known as "elasticity of demand").

2.5.2.2 Benefit categories

Benefits can be broadly categorized as consumer benefits, producer benefits, or externalities. Aggregating these would represent the total benefit to society. CBA measures the welfare improvement (surplus) created by the ability to use infrastructure more and/or at a lower cost.

- **Consumer surplus:** benefits to those who are using the infrastructure. This may include cost savings and/or improved quality of service.
- **Producer surplus:** benefits to the operators of the infrastructure, such as avoided capital or operating costs, or unlocked operating profits (surplus).
- **Externalities:** external impacts which may not directly effect producers or consumers using the infrastructure. These often include environmental or health impacts which affect non-users. These benefits or costs are not typically observed or incorporated in market transactions.

Figure 4: Economic Benefits as Surplus Welfare



Note: Δ = “change in.” This refers to the change in the consumer surplus, producer surplus, externalities, and in the social surplus due to a project in terms of higher benefits than would exist without the project (i.e., the difference between their values in the project cases compared to the base case).

Source: Adapted from Infrastructure Australia. 2021. *Guide to Economic Appraisal: Technical Guide of the Assessment Framework*. N.p.

The total benefits of a project are a factor of the number of people, businesses, and other stakeholders impacted (number of users, level of demand); the size and number of the benefits they receive, and the economic value the beneficiaries put on them. In order to quantify the benefits, it is essential to know the number of stakeholders impacted in both the base and project cases, as well as any changes in costs due to project implementation. This calculation is described in further detail in section 2.7.

Figure 5 shows an example of how the consumer surplus (benefit) to **existing users** could be calculated for a project that results in lower consumer costs.

Figure 5: Calculation of Consumer Surplus (Project Benefits)

Δ Consumer Surplus =

$(\text{Project Case Consumer Cost} - \text{Base Case Consumer Cost}) \times \text{Number of Existing Users}$

Where Consumer Cost is the underlying resource cost (or cost of service) excluding taxes

Source: authors

The producer surplus and externalities would be calculated in a similar way.

Projects that attract **new users**, or cause a change in demand from existing users, may require additional analysis to separately estimate the change in costs for both new and existing users as each group may have different costs and benefits in the base and project case.

Identifying and estimating (monetizing) economic benefits can be complex. Expert guidance or assistance may be needed to ensure the analysis is conducted correctly.

A full list of the types of benefits that may need to be considered in the CBA for different types of infrastructure can be found in Appendix A.

Key point

Identifying and estimating (monetizing) economic benefits can be complex. Expert guidance or assistance may be needed to ensure the analysis is conducted correctly.

2.5.2.3 Distributional considerations

Benefits may be distributed among several different users or parties, such as households, businesses, and the government. It is important to note that the overall economic viability of a project in a cost-benefit sense ignores the distribution of the benefits. In reality, a project may benefit one group more than others by design (e.g., when it aims to address equity concerns). However, this will not prevent the project being defined as economically viable based on the CBA.

Additional distributional analysis or reporting can be undertaken to provide decision-makers with more detail on the potential “**winners and losers.**” For major projects, good practices should include distributional analysis as part of the business case and/or feasibility study, and they should inform the preparation of environmental and social safeguards.

2.5.2.4 Residual value

The value of an asset at the end of the appraisal period, which is included as a benefit in the economic evaluation, is known as the “**residual value.**” Residual values are used in CBA calculations involving long-lived infrastructure assets whose life extends beyond the end of the appraisal period.

The measurement of residual values, or “terminal asset values,” is a proxy for future user benefits generated by the assets. In practice, however, it is measured as the residual value of the assets after the appraisal period is over.

2.6 Step 4: Forecasted Demand and Impacts over the Life of an Investment

Considerations for the manager:

- Demand forecasts should include a profile covering the full project evaluation period— with 5- or 10-year periodic or annual forecasts—for both the base and project cases.
- An accompanying report should be provided, outlining all the key inputs and assumptions used to produce the demand forecasts.
- Forecasting demand in the Pacific Island countries may be challenging due to the lack of available data, inputs, and models.
- Managers and reviewers should consider whether the method used to forecast demand is appropriate for the stage of the project. For example, high-level assumptions about population and economic growth could be used for early-stage or rapid appraisals, but more detailed data collection and/or modelling may be needed to inform a final investment decision.

2.6.1 Demand as the Driver of Benefits and Costs

The major driver of the various costs and benefits of an infrastructure project is the underlying demand for the infrastructure and/or service. **“Underlying demand”** refers to the degree to which users will use, or be affected by, the infrastructure in both the base and project cases. Understanding this demand is critical because it determines the extent to which the benefits and costs of the project will be realized. Key questions about demand include:

- Who will use the infrastructure?
- What will they use it for?
- How often will they use it, or how much?
- How will use change over time?
- Will this infrastructure compete with other assets for users?
- Will the infrastructure attract new users?
- Do different options have different levels or sources of demand?

Infrastructure assets last a long time, so these questions need to be addressed in demand forecasts, which may cover an evaluation period of 20 or 30 years or more.

2.6.2 Inputs Considered When Assessing Underlying Demand

There are several important factors to consider when estimating the level of demand associated with a particular project. The factors to be considered include, but are not limited to:

- an assessment of current market conditions, including direct infrastructure use;
- existing infrastructure demand, as well as pent-up or latent demand;
- the behavior of existing and potential users; and
- other macro factors, such as demographics and economic growth.

For example, if the project is a new highway, the analysis would consider the demand for the current road network, as well as factors influencing how often people travel, such as population growth, the availability of alternative modes of transportation, and the rate of economic growth. These would all inform the estimates of the number of people who would use the new highway and of the frequency of their use.

Other examples of demand may include household water and electricity consumption in a town (services that may or may not already exist), whereby demand can be estimated by considering household numbers and size, business use, and incomes.

Demand assessment may also need to consider other factors, such as the cost of the service and the existence of any alternatives that consumers and producers may prefer to use.

2.6.3 Various Forms of Demand Forecasts

Forecasts of underlying demand can take many forms, with varying levels of sophistication. Simple approaches can use population growth, current observations, and data from similar schemes and investments in the country (or similar countries) to triangulate an estimated demand profile over time. Household surveys may also be a useful tool here. This approach is recommended in the first instance if the nature and scale of the project are uncomplicated and small enough to make it feasible.

For major projects, good practice requires undertaking additional data collection and/or modeling to assess demand more fully and provide decision-makers with a higher level confidence about the proposed investment. The manager may need to consider the outputs of sector-specific modeling

tools, such as strategic demand modeling for transport or power system modeling in the energy sector. These tools can provide a higher degree of statistical and computational rigor, as discussed just below.

2.6.3.1 Strategic demand modeling

Demand modeling can be performed with a higher-level simulation, statistical model, or assumptions-based methodology. Alternatively, in the absence of a specific modeling capability at this phase, higher-level “projections” based on an application of historical-population and employment-growth assumptions regarding existing demand may be used. It is important to acknowledge that this demand modeling is more strategic in nature and may be better at selecting a short list of project options.

2.6.3.2 Computational demand modeling

Computational demand modeling is a common method for assessing the underlying demand for infrastructure projects. Computational demand modeling involves the use of advanced statistical models and simulation techniques to predict the behavior of potential users. This modeling can take various forms, including travel demand modeling, freight demand modeling, power or water system modeling, and demographic modeling. Several growth assumptions and inputs feed into these models.

Demand modeling is typically undertaken by specialists, including, but not limited to:

- planners,
- demographers,
- engineers,
- quantitative economists, and
- industry forecasters (e.g., tourism-, education-, and health-demand specialists).

2.6.4 Best-Practice Demand Forecasting

2.6.4.1 Outputs of demand modeling

The outputs of a demand model should include forecasts of infrastructure use for both the **base and project cases**. They could be either annual forecasts or 5- or 10-year periodic forecasts that can be used to interpolate an annual demand profile. The forecasts would typically include:

- existing (or continuing) user demand (what would happen with or without the project);
- induced (new) user demand as a result of the project; and
- type of user demand, for example private individual or household (consumer) demand versus business (producer) demand.

2.6.4.2 Reporting demand assumptions in cost-benefit analysis

The outputs of a **demand forecast**, which are then used as critical inputs for cost-benefit modeling, should be documented and reported as part of a full economic appraisal report. They should include:

- the relevant assumptions regarding population and employment growth rates, technological changes, climate and environmental factors, etc.;
- government and policy considerations that impact the forecasts;
- the number of households and businesses that account for new or existing demand; and
- prices and elasticities.

As well as the documentation of the outputs, inputs, and assumptions, additional discussion should be provided to help decision-makers understand the choices of inputs, and any risks around them.

This might include why a particular growth rate was chosen, as well as the process and any peer review used to arrive there.

Given the inherent uncertainty associated with forecasting demand, the providers of the demand forecasts should also include details of how this uncertainty was dealt with. For example, if a probabilistic approach was used in the modeling, this should be outlined and discussed. Providing this level of detail will engender greater confidence in the inputs for the economic appraisal, and will help make the case for the project overall.

Key point

Estimating demand for the use of infrastructure is often vital to understand the economic benefits of infrastructure projects. There are several methods that can be adopted. The choice of methods may differ based on infrastructure types, data availability and capacity and resources available. It may be prudent to seek expert assistance for estimating demand for larger and/or more complex projects.

2.7 Step 5: Monetizing the Costs and Benefits

Considerations for the manager:

- Have all the benefits been monetized according to the accepted and agreed-upon economic values, such as market or shadow prices?
- Are all the costs presented consistently in either constant (real) or current (nominal) terms?
- Are all costs and benefits monetized and presented annually, covering the full evaluation period?

2.7.1 Monetizing the Costs

Managers should ensure that the following key requirements of cost monetization are met through the CBA process.

2.7.1.1 Annual costs through the full evaluation period

Costs are presented for the full evaluation period in annual amounts. A typical cost profile would have an up-front CapEx amount for the first phase of the project, as the construction was going on, followed by a ramping up of ongoing operational expenditures, with periodic renewals and maintenance expenditures over evaluation period (e.g., 20 or 30 years).

To allow for consistent comparisons of projects with multiyear construction profiles, the CBA should generally include the construction years plus the years of in-service operations; for example, the evaluation period for a project with 5 years of construction could be 5 + 30 years of operations. Assets that have operational lives shorter than the evaluation period should include the replacement CapEx and any residual value in the cost profile throughout the evaluation period.

2.7.1.2 Costs in constant (real) prices

Costs should be presented consistently in constant (real) prices and exclude taxes. Therefore, the **economic appraisal should not include inflation**—in contrast to the financial analysis of the project, which uses current (nominal) prices. The year that the real prices are denominated in must also be indicated (e.g., in real 2025 dollar terms). And the year must be the same as the price year used in the rest of the economic appraisal (i.e., that used for the benefits).

Real cost escalation (that is, over and above the general inflation rate) may be included, but this is considered less advisable than in the past. Guidance from cost engineers and development partners should be used when deciding whether it is appropriate to include, and any relevant assumptions should be clearly stated in the CBA report.

2.7.2 Monetizing the Benefits

The benefits identified in Step 3 require quantification in order to be recognized by the central government agencies responsible for approving and funding the project. The best practice for quantifying benefits is by monetizing the value that they represent. This may be done through direct market pricing or non-market pricing methods such as surveys to estimate how much users would be willing to pay for a new product or service (known as “revealed preference” or “stated preference” methods).

Managers should ensure that the following key requirements of benefit monetization are fulfilled.

2.7.2.1 Demand as the key input

A demand profile of the infrastructure over time will be critical for calculating the project’s benefits. Given that economic appraisals should cover the asset lifecycle, which is often 20 to 30 years into the future, there is naturally going to be some uncertainty over the accuracy of demand forecasting. As described in section 2.4, specialists must be responsible for providing these input forecasts (with a review).

2.7.2.2 Benefits generated by economic values

The monetization of a benefit requires the inclusion of the benefit’s economic value in the demand input profile, so that the improvement in public welfare resulting from the project can be captured. For example, a road project that results in travel time savings would value the decrease in travel time by applying the dollars/hour saved to demand in the project case. Similarly, for a new water-treatment facility that would lower the cost of water supplies, we would apply the incremental decreases in dollars spent per gigaliter of water consumed to estimate the value of the benefit.

Typical economic values include the value of time, commodity prices, vehicle operating costs, environmental externalities, cost per unit of infrastructure, etc. These values should reflect the underlying resource cost to provide these services, which may be higher or lower than the prices charged by governments or utilities, and may need to be adjusted if there are substantial subsidies or taxes. These values are then applied to demand inputs over time in terms of benefit cash flows.

Managers should ensure that there has been a justification for each of these economic values. Where possible, **current market prices** should be sourced. In the absence of market prices, **shadow prices** sourced from accepted economic literature should be used.

It may be challenging to source the appropriate economic values in many Pacific island countries. In these situations, benchmarks from other countries or projects may need to be used. Further guidance is provided in donor guidelines e.g. see: ADB (2017): *Guidelines for the Economic Analysis of Projects*.



Box 5: Shadow Prices and Country Adjustment Factors

There may be challenges associated with relying on market pricing for monetizing economic costs and benefits for Pacific island countries, due to the large non-formal sectors and/or non-competitive markets. The World Bank (2001) provides a summary of this:

In economies where distortions are few, market prices provide a reasonably good approximation of the opportunity costs of inputs and outputs. In economies characterized by price distortions, however, market prices are a poor reflection of those costs...[An] evaluation requires that the analyst compensate for price distortions by using shadow prices that reflect more closely the opportunity costs and benefits of the project, instead of market prices. In principle, if we adjust all prices to reflect opportunity costs, these calculations would be extremely time-consuming and expensive. In practice, analysts undertake few adjustments and concern themselves primarily with adjustments of the prices of tradable goods, the exchange rate, and the wage rate.

For more information on the application of shadow prices and country adjustment factors, see: Asian Development Bank (2017): *Guidelines for the Economic Analysis of Projects*; and World Bank (2001): *Economic Analysis of Investment Operations*.

2.7.2.3 Annual benefits through the full evaluation period

The values of each of the benefits are profiled and presented annually. Like the costs, these **values must be in real terms** (i.e., in constant currency, with any inflation removed).

Key point

There are multiple approaches available to monetizing benefits and costs. The choice of approach will depend on issues such as the scale of the project, capacity and resources and data availability. It is also important to ensure that all benefits and costs are estimated in real terms (i.e. excluding inflation).

2.8 Step 6: Identifying Non-Monetizable Benefits

Considerations for the manager:

- Where possible, in the absence of monetization, provide other *quantitative* evidence to support the identified benefit.
- A direct link between the problem statement and the identified non-monetizable benefit should be made to justify the benefit.
- Qualitative benefits should be supported by a discussion of the available evidence.

Not all benefits associated with a project can be quantified. There are going to be some that, for all practical purposes, cannot be monetized effectively. This may be due to a lack of appropriate demand or input data, or to the absence of the necessary price or value signals. In these situations, it is best to treat the benefit qualitatively. Examples of non-quantifiable benefits include:

- cultural and heritage impacts,
- visual amenities, and
- indirect health impacts.

To justify the inclusion of these benefits, managers should ensure that the following steps are taken as part of the CBA:

- Establish a direct link between the problem statement and the identified non-monetizable benefit. This will make it clear that the non-monetizable benefit is indeed attributable to the project.
- Determine if there is any quantitative evidence that could be used to support the inclusion of the benefit. This may be in the form of academic, economic, or scientific studies.
- Define the qualitative economic reasoning for the inclusion of the benefit, including the factors that would conceptually influence the benefit being generated.
- Consider whether the benefits are likely to material to the findings of the analysis, particularly if they may differ between options and therefore impact on choice of the superior option.

Appendix A presents a log of the major non-monetizable benefits associated with different infrastructure sectors.

Key point

Not all benefits associated with a project can be quantified. However, it may still be prudent to capture these benefits in a qualitative way in reporting, particularly if they are likely to be material to the final outcomes of the analysis.

2.9 Step 7: Discounting the Costs and Benefits to Determine the Net Benefit

Considerations for the manager:

- Does the discount rate reflect the real discount rate for the country in which the project would operate?
- Have the relevant central government agencies and any development partners agreed on how benefits and costs should be valued now versus in the future?
- Have the relevant central government agencies and any development partners agreed on a minimum benefit–cost ratio (BCR) or rate of return that the project will need to fulfill, so the final investment decision can be made?

All of the life-cycle net costs and quantifiable benefits over the evaluation period, as discussed in the previous sections, are combined into a net CBA calculation. This calculation is generally conducted using a spreadsheet platform, which has several advantages. It:

- enables the necessary analytical rigor;
- is reviewable; and
- provides the necessary transparency to those reviewing the CBA.

The manager should be aware of the role of the appraisal period and real discount rate in the generation of the net benefit.

2.9.1 Appraisal Period

The appraisal period typically covers at least the asset lifecycle, and in many jurisdictions an appraisal period of 30 years is used for consistency across projects. However, certain jurisdictions may prefer

to consider shorter analysis periods (e.g., 20 years). The analysis period should stay constant across projects to enable comparisons among them.

2.9.2 Real Discount Rate

The real discount rate translates the cost–benefit profiles over time into a **present value of money**. The appropriate real discount rate should therefore reflect as best as possible:

- the risk-free rate of return in the market (in this sense it is the social discount rate reflecting a risk-free time value of money), and
- the country's valuation of the **present** versus that of the **future**.

It should be noted that the real discount rate is going to vary by jurisdiction, reflecting the monetary and economic environment present there.

2.9.3 Reporting Key Metrics

Discounted costs and benefits over the life of the project are then used to calculate the key metrics reported in the CBA, which include the:

- **net present value of benefits (PV(B))**, the sum of all benefits over time, discounted to their present value;
- **net present value of costs (PV(C))**, the sum of all costs over time, discounted to their present value;
- **net present value (NPV)**, the overall net present monetary value of the project after subtracting the net present costs from the net present benefits. For a project to be economically viable the NPV should be greater than \$0. The option with the highest NPV is generally considered the most superior option;
- **benefit–cost ratio (BCR)**, the sum of all the net present benefits divided by the sum of all the net present costs. For a project to be economically viable the BCR should be greater than 0. The option with the highest BCR is generally considered the most superior option; and the
- **economic internal rate of return (EIRR)**, the discounted value of the benefits expressed as an annualized rate of return on the resources invested in the project (which can be compared to, and should exceed the discount rate, i.e., the social cost of the resources invested).

Central government agencies or their guidelines for donor funded programs may specify different ways of calculating these metrics and the minimum values that must be met to be considered for funding.

While these calculations can be complex, the use of well-designed spreadsheet in conjunction with the functions already available in spreadsheet packages should make this task easier.

Further discussion of the interpretation of these metrics is included in section 3.1.1.

Key point

Calculations to determine the net benefits of projects in present values (i.e. their value in today's terms) is vital to analyzing projects.

2.10 Step 8: Analyzing the Risks and Testing Sensitivities

Considerations for the manager:

- Have the main economic parameters, benefits, and costs been varied within a reasonable range to test the sensitivity of the main economic metrics?
- Have the sensitivities been run using appropriate upper and lower ranges to determine all the likely impacts, both positive and negative, on the project in order to support an investment decision?

2.10.1 Sensitivity Analysis

It is prudent for those undertaking the CBA and decision-makers to consider the various sensitivities of the costs, benefits, and other parameters and assumptions used in the analysis.

The purpose of sensitivity testing is to determine what factors have to hold true for the calculated economic benefits of a project to exceed the future costs. That is, what changes to demand, benefits, and costs would result in a negative NPV or in a BCR of less than 1? Or can one reasonably conclude that the project will probably not result in these changes?

The point here is to demonstrate what the key metrics calculated above would look like under various alternative scenarios.

Examples of ranges of sensitivities to be run include:

- CapEx ($\pm 5\%$, 10%, 20%)
- OpEx ($\pm 5\%$, 10%, 20%)
- benefits ($\pm 5\%$, 10%, 20%)
- discount rate (3%, 5%, 7%, 10%).

Running sensitivity analysis by varying each of these components will enable evaluators to determine the robustness of the key appraisal metrics, and how well the project would stand up when factoring in uncertainty.

2.10.2 Scenario Analysis

Scenario analysis complements sensitivity testing by trying specific combinations of inputs and assumptions, with each combination representing a situation that may arise for the project. The project case should usually be based on the expected or most likely outcomes, but other outcomes that can be imagined can also be tested.

The scenarios to test may be identified by working with experts, project analysts, and project sponsors, or through consultation. Typical examples of scenarios might include: the impact of specific commodity prices or exchange-rate scenarios; changes in the project schedule or cost; or the impact of delays in other related projects.

The results of the scenario analysis can be compared with the project case based on key metrics such as the NPV and BCR, and then used to determine if the project would still be a good investment under different assumptions about the future.

A well-designed CBA spreadsheet will make undertaking sensitivity analysis significantly easier.

Key point

Sensitivity analysis is the processing testing your CBA results under different ranges of inputs and assumptions. It provides powerful knowledge to decision-makers to understand how robust the results of the CBA are and the reliability of the analysis to underpin well-informed decisions.

2.11 Step 9: Reporting on Cost–Benefit Analysis Results

Considerations for the manager:

- Has an accompanying CBA report been prepared that documents the methodological development of the analysis, including all the inputs, assumptions, and results?
- Does the CBA report provide the necessary transparency of results (including an appropriate costs-and-benefits breakdown), and align with any supporting technical studies for the project?
- Do the results provide a conclusion and recommendation for the preferred project option, based on its economic viability and any risks?

2.11.1 Cost–Benefit Analysis Report

A CBA report is a key deliverable of the CBA process. The aim of the report is to summarize the analysis and give decision-makers the necessary confidence in the robustness of the results.

The manager should ensure that the report includes the:

- problem (or market failure) being addressed,
- assumptions,
- parameters,
- base case,
- project case options,
- demand inputs,
- outline of benefits,
- outline of costs,
- calculation methodology,
- results (including sensitivity and scenario analyses), and
- conclusion.

The report should document how the CBA was compiled, including an outline of all the assumptions, the methodology used for calculating benefits and costs, and a presentation of the results. Ideally, the report would be written such that the results of the CBA could be replicated by other parties.

In addition to providing this written report, an open spreadsheet model that has been externally reviewed should also be provided. This will allow for the necessary transparency of the CBA results, and enable them to be reconciled with what has been presented in the full report.

Table 5 sets out the details that should be included in a full CBA report.

Table 5: What to Include in a Full Cost–Benefit Analysis Report

Section	What to Include
Project Alignment	
Problem/market failure	An explanation of how the project will address the problem or market failure that currently exists. It should include a description of the economic problem, an argument in favor of the project infrastructure, and an explanation of how the infrastructure would address the problem or market failure.
Base case	A clear description of the base case, including what the economic problem would look like under the do-minimum scenario.
Project case	A clear description of the project case option(s), including how the option(s) would address the economic problem and generate economic benefits.
Assumptions and Parameters	
Assumptions	A listing of the key assumptions of the analysis, including the sources of inputs for the analysis, such as demand modeling and cost modeling, as well as any other assumptions made over the course of the analysis.
Parameters	Documentation on any economic parameters used in the analysis, such as the discount rate, appraisal period, inflation rate, cost and benefit escalation, benefits realization, value of time, etc.
Demand inputs	Documentation of the infrastructure demand profiles in both the base and project cases, including all the relevant assumptions that went into their generation.
Methodology	
Outline of benefits	A description of all the benefits used in the analysis and how they were calculated. This should include the formula for the benefits and the inputs used in calculating each one. For example, if the project is a new road, one benefit might be time savings for users, which is calculated using inputs from a transport demand model.
Outline of costs	A description of each of the cost components included in the analysis, such as CapEx and ongoing OpEx.
Results	
Results	A compilation of the results for each of the benefits and costs (both discounted and undiscounted), as well as their total sum. It should include a report on the BCR and NPV—the key metrics for evaluating the economic viability of the project. There should also be a review of the sensitivity and scenario analyses as part of the project evaluation.
Conclusion	The conclusion should summarize the overall economic viability of the project, including the preferred project case.

BCR = benefit–cost ratio, CapEx = capital expenditure(s), NPV = net present value, OpEx = operating expense(s).
Source: The authors.

When commissioning an external party—such as an academic institution, nongovernment organization (NGO), or consultancy—to undertake the CBA, the manager should ensure that the reporting and transparency requirements are specified in the request for tender.

Key point

There are several typical inclusions in any CBA report.

2.11.2 Promoting Confidence in the Preferred Project Option

The manager should ensure that the report provides the necessary details, as well as transparent results. Appropriate splits between, and documentation of, the benefits and costs are an important part of this process, making it more likely that the analysis will be accepted by central government agencies.

The key purpose of the CBA is to provide a conclusion and recommendation on the economic viability of the project. The manager should ensure that the reporting also provides the reader with the ultimate recommendation of preferred project option.

2.11.3 Reporting on the Outcomes and Contributions to Strategic Objectives

As part of the assessment of the costs and benefits of a project, several outcomes and contributions for other strategic agendas may need to be quantified and included in the CBA report. Doing so will support decision-making that considers the full range of economic, social, and environmental outcomes of a proposed investment.

Key examples relevant to Pacific Island countries include:

- national or sectoral outcome frameworks (e.g., jobs or poverty alleviation),
- Nationally Determined Contributions under the Paris Agreement to reduce global greenhouse gas emissions (e.g., renewable energy delivered), and
- Sustainable Development Goals (e.g., those for access to water and sanitation).



3 The Outputs and Outcomes of a Cost–Benefit Analysis

The aim of this section is to inform the practitioner of what to expect in terms of the outputs and outcomes of a CBA. This includes how to interpret and report on the results for submission to central government agencies, and how to use the outcomes of a CBA to inform decisions on portfolio prioritization and investment decision-making.

Included in this section:

3.1 How to Interpret the Results of a Cost–Benefit Analysis

3.2 How to Use Cost–Benefit Analysis across the Infrastructure Project Life Cycle

3.3 Roles and Responsibilities

3.4 Reviews of Cost-Benefit Analysis



3.1 How to Interpret the Results of a Cost–Benefit Analysis

The results of the CBA provide central government agencies with a robust, standardized monetary appraisal of the economic viability of a project. Care must be taken in interpreting each of the key metrics outlined in the previous section, both in terms of the individual project itself and when comparing across multiple projects.

Critically, these results do not represent *all* of the costs and benefits that may arise from the project. The non-quantifiable costs and benefits discussed in Appendix B may still be considered in conjunction with the results of the CBA, at least in a qualitative sense.

3.1.1 Interpretation of Results

A project is considered economically viable when the benefits to society exceed costs, resulting in a benefit-cost ratio of 1.0 or higher

A **benefit-cost ratio (BCR)** greater than 1.0 means that the project is **economically viable**, at least in terms of the costs and benefits that were monetizable. The higher this ratio, the better the expected economic viability, or value-for-money provided by the project. For example, a BCR of 1.8 is superior to a BCR of 1.1, as it represents greater economic viability and is expected to withstand larger changes in input sensitivities. The BCR is expressed as the ratio of multiple benefits compared to costs, rather than dollars, and allows for projects of different sizes to be compared.

When comparing projects and seeking to maximize economic returns in a budget-constrained setting, the project with the higher BCR should be chosen.

Note that the BCR is agnostic with regard to the size (i.e. cost) of the project. So, by presenting a ratio, one is normalizing for the expenditure and size of the project. This is one of the key advantages of evaluating a portfolio of projects of different scales against each other.

Net Present Value (NPV) is expressed in dollars, and a project with a NPV that is greater than zero dollars (or than zero in any other appropriate currency) represents a project with a net economic benefit, over and above the costs of the project. To be viable, the NPV should be greater than \$0.

The size of the monetized net economic benefit, as measured by dollars of NPV, is also important to consider alongside the BCR. This is because comparing the net economic benefits of different projects may result in a different ranking of projects, compared to using BCR. For example, a project with a higher investment outlay may produce a *higher* net economic benefit despite having a *lower* BCR.

If the goal of the infrastructure investment is to maximize economic value, rather than the return on spend, NPV may be given more weight.

The economic internal rate of return (**EIRR**) is the discount rate that would make the NPV equal to zero. An internal rate of return (IRR) higher than the project discount rate would indicate a net economic return. This can be a useful metric for comparing the economic returns of projects with different scales and levels of expenditure.

The IRR should be greater than the project discount rate for the project to be economically viable.

As outlined earlier, this allows managers to consider how to maximize the economic **return** across an overall portfolio of expenditures – which is often aligned with annual budget processes. The best tool available for this is the **BCR**, which should be given the most weight when evaluating the validity of an individual project and ranking it against others.

To strike a balance between sectoral priorities, other tools may be needed, however, such as multi-criteria or macroeconomic analyses, which can be used to guide sectoral allocations.

Recommendation: infrastructure spending should be prioritized with both the budget constraints and the full portfolio of projects in mind.

Key point

There are several different measures used in CBA to inform decision-makers including NPV, BCR and EIRR. Each of these measures provides different types of insight to decision-makers.

Box 6: Interpreting cost-benefit analysis results – what happens if the results are bad?

Economic evaluation considers how allocating a part of the government's limited resources to a project will impact the welfare of all the citizens. It is primarily concerned with whether a particular use of resources (e.g., land, labor, capital) would improve public welfare, regardless of where the funding comes from.

Many countries or development partners will use a decision rule based on the key metrics of NPV, BCR or EIRR to recommend only investing in projects if they are expected to achieve an adequate return on public investment.

However, in some cases it may be desirable to proceed with a project, even if the CBA results don't meet the required rule. In the Pacific region, this can be a more common outcome of CBAs for a number of reasons including:

- Data on outcomes and market prices are not available or difficult to estimate reliably.
- Small, remote populations mean projects are more expensive and difficult to deliver.
- Many projects target poverty reduction, equitable access to basic services or environmental outcomes which are hard to value.

If CBA results are not favorable for proceeding with a project it is important to consider whether this is an accurate reflection of the project or a result of limitations of the study, and note this in the investment recommendation.

In preparing an investment recommendation, it is important to report CBA results clearly and transparently for decision makers, and lay out any additional reasoning for or against proceeding with a project.

Key questions to consider in preparing an investment recommendation based on CBA results are:

- Are there large benefits which haven't been quantified or monetized?
- Is the discount rate comparable with other projects or the cost of funding? Is the project viable at a lower discount rate?
- Can the project be improved through value management techniques to reduce costs, reduce risks, improve benefits or get more information?
- Are there alternative projects that could deliver the same outcome?
- Is this project the best available option from a number of less viable alternatives?
- Does the project deal with long term or high risk events (e.g. climate change), strategic or transformational investments?
- Is the project required to support other viable investments that wouldn't occur without an initial public investment?
- Is this a basic service for which we have a Community Service Obligation (CSO)? How large is the gap in project viability compared to the value of CSOs or subsidies provided to infrastructure operators?

3.2 How to Use Cost–Benefit Analysis across the Infrastructure Project Life Cycle

As noted in section 1, there is no one-size-fits-all approach to economic evaluations of infrastructure life cycles. Different projects will need to use different types of economic analyses to answer different questions; and the level of detail available will vary by project, sector, and life-cycle stage.

However, good practices for integrating CBA exist at each life-cycle stage, and they are listed in Table 6, where they are also aligned with principles of quality public financial management. Further details can be found in resources such as the World Bank’s public expenditure reviews, the Public Expenditure and Financial Accountability (PEFA) program’s *Framework for Assessing Public Financial Management* (2019), and the International Monetary Fund (IMF) Public Investment Management Assessment (PIMA) Framework.

Table 6: Cost–Benefit Analysis across the Infrastructure Project Life Cycle

Life-Cycle Stage	How to Incorporate Cost–Benefit Analysis Results
1. Strategize	<ul style="list-style-type: none"> • A CBA may be undertaken on program-level outcomes as part of sector plan development. • Partial CBAs or CEAs may be undertaken to identify and test indicative sub-project options as part of sector plan and pathway development. • Asset management planning may incorporate a CBA or CEA to determine efficient asset-replacement requirements.
2. Initiate	
3. Plan	<ul style="list-style-type: none"> • Undertake rapid CBA or CEA analysis to inform prioritization; assess options; and identify the scale of likely costs and benefits, as well as potential viability. • Check if a project is viable before committing resources to its development. • Consider published standard criteria for inclusion in the national budget by central government agencies. • Identify the potential beneficiaries of the procurement, funding, and financing options during the develop stage. <p><i>Decision Point #1: Does the project help to define the problem and to achieve the related national strategic objectives?</i></p>
4. Develop	<ul style="list-style-type: none"> • Undertake a full CBA or CEA to inform final investment decisions for all major projects, using established national guidelines. • Integrate the CBA or CEA results into the business case and/or feasibility study. • Have a third party review the project and publish its review and the CBA or CEA results. • Integrate the cost, benefit, and delivery metrics used in the CBA or CEA into the project’s monitoring-and-evaluation planning. <p><i>Decision Point #2: Is the project economically viable?</i></p>
5. Execute	<ul style="list-style-type: none"> • The government budget documents should include the projections of the total life-cycle and annual costs for the major projects covered by a CBA. • Project-governance bodies should periodically monitor major project performance against cost, benefit, and delivery metrics, and against evidence findings. • Undertake post-completion reviews against CBA metrics and/or ex-post CBA to assess outcomes and identify lessons for future projects and appraisals.
6. Monitor	

CBA = cost–benefit analysis, CEA = cost-effectiveness analysis.

Note: The Strategize and Initiate stages share the same incorporation cell in the column to the right, and the Execute and Monitor stages also share the same incorporation cell. This means that the steps for incorporation will often spill over from the earlier stage to the subsequent one.

Sources: The authors; International Monetary Fund (IMF). Public Investment Management Assessment (PIMA) Framework. Public Expenditure and Financial Accountability (PEFA) program. 2019. *Framework for Assessing Public Financial Management*, 2nd ed. Washington, DC and World Bank, Public Expenditure Reviews.

Key point

Economic analysis can inform better decision-making at several points along the infrastructure project life cycle.

3.3 Roles and Responsibilities

There are several stakeholders throughout the delivery of a CBA, including the consumers of the CBA, which typically span both government and the private sector.

Key point

There are typically multiple stakeholders involved in the development of a CBA. Each of these stakeholders undertakes different important roles in a successful CBA.

3.3.1 Government and State-Owned Enterprises

Central government agency

The central government agency responsible for recommending funding decisions (typically, the treasury or finance ministry) uses the results of the CBA as a critical input into its funding decision or recommendation. To secure a funding recommendation, a project needs to have demonstrated economic viability through its CBA. The central government's roles and responsibilities, as set out in the National Infrastructure Investment Plan (NIIP) guideline, are listed in Box 7:

Box 7: Central Government Roles and Responsibilities

- Confirm that the project was approved for further development following prioritization.
- Check that the business case is complete.
- Check that the business case provides sufficient evidence of the alignment of the project with national development objectives, the viability of the project, and the project's sustainability.
- Contribute to the economic analysis of the project, where needed.
- Make recommendations to decision-makers regarding project selection, based on a clear set of selection criteria agreed to by the government and published.

Source: Pacific Region Infrastructure Facility (PRIF). 2022. *Guideline to Preparing National Infrastructure Investment Plans*. Sydney.

Infrastructure committee or steering group

This is always a committee within the proponent agency that ultimately owns the final delivery of the CBA and the business case. The committee can either undertake the CBA internally or commission the CBA as part of the wider business case for the project. The committee is generally responsible for submitting the business case to the central government agency responsible for funding decisions. The committee works closely with the consultants and specialists responsible for compiling the business case and for conducting the CBA.

Managers and internal reviewers

Within the infrastructure-related government agencies and state-owned enterprises, several officers may be involved in the day-to-day commissioning, oversight, and review of the results of a CBA prepared by others. These officers may have varying responsibilities and expertise in economic analysis, and may be reviewing the CBA from the perspective of other technical workstreams (e.g., project engineers or managers). Some Pacific Island countries will have national, sectoral, or agency guidelines relevant to the CBA, and these should be consulted.

Section 3.4 provides more detail on the review steps, and a suggested checklist for use by these officers is included in section 4.3.

3.3.2 Consultant(s)

Consultants may be engaged to perform the economic CBA. These consultants would have demonstrated expertise in compiling appraisals, and would be responsible for:

- coordinating inputs into the CBA (e.g., from cost and demand input providers),
- developing the relevant assumptions and parameters for the CBA,
- doing the calculations,
- compiling the results of the CBA and reporting them, and
- presenting the results to the stakeholders, including the infrastructure committee or steering group and the relevant central government agency (for appropriate review and evaluation processes).

3.3.3 Technical Input Providers

Technical input providers for a CBA are typically engineers with expertise in infrastructure. Specialist engineers are generally hired as consultants, but in some circumstances the necessary technical expertise is found in a government department.

The extent to which technical providers are required for a project should depend on its scale. For smaller projects, individual consultants or the government itself may be able to take responsibility for the technical inputs. As the quantum of investment increases, the expectation is that specialized engineering firms would be engaged to provide the technical inputs.

Technical providers are responsible for providing the following:

Costs

Typically, cost input data is provided by engineering firms and other operational specialists. The data include:

- annual capital expenditure profile (CapEx),
- annual operational expense estimates (OpEx), and
- end-of-life costs.

Demand

Typically, demand input data are provided by engineering firms and industry specialists. The data include:

- annual demand profile (e.g., traffic by mode for a transport project, water demand for a dam project, or electricity consumption for a transmission line project); and
- user costs, tariffs, or other pricing estimates.

Economic evaluation

Specialist consultants can be engaged to support governments through the option development, benefit identification, and monetization process, and through the completion of the economic evaluation and reporting processes.

Each of the technical providers is responsible for providing a technical report detailing how the inputs have been modeled from an engineering perspective.

3.3.4 Third-Party Reviewer(s)

It is best practice to engage third party reviewers to look at both the economic cost-benefit model and the full economic cost-benefit report. The reviewers should be experts with the necessary knowledge and experience for undertaking economic appraisals. Their role should be to provide constructive technical guidance through the development of the CBA, and to provide independent assurances and/or critiques regarding the results and recommendations.

A detailed discussion of the review process is presented in the next section.

3.4 Reviews of Cost-Benefit Analysis

3.4.1 The Importance of a Review Process

Reviewing the full economic CBA is an important step in the CBA process, essential for ensuring its robustness and accuracy, so that it reaches the standard necessary for informing infrastructure-funding decisions. It also provides an opportunity to receive feedback and address any concerns with the analysis before it is submitted to the infrastructure committee or steering group and the central government agency. Managers should ensure that the following questions are addressed as part of the review.

Does the framing of the analysis make sense through an economic lens?

Consider:

- what is the economic problem in the base case that needs intervention?
- the validity of the base and project case options,
- the methodology behind the benefits and costs, and
- the existence of any omissions that need to be highlighted?

Is the CBA model accurate?

Consider:

- what level of confidence can you put on key inputs and assumptions?
- how do you know that calculations have been performed correctly?
- do the sensitivity test results make sense with what you know about the project?
- has a third party or independent review of the model been done?
- can there be confidence in the results?

Would an independent, peer review agree with the supplied cost estimates?

Consider:

- can the capital-expenditure (CapEx) estimates be validated?
- are benchmarks and unit rates appropriate?
- how complete are the cost estimates compared to the project scope?
- how has cost escalation and risk been addressed?
- how does the final cost estimate compare to other recent projects?

The review process plays a valuable part in preempting any questions or concerns that may come from the central government agency when determining whether to greenlight the project for funding.

3.4.2 What Should Reviewers Look For?

Reviewers of the economic CBA should undertake a holistic review of the appraisal. Managers should ensure that the team doing the CBA have addressed, or can answer, the following key questions that the reviewers typically cover.

Base and project case options

- Does the base case make sense? And is it a realistic “counterfactual” scenario if the project investment does not happen?
- Are the project case options appropriate? Are they addressing the “need for investment” in a sensible way (i.e., not gold-plating or under-provisioning)?
- Does the projected demand look realistic with respect to population growth and to other projects of a similar nature?

Inputs and parameters

- What are the key assumptions and inputs?
- Are they reasonable and up-to-date?
- Are they used appropriately in the appraisal?
- Do they make use of local data and, where possible, backed up by the economics literature?

Benefits

- Do the benefits make sense from an economic perspective and are they calculated correctly?
- Does the review verify that the benefits are truly economic benefits, and not simply financial transfers?
- Are there benefits over and above the base case? That is, are they net benefits, as opposed to gross benefits?
- Are there any benefits or disbenefits missing from the analysis? Or was there a double counting of the benefits?
- Have all the material project impacts been addressed?

Costs

- Are the costs reasonable? And will they give an appropriate level of confidence on the part of the government and development partners?
- Are the unit parameters used to undertake the cost estimate appropriate, given the local circumstances? And are they comparable to those used in similar projects?
- Does the size of the costs make sense? Have all the ongoing and periodic maintenance costs been included in the analysis? How do the costs compare with those for other infrastructure projects of a similar nature and magnitude?
- Has an appropriate consistency been maintained, and a sensitivity analysis undertaken, to reassure the government and development partners with regard to the costs?

CBA model

Reviewers typically gauge the integrity of the model based on the application of parameters and consistency and accuracy of the calculations and results. Two key questions to be answered are:

- Has there been a stress test of inputs, parameters, and assumptions?
- Has a full model calculation and formula review been done to check for calculation errors or double counting, and that the calculations match the formulas expressed in the methodology?

Any comments or concerns from the reviewer should be addressed by the party conducting the CBA before the reviewer endorses the analysis.

Key point

Having an independent review of the CBA is advisable as this ensures that the CBA has been properly conducted and sufficiently robust to inform good decision-making.

4 Best-Practice Management of Cost–Benefit Analysis

This section aims to give practitioners the relevant tools, tips, and tricks to best manage the CBA process. It is designed to provide them with a practical guide to procurement and management as they undertake the CBA delivery process, as well as an “at a glance” checklist to ensure that they adhere to the appropriate delivery path.

This section includes:

4.1 Cost–Benefit Analysis Procurement Considerations

4.2 Cost–Benefit Analysis Management Considerations

4.3 Tools and Checklists for Managers



Key point

It is important to manage a CBA process properly to ensure a robust CBA product to inform decision-makers.

4.1 Cost–Benefit Analysis Procurement Considerations

There are several options available to the practitioner responsible for procuring the CBA. The relative strengths and weaknesses associated with each are discussed in this section. They relate to expertise, time, practicality, and accountability. Those involved in delivering the CBA can potentially include:

- the government itself including specialist units in line agencies or the central government,

- academics, and
- private sector consultants.

Their participation should be consistent with the roles and responsibilities discussed earlier in section 3.3.

4.1.1 Strengths and Weaknesses of Procurement Options

External procurement of a CBA (whether by academics or consultants) usually has the advantage of providing the manager with a greater level of economic expertise. This can increase general confidence in the robustness of the CBA. But obtaining this expertise costs more, and there is less accountability regarding quality compared with a CBA conducted internally, by analysts within the government. These points, combined with the anticipated speed of delivery and practicality of using a particular CBA provider, need to be considered when deciding on the best procurement option.

As discussed in section 3.3, the stage and scale of the project business case should also be considered when selecting the procurement option. A project that is smaller, and at an earlier stage, is more conducive to internal delivery.

Table 7 below summarizes the key pros and cons of each procurement option.

Table 7: Cost–Benefit Analysis Procurement Options

Option	Accountability re Quality	Speed of Delivery	Theoretical vs. Practical	Level of Expertise	Cost
Government	High	Medium	Medium	Generalist	N/A
Academics	Medium–Low	Low	Theoretical	Expert	Medium
Consultants	Medium–Low	High	Practical	Expert	High

N/A = not applicable, vs. = versus, re = regarding.
Source: The authors.

4.1.2 Technical Input Procurement

Procurement should also take into account the additional technical expertise or external advisers needed for the inputs they can contribute to the CBA. The major considerations include the following:

- **Capital and operational costs.** Taking project size and stage of the infrastructure life cycle into account (and therefore the required level of cost detail), the manager should consider cost versus expertise when choosing among procurement options. Expertise may be sourced from external accredited engineers or it may be available from within the government.
- **Demand.** Depending on the size and nature of the project, demand may have to be gauged through surveys, modelling, and forecasts, in which case a higher cost will be associated with the expertise; or the needed expertise may be of a higher level, and thus best provided by the government.

4.1.3 A Consultant’s General Scope of Work

Box 8 provides an example for the manager as to what a typical general scope of works might look like when deciding to use the consultant option for providing the cost-benefit analysis.

Box 8: A Consultant's General Scope of Work—The Services Required

Guidelines

The cost-benefit analysis should be undertaken in accordance with the following guidelines:

- [insert relevant donor and national guidelines]

Purpose

The purpose of this assignment is the provision of professional services for conducting a cost-benefit analysis for the development of the [project name]. The analysis is intended to support the [type of study, e.g., pre-feasibility, feasibility, or evaluation] for the Project.

Scope of services

The required services should include the identification, measurement, and monetization of costs and benefits that are expected to be achieved through the development and implementation of the [project name]. The [Service Provider] will be required to work with the [Issuer] and their external advisers to ensure clarity regarding the specifications of the cost-benefit analysis, **as well as** the suitable inputs and assumptions.

[x number of project options] will need to be considered, including:

- [insert project options]

The [Service Provider] should consider the typical costs and benefits, including:

- [insert relevant sectoral list from Appendix A]

This is a non-exhaustive list, but the [Service Provider] will provide a comprehensive assessment of the advantages, disadvantages, risks, and potential benefits of the options considered.

Other specific requirements include:

- [insert any donor- or agency-specific requirements, e.g., evaluation periods]

Input specifications—demand

The following demand estimates [will/will not] be supplied to the [Service Provider] for the evaluation period:

- demand by [user groups] and year,
- demand growth assumptions by [user groups] and year, and
- ramp-up period.

Input specifications—costs

The following project cost estimates [will / will not] be supplied to the [Service Provider]:

- capital expenditures (CapEx) by [cost breakdown structure level] and year,
- operational expenses (OpEx) by [cost breakdown structure level] item year,
- schedule of major periodic maintenance and other expected costs to reflect a whole-of-life cost profile,
- any expected resource cost corrections (e.g., removing cost escalation, removing tax and transfer components), and
- contingency and cost escalation allowances (if any).

Methodology and assumptions

The [Service Provider's] proposal should clearly outline the methodology, inputs, and assumptions to be used in the analysis.

Outputs, scenarios, and sensitivity tests

The following indicators must be calculated and presented in the Cost-Benefit Analysis Report for each option considered:

- discounted and undiscounted annual cash flows for each cost and benefit category, in tables and/or charts;
- present value of benefits (PVB) and present value of costs (PVC);
- economic net present value (ENPV);
- benefit–cost ratio (BCR);
- economic internal rate of return (EIRR); and
- [insert others as required].

The results for these indicators should be reported for the following scenarios and/or sensitivity tests:

- CapEx costs ($\pm 5\%$, 10%, 20%),
- OpEx costs ($\pm 5\%$, 10%, 20%),
- benefits ($\pm 5\%$, 10%, 20%),
- discount rate (3%, 5%, 7%, 10%), and
- [insert others as required].

The robustness of the results for these indicators should be assessed with reference to the main risks associated with the base-case and project options, and with the sensitivity or scenario analysis of these risks.

Deliverables

The following workshops should be undertaken by the [Service Provider] with the [Issuer] and any external advisers as required:

- initial workshop, to confirm timings, outputs, and deliverables;
- costs/benefits workshop, to identify and confirm the costs and benefits associated with the base case and project option(s) to be considered in the cost–benefit analysis;
- methodology workshop, to confirm inputs, assumptions, and calculations;
- draft results workshop, to present and validate the initial results of the cost–benefit analysis modeling; and
- final results workshop, to confirm the results of the cost–benefit analysis modeling.

A Cost–Benefit Analysis Report (the “Report”) will be delivered by the [Service Provider], and will include the following for each project option considered:

- definition of the base case(s) and project option(s);
- the breakdown of estimated economic costs and benefits;
- identification and discussion of any significant costs or benefits that were not quantified and/or not monetized;
- report on key metrics;
- the distribution of costs and benefits for key stakeholders, such as user groups, nonuser groups, households, businesses, and government;
- sensitivity test scenarios relating to meaningful changes in specific variables, such as the CapEx, OpEx, and benefits;
- a technical-methodology report that details the inputs, assumptions, and calculations used in the conduct of the cost–benefit analysis; and
- a recommendation of the preferred option, supported by analysis and key outputs.

A Cost–Benefit Analysis Model (the “Model”), will be delivered by the [Service Provider] to support the Report; it will include the following:

- inputs, assumptions, calculations, and outputs for all costs and benefits, considered by year, for the base case(s) and project option(s);
- the Model in Microsoft Excel format, or other equivalent by agreement; and
- a specification document that describes the structure and use of the Model, with a log of inputs and assumptions, along with their dates, versions, and sources.

4.2 Cost–Benefit Analysis Management Considerations

During the conduct of a CBA, there are several outputs, workflows, contributors, and stakeholders to manage at various stages of the process.

There is a broad range of contributors and stakeholders, including external advisers such as engineers and specialists providing inputs, consultants or experts performing the CBA, and infrastructure committees and agencies on the central government side.

Workflows and outputs include engineering and demand-forecasting inputs, land use and planning assessments, rapid and full CBA development and results, a technical review, and the presentation to the central government agencies.

Managers may find the following tips and key considerations useful when managing these elements of the CBA process.

4.2.1 Managing Contributors and Stakeholders

The following can be useful considerations when managing contributors and stakeholders.

- **Working group or forum.** With such a large collection of participants, it is useful to have an ongoing working group or forum so that everyone is aware of what stage the process is at. This helps different contributors in their own planning, and assists in the workflows and interactions between contributors.
- **Progress scheduling.** It is important for the manager to establish a progress schedule for their contributors. This could be a weekly (or other appropriate interval) check-in whereby the contributors provide an update on their progress.
- **Stakeholder management.** The manager is also responsible for supervising the stakeholders during the analysis, such as heads of infrastructure committees and central government agency representatives. It is good practice for the manager to have a standing session for updating these stakeholders on the project status, and for helping to manage expectations with regard to delivery and results (including the economic viability of the project itself).

4.2.2 Managing Workflows and Outputs

The following can be useful considerations when managing workflows and outputs.

- **Establishing interim and final deadlines.** Setting up interim and final deadlines for each contributor within the overall CBA project plan is essential for the ultimate delivery and success of the CBA.
- **Ensuring that the necessary review process is in place.** Given that a review of the CBA is a prerequisite for approval by the relevant central government agency, the manager should ensure that the necessary CBA review is in place. The scheduling of the review should allow enough lead time before the completion of the CBA.
- **Input coordination.** To avoid persistent obstacles in the CBA workflow, the manager may assist in the coordination of inputs and approvals needed by the various contributors. These may include inputs or approvals from the government or inputs from contributors.

- **Establishing a forum for the presentation of work.** The manager should require that their project contributors present the work they are responsible for. This can occur at logical milestones during the CBA process. The presentations will enable the manager to ensure that the output is on track and standards are maintained.
- **Coordinating the presentation of final results.** The manager should also coordinate the presentation of the CBA results and of the project option recommendation to the relevant central government agency. This would include the economic expert(s) involved in the delivery of the CBA.
- **Integration of monitoring, evaluation, review, and learning (MERL).** The manager should also coordinate the MERL planning for the project. Countries or development partners may have specific requirements, but it is generally good practice to document the key benefits, how they are measured, and who is responsible for benefit realization and monitoring as the project is handed over to new contributors at each stage of the project life cycle.

4.2.3 Managing the Input and Assumption Log

A useful tool for keeping track of various inputs and assumptions in the CBA process is an input and assumptions log. The various contributors to the CBA would be required to update this log as each input and assumption is added or changed over the course of the delivery.

This requirement by the manager will ensure that a historical record of any changes is kept, so the original reasons for any inputs and assumptions are not forgotten and best-practice documentation is followed.

4.3 Tools and Checklists for Managers

There are a series of available tools to assist practitioners in the procurement, management, and delivery of a CBA. These are listed below, and should be referred to when undertaking the CBA process.

Asian Development Bank (ADB) (2017): *Guidelines for the Economic Analysis of Projects*. The guidelines provide general principles for conducting economic analyses of projects. The appendixes provide illustrations of their application.

Pacific Region Infrastructure Facility (PRIF) (2022): *Guideline to Preparing National Infrastructure Investment Plans*. The guideline outlines the key activities governments need to undertake when preparing a National Infrastructure Investment Plan (NIIP), and highlights generally accepted best practices for each step in the process. It draws on and highlights case examples from past NIIPs.

Public Expenditure and Financial Accountability (PEFA) program (2018): *PEFA Handbook Volume II: PEFA Assessment Fieldguide*. This guide presents the minimum requirements for public investment management when it comes to reaching an appropriate score. Economic analysis of investment proposals and a CBA are important dimensions of this.

Secretariat of the Pacific Regional Environment Programme (SPREP), Secretariat of the Pacific Community (SPC), the Pacific Island Forum Secretariat (PIFS), Landcare Research, and Gesellschaft für Internationale Zusammenarbeit (GIZ) (2013): *Cost-Benefit Analysis for Natural Resource Management in the Pacific: A Guide*. This guide brings together the steps of CBA with an emphasis on the Pacific region. It also standardizes approaches to CBA, so that practitioners receive consistent advice and support. The guide was written from the perspective of supporting decisions in the natural-resource management sectors, but the principles apply broadly to all sectors of the economy and society.

World Bank (2001): *Economic Analysis of Investment Operations: Analytical Tools and Practical Applications*. This guideline presents general principles and detailed methodologies that are applicable across sectors, including quantitative risk analysis. It provides both theory and practice on how to evaluate transportation, health, and education projects; and it explains how to assess the economic, social, and environmental impact of these projects.

4.3.1 Guidance from Development Partners

Further to the general guidance identified above, Table 8 sets out the specific guidance relevant to the conduct of economic evaluations by each of PRIF’s development partners.

Table 8: Guidance for Development Partner Conformance

Development Partner	Relevant Guidance	Comments
Asian Development Bank	<ul style="list-style-type: none"> ADB (2017): <i>Guidelines for the Economic Analysis of Projects</i> ADB (2013): <i>Cost-Benefit Analysis for Development: A Practical Guide</i> 	<ul style="list-style-type: none"> These publications provide specific guidelines for the conduct and assessment of CBAs for program and project investments, including sectoral guides.
Australian Department of Foreign Affairs and Trade	<ul style="list-style-type: none"> Department of Finance and Administration, Australia (2006): <i>Handbook of Cost-Benefit Analysis</i> Department of Foreign Affairs and Trade (2023): <i>International Development Programming Guide</i> 	<ul style="list-style-type: none"> General VFM principles apply. However, individual programs may have specific guidance on requirements for CBA and/or threshold metrics.
European Union and European Investment Bank	<ul style="list-style-type: none"> Sartori, Davide, Gelsomina Catalano, Mario Genco, Chiara Pancotti, Emanuela Sirtori, Silvia Vignetti, and Chiara Del Bo (2015): <i>Guide to Cost-Benefit Analysis of Investment Projects: Economic Appraisal Tool for Cohesion Policy 2014-2020</i> EIB (2023): <i>The Economic Appraisal of Investment Projects at the EIB</i>, 2nd Edition 	<ul style="list-style-type: none"> All major investment projects require a formal CBA based on monetary thresholds. EIB-financed projects typically require an EIRR greater than the social discount rate. CEA or MCA may be used when a CBA is not feasible.
Japan International Cooperation Agency	<ul style="list-style-type: none"> Tadashi Matsuno and Tetsuo Yaguchi (1999): <i>Kaihatsu Project no Hyoka (Development Project Appraisal)</i> (Japanese only) Ministry of Land, Infrastructure, Transport and Tourism, Japan (2018): <i>Hiyou Benneki Bunseki Manual (Cost Benefit Analysis Manual)</i> (Japanese only) 	<ul style="list-style-type: none"> CBA or CEA are most relevant at the individual project level.
New Zealand Ministry of Foreign Affairs and Trade	<ul style="list-style-type: none"> MFAT (2011): <i>Value for Money Guideline</i> New Zealand Treasury (2015): <i>Guide to Social Cost Benefit Analysis</i> New Zealand Treasury (2022): <i>CBAX Tool</i> 	<ul style="list-style-type: none"> VFM principles may require CBA during project design, but not necessarily for all projects. CBAX tool contains a database of New Zealand-specific data that may be relevant for valuing some impacts in PICs.

Development Partner	Relevant Guidance	Comments
United States Department of State	<ul style="list-style-type: none"> USAID (2015): <i>USAID Guidelines: Cost-Benefit Analysis</i> 	<ul style="list-style-type: none"> There is a general increase in focus on costing and effectiveness. CBA or CEA are most relevant at the individual project level.
World Bank Group	<ul style="list-style-type: none"> World Bank (2001): <i>Economic Analysis of Investment Operations: Analytical Tools and Practical Applications</i> World Bank (2010): <i>Cost-Benefit Analysis in World Bank Projects</i> World Bank (2020): <i>Public Investment Management Reference Guide</i> 	<ul style="list-style-type: none"> Specific guidelines apply for the conduct and assessment of CBAs and CEAs for program and project investments, including sectoral guides, but they are not necessarily required for all projects.

ADB = Asian Development Bank, CBA = cost-benefit analysis, CEA = cost-effectiveness analysis, EIRR = economic internal rate of return, MCA = multi-criteria analysis, MFAT = Ministry for Foreign Affairs and Trade (New Zealand), PIC = Pacific island country, USAID = United States Agency for International Development, VFM = value for money.

Source: The authors.

Box 9: Access to Climate Finance and Cost-Benefit Analysis

Preparing a CBA as part of a feasibility study for an infrastructure project is a key step in accessing climate finance.

Climate finance institutions have a responsibility to manage their finances effectively, and PIC governments and other accredited entities seeking their support are required to demonstrate good public financial management foundations and public-investment management practices. For example, the largest climate finance institute, the Green Climate Fund, requires a CBA at the project concept note stage, and more detailed costing and an updated feasibility study at the funding-proposal stage.

For projects that may consider climate finance as a financing source, it is therefore worthwhile to be prepared to integrate CBA into the project's identification, preparation, and appraisal processes.

CBA = cost-benefit analysis, PIC = Pacific Island country.

Source: M. Fouad et al. 2021. *Unlocking Access to Climate Finance for Pacific Island Countries. Departmental Papers. No. 2021/020.* Washington, DC: International Monetary Fund (IMF).

4.3.2 Procurement Checklist

Managers should use the checklist presented in Table 9 to ensure that the key procurement considerations have been addressed during the procurement process.

Table 9: Procurement Checklist

Checklist Item	Addressed?
What level of detail is required for the cost–benefit analysis? Who, therefore, is best placed to undertake it?	<input type="checkbox"/>
Can cost inputs be provided by the government? Or will external providers be required?	<input type="checkbox"/>
Can demand inputs be provided by the government? Or will external providers be required?	<input type="checkbox"/>
Has the relevant external expertise—academic(s), consultant(s)—been identified? And has a scope of work outlining the required services and outputs been written for each?	<input type="checkbox"/>
Has a working group or forum been established for the project?	<input type="checkbox"/>
Are regular progress updates in place for key stakeholders responsible for delivery?	<input type="checkbox"/>
Has a timeline for key delivery milestones been developed?	<input type="checkbox"/>
Is the necessary review process in place for key inputs and for the cost–benefit analysis itself?	<input type="checkbox"/>
Has an input and assumption log been set up for the cost–benefit analysis?	<input type="checkbox"/>

Source: The authors.

4.3.3 Cost–Benefit Analysis Checklist

Managers should use the checklist presented in Table 10 to ensure that the key elements of the CBA have been addressed. The checklist reflects the management considerations described throughout section 2 of this guide.

Table 10: Cost-Benefit Analysis Checklist

Checklist Item	Addressed?
The Base-Case and Project-Case Options	
Is the base case representative of what would happen to the problem if the government maintained its <i>current level</i> or “ <i>do-minimum</i> ” expenditure?	<input type="checkbox"/>
Do the project case options address the problem definition? What market failure is being addressed? How does the project address these problems?	<input type="checkbox"/>
Have a range of options for the project been considered, including built and non-built options? What stage of the project is being discussed? And what type of decision is being sought?	<input type="checkbox"/>
Identification of Costs and Benefits	
Do the costs span the full project life cycle (upfront and ongoing)? And are they included for both the base and project cases? Is there a supporting cost report? If so, what is the basis of estimate? Have risks, escalation, and estimate confidence been considered?	<input type="checkbox"/>
Have all the benefits been considered, including consumer benefits, producer benefits, and externalities?	<input type="checkbox"/>
Do the identified benefits arise directly from the project? Are they truly economic benefits, rather than financial transfers?	<input type="checkbox"/>

Checklist Item	Addressed?
Have the non-monetizable benefits been considered and justified with quantitative or qualitative evidence?	<input type="checkbox"/>
Assessing Underlying Demand	
Does the demand modeling include a profile of the full project evaluation period? Are there 5-year or 10-year periodic forecasts or annual forecasts? When does the project infrastructure open to users? How long will it take to reach full capacity?	<input type="checkbox"/>
Is an accompanying demand report provided, outlining all the key inputs and assumptions used to produce the demand forecasts?	<input type="checkbox"/>
Does the method for assessing underlying demand fit the stage of the project?	<input type="checkbox"/>
Monetizing the Costs and Benefits	
Have all benefits been monetized according to accepted and agreed-upon economic values, such as market or shadow prices? Is there a risk of double counting some benefits? Are all the benefits clearly due to the project?	<input type="checkbox"/>
Are all the costs presented in constant real terms?	<input type="checkbox"/>
Are all costs and benefits monetized and presented annually over the full evaluation period?	<input type="checkbox"/>
Determining the Net Benefit	
What discount rate has been used? Does it reflect the social discount rate for the country in which the project would operate? Are any key costs and benefits missing?	<input type="checkbox"/>
Has the infrastructure committee or steering group agreed upon how the benefits and costs should be valued now versus into the future?	<input type="checkbox"/>
Running Sensitivities	
Have the main economic parameters, benefits, and costs been flexed to test the sensitivity of the main economic metrics? Are the main project risks reflected in the sensitivity analysis?	<input type="checkbox"/>
Has the sensitivity analysis been conducted using the appropriate upper and lower ranges?	<input type="checkbox"/>
CBA Reporting	
Has an accompanying CBA report been prepared that documents the methodological development of the CBA, with all the inputs, assumptions, and results?	<input type="checkbox"/>
Is a conclusion and recommendation of the preferred project option provided, based on economic viability?	<input type="checkbox"/>
CBA = cost-benefit analysis. Source: The authors.	

4.3.4 Benefits Checklist

Appendix A contains a breakdown of the different benefits that would be expected, by infrastructure type. It can be used to check that all the relevant benefits have been captured as part of the project.



Appendixes

Appendix A: Quantifiable Benefits Log

Infrastructure Type	Benefit Type	Cost or Benefit Examples
Roads	Economic	<ul style="list-style-type: none"> • Travel time savings • Reduced road maintenance costs • Higher property values • Job creation • Increased tourism • Enhanced connectivity: <ul style="list-style-type: none"> ○ Improved connectivity between urban and rural areas ○ Enhanced access to markets, jobs, and services • Reduced transportation costs: <ul style="list-style-type: none"> ○ Lower transportation costs for businesses ○ Lower transportation costs for individuals • Ability to use more productive vehicles: <ul style="list-style-type: none"> ○ Accommodation of higher-capacity vehicles ○ Enhanced productivity and economic growth ○ Lower vehicle-operating costs due to better road infrastructure, including costs due to fuel consumption, maintenance, and tire wear.
	Social	<ul style="list-style-type: none"> • Improved access to essential services: <ul style="list-style-type: none"> ○ Increased access to health care ○ Increased access to education ○ Improved emergency response times • Improved road safety: <ul style="list-style-type: none"> ○ Reduced accidents ○ Saved lives • Improved social cohesion: <ul style="list-style-type: none"> ○ Connecting communities ○ Facilitating social interactions • Improved amenities: <ul style="list-style-type: none"> ○ Enhanced aesthetic appeal ○ Increased attractiveness of the area ○ Noise reduction
	Environmental	<ul style="list-style-type: none"> • Ecosystem protection • Climate resilience • Reduced greenhouse gas emissions due to: <ul style="list-style-type: none"> ○ Efficient road infrastructure ○ Use of fuel-efficient vehicles ○ Reduced traffic congestion • Improved air quality • Promotion of sustainable transportation, as road infrastructure projects include such features as dedicated bicycle lanes and pedestrian pathways
Ports/ Maritime	Economic	<ul style="list-style-type: none"> • Boost to trade and commerce • Improved productivity • Job creation • Cost-effective transportation • Attraction of investment • Enhanced tourism • Strengthening of the supply chain • Regional development • Economic diversification • Regional integration

Infrastructure Type	Benefit Type	Cost or Benefit Examples
Ports/ Maritime		<ul style="list-style-type: none"> • Foreign investment
	Social	<ul style="list-style-type: none"> • Improved connectivity • Access to essential services and resources • Skills development and capacity building • Emergency response and disaster relief • Cultural preservation and promotion • Public amenities • Disaster preparedness
	Environmental	<ul style="list-style-type: none"> • Emission reductions • Sustainable port operations • Protection of marine ecosystems • Climate resilience • Promotion of green shipping • Green infrastructure • Environmental monitoring and management
Airports	Economic	<ul style="list-style-type: none"> • Enhanced trade and commerce • Job creation • Attraction of investment • Increased tourism • Economic diversification • Regional integration
	Social	<ul style="list-style-type: none"> • Improved connectivity with other countries • Access to essential services and resources • Skills development and capacity building • Emergency response and disaster relief • Cultural preservation and promotion
	Environmental	<ul style="list-style-type: none"> • Sustainable airport operations • Protection of local ecosystems • Climate resilience • Promotion of green aviation • Green infrastructure
Energy	Economic	<ul style="list-style-type: none"> • Cost savings • Job creation • Attraction of investment • Economic diversification • Improved energy security • Regional integration
	Social	<ul style="list-style-type: none"> • Access to reliable energy • Rural electrification • Skills development and capacity building • Emergency response and disaster relief • Improvements in public health
	Environmental	<ul style="list-style-type: none"> • Reduced emissions • Sustainable resource use • Biodiversity conservation • Climate resilience • Energy efficiency
Water/ Sanitation	Economic	<ul style="list-style-type: none"> • Cost savings: <ul style="list-style-type: none"> ○ Reduced water waste ○ Lower treatment costs • Job creation: <ul style="list-style-type: none"> ○ Construction

Infrastructure Type	Benefit Type	Cost or Benefit Examples
Water/ Sanitation		<ul style="list-style-type: none"> ○ Operations ○ Maintenance ○ Related industries ● Attraction of investment ● Improved agricultural productivity ● Economic diversification: <ul style="list-style-type: none"> ○ Water management ○ Water treatment technology ○ High-value exports ● Regional integration
	Social	<ul style="list-style-type: none"> ● Access to clean water and sanitation: <ul style="list-style-type: none"> ○ Improved living standards ○ Social development support ● Rural development ● Health improvements: <ul style="list-style-type: none"> ○ Reduced disability-adjusted life years ○ Lower incidence of waterborne diseases ○ Decreased burden on the health system and reduced health care costs ● Gender equality: <ul style="list-style-type: none"> ○ Reduced workload for women ○ Increased time for educational or other activities ● Skills development and capacity building
	Environmental	<ul style="list-style-type: none"> ● Water resource management: <ul style="list-style-type: none"> ○ Sustainable water use ○ Long-term availability of water resources ● Pollution reduction: <ul style="list-style-type: none"> ○ Decreased water pollution ○ Protection of ecosystems and human health ● Biodiversity conservation ● Climate resilience ● Water efficiency: <ul style="list-style-type: none"> ○ Reduced water losses ○ Increased water conservation
Solid Waste	Economic	<ul style="list-style-type: none"> ● Cost savings: <ul style="list-style-type: none"> ○ Efficient waste collection and disposal ○ Lower waste-management costs ● Job creation: <ul style="list-style-type: none"> ○ Collection and transportation ○ Recycling and processing ○ Landfill operation and maintenance ○ Related industries ● Attraction of investment ● Economic diversification: <ul style="list-style-type: none"> ○ Waste management and recycling ○ Waste-to-energy technologies ○ High-value exports from recycled materials ● Resource recovery: <ul style="list-style-type: none"> ○ Extraction of valuable materials from waste ○ Generation of income from recycled products ● Regional integration
	Social	<ul style="list-style-type: none"> ● Improved living conditions: <ul style="list-style-type: none"> ○ Reduced exposure to waste-related health risks ○ Enhanced cleanliness and aesthetics in urban areas ● Health improvements:

Infrastructure Type	Benefit Type	Cost or Benefit Examples
Solid Waste		<ul style="list-style-type: none"> ○ Reduced disability-adjusted life years ○ Lower incidence of waste-related diseases ○ Decreased burden on health-care systems and reduced health-care costs ● Education and awareness: <ul style="list-style-type: none"> ○ Promotion of responsible waste-disposal practices ○ Encouragement of recycling and waste-reduction behaviors ● Skills development and capacity building
	Environmental	<ul style="list-style-type: none"> ● Pollution reduction: <ul style="list-style-type: none"> ○ Decreased air, soil, and water pollution from improper waste disposal ○ Reduced greenhouse gas emissions from waste decomposition ● Resource conservation: <ul style="list-style-type: none"> ○ Reduced consumption of raw materials through recycling ○ Conservation of natural resources and ecosystems ● Climate resilience: <ul style="list-style-type: none"> ○ Proper management of waste, thereby reducing methane emissions from landfills ○ Adaptation to changing waste generation patterns due to climate change ● Biodiversity conservation: <ul style="list-style-type: none"> ○ Mitigation of waste-related impacts on ecosystems and wildlife ○ Preservation of natural habitats ● Circular economy promotion: <ul style="list-style-type: none"> ○ Encouragement of waste reduction, reuse, and recycling ○ Minimization of waste generation and environmental impacts
Telecommunications/ICT	Economic	<ul style="list-style-type: none"> ● Cost savings ● Job creation ● Attraction of investment: <ul style="list-style-type: none"> ○ Encouragement of business investment in the region ○ Promotion of innovation and technology-based industries ● Economic diversification: <ul style="list-style-type: none"> ○ Development of digital services and products ○ Expansion of technology-based sectors ● Enhanced trade and commerce: <ul style="list-style-type: none"> ○ Facilitation of electronic transactions and e-commerce ○ Improved access to global markets ● Regional integration: <ul style="list-style-type: none"> ○ Strengthened connectivity among neighboring countries ○ Facilitation of cross-border collaboration
	Social	<ul style="list-style-type: none"> ● Improved access to information and services: <ul style="list-style-type: none"> ○ Enhanced availability of education, health-care, and government services ○ Greater access to global information and knowledge resources ● Digital inclusion: <ul style="list-style-type: none"> ○ Reduction of the digital divide ○ Empowerment of marginalized groups ● Social cohesion: <ul style="list-style-type: none"> ○ Strengthened communication and collaboration among communities ○ Enhanced cultural exchange and understanding ● Health improvements: <ul style="list-style-type: none"> ○ Improved access to telemedicine and remote health-care services ○ Increased health awareness through digital health information

Infrastructure Type	Benefit Type	Cost or Benefit Examples
Telecommunications/ICT		<ul style="list-style-type: none"> • Skills development and capacity building: <ul style="list-style-type: none"> ○ Training opportunities in ICT and digital skills ○ Creation of a skilled workforce
	Environmental	<ul style="list-style-type: none"> • Reduced environmental impact: <ul style="list-style-type: none"> ○ Decreased need for transportation and travel ○ Lower emissions and resource consumption • Promotion of sustainable practices: <ul style="list-style-type: none"> ○ Facilitation of digital solutions for energy and resource management ○ Encouragement of eco-friendly technologies and practices • Climate resilience: <ul style="list-style-type: none"> ○ Improved access to climate data and early warning systems ○ Enhanced communication during disaster response and recovery efforts • Biodiversity conservation: <ul style="list-style-type: none"> ○ Monitoring and management of natural resources and ecosystems ○ Raising environmental awareness through digital platforms • Circular economy promotion
Health	Economic	<ul style="list-style-type: none"> • Cost savings: <ul style="list-style-type: none"> ○ Reduced health-care costs ○ Improved resource allocation • Job creation • Attraction of investment: <ul style="list-style-type: none"> ○ Encouragement of private health-care providers to invest in the region ○ Attraction of research institutions and funding
	Social	<ul style="list-style-type: none"> • Access to health care: <ul style="list-style-type: none"> ○ Enhanced availability of health-care services ○ Improved quality of health-care services • Health improvements: <ul style="list-style-type: none"> ○ Reduced disability-adjusted life years ○ Lower morbidity and mortality rates • Health equity: <ul style="list-style-type: none"> ○ Reduced health-care access disparities ○ Improved health-care services in rural areas • Skills development and capacity building <ul style="list-style-type: none"> ○ Training opportunities for health-care professionals ○ Development of a skilled health-care workforce
	Environmental	<ul style="list-style-type: none"> • Reduced environmental impact: <ul style="list-style-type: none"> ○ Lower energy consumption ○ Reduced waste generation and pollution • Climate resilience: <ul style="list-style-type: none"> ○ Climate-resilient design and construction ○ Adaptation to changing climate conditions • Promotion of sustainable practices: <ul style="list-style-type: none"> ○ Adoption of eco-friendly technologies ○ Implementation of sustainable practices at health-care facilities • Biodiversity conservation: <ul style="list-style-type: none"> ○ Preservation of natural resources ○ Protection of ecosystems
Education	Economic	<ul style="list-style-type: none"> • Cost savings: <ul style="list-style-type: none"> ○ Reduced education costs ○ Improved allocation of resources • Job creation

Infrastructure Type	Benefit Type	Cost or Benefit Examples
Education		<ul style="list-style-type: none"> • Attraction of investment: <ul style="list-style-type: none"> ○ Encouragement of private education providers to invest in the region ○ Attraction of research institutions and funding • Human capital development: <ul style="list-style-type: none"> ○ Development of a skilled workforce ○ Increased productivity and economic growth
	Social	<ul style="list-style-type: none"> • Access to education: <ul style="list-style-type: none"> ○ Enhanced availability of education services ○ Improved quality of education services • Education equity: <ul style="list-style-type: none"> ○ Reduced education access disparities ○ Improved education services in rural areas • Skills development and capacity building: <ul style="list-style-type: none"> ○ Training opportunities for educators ○ Development of a skilled education workforce • Social cohesion: <ul style="list-style-type: none"> ○ Strengthened community bonds ○ Enhanced cultural exchange and understanding
	Environmental	<ul style="list-style-type: none"> • Reduced environmental impact: <ul style="list-style-type: none"> ○ Lower energy consumption ○ Reduced waste generation and pollution • Climate resilience: <ul style="list-style-type: none"> ○ Climate-resilient design and construction ○ Adaptation to changing climate conditions • Promotion of sustainable practices: <ul style="list-style-type: none"> ○ Adoption of eco-friendly technologies ○ Implementation of sustainable practices in educational facilities • Environmental education: <ul style="list-style-type: none"> ○ Integration of environmental education into the curriculum ○ Raising environmental awareness among students
Government Buildings/ Facilities	Economic	<ul style="list-style-type: none"> • Cost savings: <ul style="list-style-type: none"> ○ Reduced operating costs ○ Improved allocation of resources • Job creation • Attraction of investment: <ul style="list-style-type: none"> ○ Signaling a stable and organized administration ○ Attraction of businesses
	Social	<ul style="list-style-type: none"> • Improved public services: <ul style="list-style-type: none"> ○ Enhanced delivery of public services ○ Improved interaction with the public • Access to government services: <ul style="list-style-type: none"> ○ Reduced access disparities ○ Improved government services in rural areas • Civic pride and engagement: <ul style="list-style-type: none"> ○ Strengthened civic pride ○ Encouragement of public engagement in governance
	Environmental	<ul style="list-style-type: none"> • Reduced environmental impact: <ul style="list-style-type: none"> ○ Lower energy consumption ○ Reduced waste generation and pollution • Climate resilience: <ul style="list-style-type: none"> ○ Climate-resilient design and construction ○ Adaptation to changing climate conditions • Promotion of sustainable practices: <ul style="list-style-type: none"> ○ Adoption of eco-friendly technologies

Infrastructure Type	Benefit Type	Cost or Benefit Examples
		<ul style="list-style-type: none"> ○ Implementation of sustainable practices in public infrastructure ● Environmental leadership: <ul style="list-style-type: none"> ○ Showcasing sustainable design and construction ○ Encouraging other development projects to adopt sustainable practices
Agricultural / Forestry	Economic	<ul style="list-style-type: none"> ● Increased productivity: <ul style="list-style-type: none"> ○ Enhanced farming productivity ○ Enhanced fishing productivity ○ Enhanced forestry productivity ● Job creation ● Market access: <ul style="list-style-type: none"> ○ Enhanced access to domestic markets ○ Enhanced access to international markets ● Value added to production: <ul style="list-style-type: none"> ○ Encouragement of value addition ○ Increased processing of agricultural and forestry products
	Social	<ul style="list-style-type: none"> ● Food security: <ul style="list-style-type: none"> ○ Increased availability of food ○ Improved access to food ● Rural development: <ul style="list-style-type: none"> ○ Infrastructure development in rural areas ○ Improved quality of life for rural populations ● Skills development and capacity building: <ul style="list-style-type: none"> ○ Training opportunities for farmers, fishers, and foresters ○ Development of a skilled workforce in agriculture and forestry
	Environmental	<ul style="list-style-type: none"> ● Sustainable resource management: <ul style="list-style-type: none"> ○ Responsible use of land and water resources ○ Sustainable management of forests and fisheries ● Climate resilience: <ul style="list-style-type: none"> ○ Climate-resilient design and construction ○ Adaptation to changing climate conditions ● Promotion of sustainable practices: <ul style="list-style-type: none"> ○ Adoption of eco-friendly technologies ○ Implementation of sustainable practices in agriculture and forestry ● Biodiversity conservation: <ul style="list-style-type: none"> ○ Preservation of natural resources ○ Protection of ecosystems
Fisheries	Economic	<ul style="list-style-type: none"> ● Increased productivity: <ul style="list-style-type: none"> ○ Enhanced fishing productivity ○ Improved fishing efficiency ● Job creation ● Market access: <ul style="list-style-type: none"> ○ Enhanced access to domestic markets ○ Enhanced access to international markets ● Value addition: <ul style="list-style-type: none"> ○ Encouragement of value addition ○ Increased processing of fishery products
	Social	<ul style="list-style-type: none"> ● Food security: <ul style="list-style-type: none"> ○ Increased availability of fishery products ○ Improved access to fishery products ● Rural development: <ul style="list-style-type: none"> ○ Infrastructure development in coastal areas ○ Improved quality of life for fishing communities ● Skills development and capacity building:

Infrastructure Type	Benefit Type	Cost or Benefit Examples
Fisheries		<ul style="list-style-type: none"> ○ Training opportunities for fishers and fishery workers ○ Development of a skilled workforce in the fishing industry
	Environmental	<ul style="list-style-type: none"> ● Sustainable resource management: <ul style="list-style-type: none"> ○ Responsible use of fishery resources ○ Sustainable management of fish stocks ● Climate resilience: <ul style="list-style-type: none"> ○ Climate-resilient design and construction ○ Adaptation to changing climate conditions ● Promotion of sustainable practices: <ul style="list-style-type: none"> ○ Adoption of eco-friendly technologies ○ Implementation of sustainable practices in fisheries ● Biodiversity conservation: <ul style="list-style-type: none"> ○ Preservation of marine resources ○ Protection of marine ecosystems
Coastal/ River Protection	Economic	<ul style="list-style-type: none"> ● Infrastructure protection: <ul style="list-style-type: none"> ○ Reduced repair and replacement costs ○ Enhanced infrastructure resilience ● Job creation ● Increased land value: <ul style="list-style-type: none"> ○ Enhanced land value in protected areas ○ Attraction of investment and development ● Reduced economic loss: <ul style="list-style-type: none"> ○ Minimized losses from flooding ○ Minimized losses from coastal erosion
	Social	<ul style="list-style-type: none"> ● Community safety: <ul style="list-style-type: none"> ○ Enhanced safety in flood-prone areas ○ Enhanced safety in coastal areas ● Improved quality of life: <ul style="list-style-type: none"> ○ Reduced disruption from flooding ○ Reduced disruption from coastal erosion ● Social cohesion: <ul style="list-style-type: none"> ○ Strengthened community bonds ○ Encouragement of public engagement in infrastructure projects
	Environmental	<ul style="list-style-type: none"> ● Ecosystem preservation: <ul style="list-style-type: none"> ○ Preservation of coastal ecosystems ○ Preservation of riverine ecosystems ● Climate resilience: <ul style="list-style-type: none"> ○ Climate-resilient design and construction ○ Adaptation to changing climate conditions ● Sustainable resource management: <ul style="list-style-type: none"> ○ Responsible use of coastal resources ○ Responsible use of river resources ● Biodiversity conservation: <ul style="list-style-type: none"> ○ Conservation of aquatic species ○ Conservation of terrestrial species
Other	Economic	<ul style="list-style-type: none"> ● Cost savings: <ul style="list-style-type: none"> ○ Reduced operating costs ○ Improved allocation of resources ● Job creation ● Attraction of investment: <ul style="list-style-type: none"> ○ Signaling a stable and organized administration ○ Attraction of businesses
	Social	<ul style="list-style-type: none"> ● Improved public services: <ul style="list-style-type: none"> ○ Enhanced delivery of public services ○ Improved interaction with the public

Infrastructure Type	Benefit Type	Cost or Benefit Examples
Other		<ul style="list-style-type: none"> • Access to services: <ul style="list-style-type: none"> ○ Reduced access disparities ○ Improved services in rural areas • Civic pride and engagement: <ul style="list-style-type: none"> ○ Strengthened civic pride ○ Encouragement of public engagement in governance
	Environmental	<ul style="list-style-type: none"> • Reduced environmental impact: <ul style="list-style-type: none"> ○ Lower energy consumption ○ Reduced waste generation and pollution • Climate resilience: <ul style="list-style-type: none"> ○ Climate-resilient design and construction ○ Adaptation to changing climate conditions • Promotion of sustainable practices: <ul style="list-style-type: none"> ○ Adoption of eco-friendly technologies ○ Implementation of sustainable practices in public infrastructure • Environmental leadership: <ul style="list-style-type: none"> ○ Showcasing sustainable design and construction ○ Encouraging other development projects to adopt sustainable practices

ICT = information and communication technology.

Source: The authors



Appendix B: Relevant Economic Guidelines

Guideline	Type
Asian Development Bank (2017): <i>Guidelines for the Economic Analysis of Projects</i>	Economic evaluation
Infrastructure Australia (2021): <i>Guide to Economic Appraisal: Technical Guide of the Assessment Framework.</i>	Economic evaluation
World Bank (2001): <i>Economic Analysis of Investment Operations: Analytical Tools and Practical Applications</i>	Economic evaluation
New Zealand Transport Agency (2023): <i>Monetised Benefits and Costs Manual</i>	Economic evaluation
Secretariat of the Pacific Regional Environment Programme (SPREP) (originally published 2013, modified 2022): <i>Cost–Benefit Analysis for Natural Resource Management in the Pacific: A Guide</i>	Economic evaluation
Public Expenditure and Financial Accountability (PEFA) program (2018): <i>PEFA Handbook Volume II: PEFA Assessment Fieldguide</i>	Public financial management
United Kingdom Department for Transport (2013): <i>Transport Analysis Guidance</i>	Economic evaluation
European Commission (2021): <i>Economic Appraisal Vademecum 2021–2027: General Principles and Sector Applications</i>	Economic evaluation
Pacific Region Infrastructure Facility (PRIF) (2022): <i>Guideline to Preparing National Infrastructure Investment Plans</i>	Infrastructure planning

Source: The authors.





Pacific Region
Infrastructure Facility

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