Cost-Benefit Analysis – CRIDF Guidance & Template

CBA Guideline & Template

Version: Final

August 2015

CRIDF

Version #: Final **Date:** 26 August 2015 **Lead Author:** Candice Eb, Ewan Snedden **QA'd by:** Charles Reeve, Jeremy Richardson, Valsa Shah, Mbali Malekane

Disclaimer

The British Government's Department for International Development (DFID) financed this work as part of the United Kingdom's aid programme. However, the views and recommendations contained in this report are those of the consultant, and DFID is not responsible for, or bound by the recommendations made.

UKaid from the British people

Contents

List of Tables

CRIDF

List of Acronyms

Acronym	Long-Form
ADB	Asian Development Bank
AFDB	African Development Bank
ATP	Ability to pay
B/C Ratio	Benefit to cost ratio
CBA	Cost benefit analysis
CBO	Community based organisation
CEA	Cost effectiveness analysis
CRIDF	Climate Resilient Infrastructure Development Community
DFID	Department for International Development
ENPV	Economic net present value
ERR	Economic rate of return
FIRR	Financial internal rate of return
FNPV	Financial net present value
NGO	Non-governmental organisation
N/K Ratio	Net benefits to investment ratio
NPV	Net present value
O&M	Operations and maintenance
SADC	Southern African Development Community
SDR	Social Discount Rate
VFM	Value for money
WACC	Weighted average cost of capital
WASH	Water, sanitation and hygiene
WB	World Bank
WRC	Water Research Commission
WTP	Willingness to pay

Key Definitions

Ability-to-Pay	ATP refers to the ability of the users to pay for the (water) services, as expressed by the ratio of the monthly household water consumption expenditure to the monthly household income[1]
Conversion Factor	Ratio between the economic price and the financial price for a project output or input, which can be used to convert the financial values of project costs and benefits to economic values. Conversion factors can also be applied for groups of typical items, such as water supply, transport, etc.[2]
Depreciation	The anticipated reduction over time in the value of an asset that is brought about by physical use or obsolescence. This may need to be considered in some of CRIDF's larger projects.
Discounting	The process of calculating the present day value of a future cost/benefit by multiplying the future cost/benefit by a discount rate.
Economic/project life	The period during which a fixed asset is capable of yielding services
Economic price	Price of goods and services which reflect their values or opportunity costs to the economy as a whole. This is also referred to as the shadow price.
ERR	Economic Rate of Return of a project is the rate of return that would be achieved from an investment when all cost and benefits are measured in economic prices. For a project to be acceptable, the ERR should be greater than the discount rate (or economic opportunity cost of capital), unless significant benefits are identified but remain unquantifiable in monetary terms.
Externalities	The wider impacts of a project on the environment, ecology, or general standard of living which are not reflected by the market prices of inputs/outputs, and not internalised by any particular stakeholder.
FIRR	Financial Internal Rate of Return of a project is the rate of return where all costs are measured in financial prices and where all benefits are represent the financial revenues that would accrue to the main project sponsor. The FIRR should be compared to the financial opportunity cost of capital (financial discount rate) to determine whether the project is financially viable.
Market prices	Prices at which products and services trade, irrespective of the level of interference in the market.

[1] Asian Development Bank (1999) "Handbook for the Economic Analysis of Water Supply Projects", http://www.adb.org/Documents/Handbooks/Water_Supply_Projects
[2] Ibid

Net Present Value The difference between the present value of the benefit stream and the present value of the cost stream for a project. The NPV calculated at the chosen discount rate should be greater than zero in order for the project to be undertaken, unless significant benefits are identified but remain unquantifiable in monetary terms. When analysing (mutually exclusive) alternatives, the alternative with the greatest NPV is preferred.

Opportunity cost The opportunity cost is the value of something foregone – that is the benefit foregone from not using a good or resource in its next best alternative use. Measured in economic prices, it represents the appropriate value to price impacts in the economic appraisal.

Surrogate prices The prices used to value costs and benefits in the economic appraisal when no market prices exist or where no associated market price can be determined.

Willingness to Pay WTP is an estimate of the real value society places on a good / service (unrelated to ability to pay). For example, in assessing the real economic value of additional water supplied, the revenues used in the financial analysis from water tariffs/fees, are not relevant to the economic analysis. The value of water for various uses (domestic, irrigation, industry) in the economic study should rather be the WTP for the service in each of these activities.

WTP can be estimated by market prices of alternative services (tanks, bottled water etc.) – i.e. the price of the best alternative technology or service feasible for the supply of the same area. In the absence of such WTP estimates, a conversion factor may be applied to the revenues from the water service, realised or improved by the project.

Executive Summary

Cost-Benefit Analysis (CBA) is a methodology for appraising the economic value of investment projects or proposals. A CBA seeks to identify the financial, economic and social implications of various project options with a view to identifying the best performing option. The purpose of conducting a CBA is to assess whether a proposed project design will generate a net positive benefit for society (i.e. is this a good use of public money). Importantly, the CBA estimates this impact in both financial and economic terms and consequently.

This document has been prepared to provide guidance to economists conducting a CRIDF project CBA on issues of technical methodology as well as on areas which must be analysed when deciding on what constitutes a positive impact on society in light of CRIDF's priorities. Overall, CRIDF expects that this document shall enable consistency of methodology and presentation between different CBA reports so that there is increased objectivity in the choice of which project should move ahead to implementation.

The level of detail and coverage of each CBA will vary according to the size and complexity of the project under analysis, but every CBA should cover the following areas:

The **context** and **objectives** of the project;

An **options appraisal** which outlines the technically feasible options for implementing the project and identifies a 'long list' of options and documents the rationale for reducing this to a 'short list' of technically feasible options to be included in the CBA to appraise their relative economic and financial performance;

A **financial appraisal** which presents a detailed cash flow analysis for the technically preferred option against the do–nothing counterfactual;

An **economic appraisal** which presents an analysis of the socio–economic costs and benefits, including qualitative benefits, against the do–nothing counterfactual;

A **sensitivity analysis** which tests the robustness of the results based on the key assumptions used in the financial and economic appraisals;

A **sustainability analysis** which assesses the on-going sustainability of the project based on the results of the financial and economic analysis;

A **risk assessment** presenting the financial and economic risks and potential mitigation measures.

To ensure that the CRIDF CBA Report covers the above listed areas, the economist should be involved in the project from an early stage and gain an understanding of the project, target communities and overarching objectives. The economist can also provide inputs to the technical team, assisting them in recommending the most value for money option for implementation.

The expected output of every CRIDF CBA Report is a mix of quantitative and qualitative results. The quantitative outputs for the technically feasible options being appraised must present the following indicators:

Net Present Value:

The difference between the present value of the benefit stream and the present value of the cost stream for a project.

Economic Rate of Return:

The rate of return that would be achieved, when all cost and benefits are measured in economic prices

Benefit to Cost Ratio:

The ratio of costs to benefits monetised by economic prices.

Net Benefit to Investment Ratio:

The ratio of net benefits to investment costs

Financial Appraisal	Economic Appraisal
Financial Net present value (FNPV)	Economic Net Present Value (ENPV)
Financial Internal Rate of Return (FIRR)	Economic Rate of Return (ERR)
Financial Net Benefit / Investment Ratio (F-N/K Ratio)	Economic Benefit / Cost Ratio (B/C Ratio)
	Economic Net Benefit / Investment Ratio (E-N/K Ratio)

Together with the qualitative output – which must provide a description and assessment of the costs and benefits that could not be fully quantified or monetised – the quantitative metrics will assist CRIDF in deciding whether a particular project is financially and/or economically feasible.

Since CRIDF projects are not driven by profit motive, the funding decision may be based on the outputs of the economic appraisal (i.e., where the financial case on its own is not robust). The minimum evaluation criteria for CRIDF projects are as follows:

- The Economic Net Present Value should be greater than zero
- The Economic Rate of Return should be greater than the discount rate, but
    - The ERR should be assessed with caution as it relies on the assumption that returns from an investment are reinvested and at the same rate of return as the ERR. This assumption may be unrealistic if, for example, returns are not reinvested in projects generating the same return or higher, or if non-financial benefits are not captured and reinvested in a way similar to financial investments, potentially overstating the actual returns of a project. The ERR should thus only be used in conjunction with other economic indicators as indicators of the economic viability of a project.
- The Benefit / Cost Ratio should be greater than 1, however

    Should the Benefit / Cost Ratio be marginally attractive (between 1 and 2), the appraisal results and the project will be subject to an internal discussion between the project team, CRIDF PMU, and DFID. Such a discussion will enable a more considered decision as to the project's economic viability; taking into account the project characteristics and context, qualitative impacts, and possible reasons for the marginal quantitative results.
- The Net Benefit / Investment Ratio calculates the present value of net benefits generated per unit cost of investment. It is a useful tool for ranking projects, particularly in cases where capital is limited and where the biggest "bang for buck" per unit of investment is required.

Typically, the full financial and economic appraisal is only conducted for a 'short list' of technically feasible options which have not already been discarded as being unambiguously inferior e.g. on cost, equity, environmental or social grounds. Larger projects, or projects with genuine technological or design solutions, are more likely to require a full financial and/or economic appraisal for multiple options.

Data limitations often constrain the level of detail of the CBA. It is recommended that economists use well–justified assumptions based on similar programs being implemented in the SADC region for computing the benefits of a

project. It is also recommended that even if quantification and monetisation of benefits is not possible, qualitative description be used to capture, particularly the direct benefits that can potentially accrue from the project.

Economists should make adjustments for optimism bias, use appropriate discount rates and inflation rates, as well as make fiscal corrections as explained in the section on ‘key technical issues’. Sensitivity Analysis to check the robustness of assumptions is a key part of the CBA.

Deviations from this guidance and the template provided may be required for certain projects where insurmountable data constraints exist. This will be at the discretion of the economist; however, it should be clearly explained and justified in the context of the specific project.

Introduction

The purpose of these guidelines is to enable a certain degree of consistency in the methodology and structure followed in conducting cost benefit analysis (CBA) as part of the feasibility studies for CRIDF Infrastructure Projects.

CRIDF recognises that there is a need to provide structured guidance to consultants who may be less familiar with CRIDF projects (and/or donor funded projects that are primarily focused on social benefits). Based on internationally accepted guidelines used by The World Bank, European Union, DFID, Asian Development Bank (as well as various other international development institutions), this document provides CRIDF specific guidance on CBA.

This report is set out as follows:

- Section 1 provides an overview of CBA, the purpose of the analysis, the core components and expected outputs of any CBA;
- Section 2 presents a step by step methodology for conducting a CBA;
- Section 3 provides guidance on how to deal with common technical issues, based on lessons from international best practice;
- Section 4 sets out the CRIDF template of a CBA, and expected CBA summary report structure;
- Section 5 consists of a few key references, international guidelines and relevant case-studies/reports.

It is understandable that deviation from the guidance / template provided may be required for certain projects, particularly in the light of data constraints. Deviation is at the discretion of the economist; however, it should be clearly explained and justified in the context of the specific project.

Overview of CBA

Cost-Benefit Analysis (CBA) is a methodology for appraising the economic value of investment projects or proposals. It is a test that involves weighing the implicit and explicit positive and negative impacts (costs and benefits) of a public project, in terms of its contribution to social welfare. The analysis finds, quantifies, and adds all the positive factors (benefits), then identifies, quantifies and subtracts all the negatives (costs). The difference between the two indicates whether the planned action has a net benefit and is therefore advisable or should be altered or discarded. The approach is explicitly designed to inform decision-makers through optimizing the social, economic and environmental impacts.

In order to directly compare the various costs and benefits, the impacts are quantified as far as possible and monetised (assigned a monetary value that reflects the real value to society), through the use of economic valuation techniques. The costs and benefits – which occur throughout the project lifetime – are then discounted to a present-day value to find the net present value of the project.

The purpose of conducting a CBA is to assess whether a proposed project, as it is currently designed, will result in a net positive impact on society. Importantly, a CBA estimates this impact in both financial and economic terms. A CBA seeks to identify the financial, economic and social implications of the viable project alternatives in order to identify the best alternative.[3]

Given that profit is not the main objective, particularly in the public sector; a CBA serves to indicate whether there is a socio-economic rationale for the public provision of a good/service because it will generate a positive net social benefit, even when the project may not necessarily be financially profitable. The primary objectives of CRIDF include the promotion of trans-boundary management and peace dividends; climate resilience; and poverty eradication. In addition, CRIDF projects try to seek high benefits for women and children. CRIDF CBAs must therefore be conducted with these CRIDF priorities in mind.

Moreover, in addition to being an evaluation tool that enables more scientific choice of infrastructure; in the case of joint infrastructure, CBA can be used as a tool for cost and benefit sharing with a view to promoting optimality, efficiency, equity and fairness (and thus cooperation in the allocation of a water resource either for a single project or for an entire basin's development).[4]

Key components of a CBA

The format of a CRIDF CBA should follow the CRIDF Report template set out in Table 4 below. In addition, a clean and easily understandable version of the spreadsheet consisting of the data and calculations used should accompany the Report. The detail and exhaustiveness of a CBA will vary according to the size and complexity of the project under analysis[5], but every CBA must consist of the following core components:

[3] Conningarth Economists (2007) "A Manual for Cost-Benefit Analysis in South Africa with Specific reference to Water Resource Development" Water Research Commission
[4] Economic Commission for Africa (2012) "Cost-Benefit Analysis for Regional Infrastructure in Water and Power Sectors in Southern Africa" ECA Publications, Addis Ababa
[5] This is discussed further in the section on **Data constraints** below.

Table 1 **Key components of a CBA for CRIDF Projects**

CBA Component	Basic Explanation
Context & objectives	• Socio-economic context and needs/demand analysis • Project objectives (including any specific design or technological objectives) • Definition of project boundaries/parameters/phasing
Options appraisal	• Provide a full list of costs and benefits, detailing which will be 1) quantified and monetised, 2) those that will be quantified only and 3) those which will be described qualitatively. • Outline of technically viable options to achieve the project objectives, based on appropriate technology and institutional capacity • Appraisal of technically feasible options
Financial appraisal	• Discounted net cash flow – expenditures and revenues (FNPV, FIRR, F-N/K Ratio) • Sources of finance • Application of funds
Economic appraisal	• Discounted net costs and benefits (ENPV, ERR, B/C ratio, E-N/K Ratio) • Description and assessment of qualitative impacts
Sensitivity analysis	• A robustness check of the results of both the Financial and Economic appraisals, based on the key assumptions and parameters used in the appraisals
Sustainability Analysis	• An assessment of the on-going sustainability of the project based on the results of the financial and economic analysis
Risk Assessment	• Identification of key financial and economic risks faced by the project (institutional capacity; distribution of impacts, etc.) • Recommendations for risk mitigation arrangements

Financial and Economic appraisals

As indicated in Table 1, the financial and economic appraisals are the most important parts of a CBA.

The **financial appraisal** of an investment project is an assessment of the costs and benefits in terms of project expenditures and incomes at market prices (cash flows, profitability, and the application of funds). It gives an indication of the pressure the project will place on the project budget, and the degree of subsidization it may require to be financially viable.[6] [7]Further, it also reflects the profitability of the project at market prices which is an important starting point in any comprehensive CBA. While the **options appraisal** should put forward a brief assessment of the costs associated with each technical option; the **financial appraisal** will consist of a full cash flow analysis, i.e. analysis of all expenditures (i.e. outflows) and revenues (i.e. inflows) for the preferred technical option.

[THE ECONOMIC APPRAISAL ASSESSES THE PROJECT FROM THE PERSPECTIVE OF THE WHOLE ECONOMY. IN CONTRAST, THE FINANCIAL APPRAISAL IS FROM THE PERSPECTIVE OF PROJECT BUDGET. DOING BOTH AS PART OF THE CBA ENABLES DECISION MAKING REGARDING THE FINANCING OF A PROJECT TO BE INFORMED NOT ONLY BY THE PROJECT'S FINANCIAL RETURNS BUT ALSO FROM ITS SOCIO-ECONOMIC VALUE.]

The **economic appraisal** of an investment project looks at a wider spectrum of costs and benefits than in the case of pure profit determination, and does so at monetary values that reflect the real scarcity of project costs and benefits, as opposed to market prices. The aim of an economic appraisal is to assess a, *"project's contribution to the economic welfare of the region."*[8] The **options appraisal** should include a brief qualitative assessment of the project's contribution to the standard of living of the target communities for each technical option; however the full **economic appraisal** will include the quantification and monetisation of economic costs and benefits for the preferred technical option.

A CBA requires both a financial and economic appraisal, in order to understand the impact of the project on both the implementing agent and society as a whole. The financial appraisal serves to first focus purely on monetary revenues and costs borne by the entity; while the economic appraisal then factors in non-revenue related benefits and costs to the larger society. Since most of the outputs of social/environmental projects are not traded in markets for goods and services, financial costs and revenues fail to capture the social/environmental benefits associated with such projects. Hence, on the basis of financial criteria only, social/environmental investments may fail to prove viable enough to secure public funds.

Expected Outputs – Quantitative & Qualitative

Some of the socio-economic benefits and associated risks of a project may be difficult to value. These should be identified and described in as much detail as possible. In addition to a qualitative description and assessment of

[6] Conningarth Economists (2007) "A Manual for Cost-Benefit Analysis in South Africa with Specific reference to Water Resource Development" Water Research Commission

[7] A strict distinction should be made between sustainability and viability. If ongoing subsidy is required for a project to be financially viable, sustainability should be examined in detail.

[8]European Commission (2002) "Guide to Cost-Benefit Analysis of investment projects", prepared for Evaluation Unit, DG Regional Policy, EC.

these project impacts that could not be fully quantified or monetised; the following quantitative performance indicators must be computed for the preferred technical option as part of the CBA:

Table 2 **Expected outputs of a CBA**

Financial Appraisal	Economic Appraisal
Economic Prices: Price of goods and services which reflect their values or opportunity costs to the economy as a whole. This is also referred to as the shadow price.	
Financial Net present value (FNPV)	Economic Net Present Value (ENPV)
Financial Internal Rate of Return (FIRR)	Economic Rate of Return (ERR)
Financial Net Benefit/Investment Ratio	Economic Benefit/Cost Ratio (B/C Ratio)
	Economic Net Benefit/Investment Ratio

Since CRIDF projects are not driven by profit motive, the funding decision may be based on the outputs of the economic appraisal (i.e., where the financial case on its own is not robust). The financial appraisal uses market prices in the computation of costs and benefits, while the economic analysis uses economic (shadow) prices of goods and services which include, as far as possible, any social and environmental externalities associated with the project.[9]

The minimum evaluation criteria for CRIDF projects are as follows:

[9] Economic Commission for Africa (2012) "Cost-Benefit Analysis for Regional Infrastructure in Water and Power Sectors in Southern Africa" ECA Publications, Addis Ababa

- The ENPV should be greater than zero
- The ERR should be greater than the discount rate
    - The ERR should be assessed with caution as it relies on the assumption that returns from an investment are reinvested and at the same rate of return as the ERR. This assumption may be unrealistic if, for example, returns are not reinvested in projects generating the same return or higher, or if non-financial, economic benefits are not captured and reinvested in a way similar to financial investments. The use of ERR in these cases may therefore overstate the actual returns of a project, something exacerbated the greater the difference between the ERR and the discount rate. The ERR should therefore only be used in conjunction with other economic indicators (such as the ENPV and B/C Ratio) as indicators of the economic viability of a project.
- The B/C ratio should be greater than 1, however
    - If the B/C ratio is between 1 and 2, the results and the project will be subject to an internal discussion between the project team, CRIDF PMU, and DFID. Such a discussion will enable a more considered decision as to the project's economic viability; taking into account the project characteristics and context, qualitative impacts, and possible reasons for the marginal quantitative results.

The ENPV is the most reliable quantitative indicator and is often used as the main reference signal for economic performance. The ERR and B/C ratio are also meaningful as they are independent of project size, however these indicators can be problematic – there may be cases where the ERR is undefined or has multiple solutions; and the B/C ratio may be affected by considering a given flow as either a benefit or cost-reduction.[10]

The Net Benefit/Investment (N/K) ratio is a form of the B/C Ratio that calculates the present value of the project's net benefits relative to the present value of investment necessary to fund the project.[11] This can be thought of as a profitability ratio; i.e. the present value of net benefits generated per unit cost of investment.[12] The N/K Ratio is therefore a useful tool for ranking projects, particularly in cases where capital is limited and where the biggest "bang for buck" per unit of investment is required. However, this is only the case where the CBA captures the economic value of benefits, which is unlikely in many of the projects with which CRIDF is involved – at the margins of the formal economy. A number of other considerations are outlined below, beginning with 'equity considerations', which may carry at least as much weight as the quantitative outputs from an economic CBA.

It may be the case that a full financial and economic appraisal is only conducted for the preferred option that is recommended by the technical options appraisal. However, larger projects, or projects where there is not an unambiguous technological solution, are likely to require a full financial and/or economic appraisal for several

[10] Economic Commission for Africa (2012) "Cost-Benefit Analysis for Regional Infrastructure in Water and Power Sectors in Southern Africa" ECA Publications, Addis Ababa

[11] The key difference between the N/K Ratio and the B/C Ratio is that the former shows the value of the project's discounted benefits *net of capital and operating costs* relative to investment costs, while the latter shows the value of the project's discounted gross benefits relative to discounted total costs (both investment and operating).

[12] Campbell, H.F. and Brown, Richard P.C. 2003. Benefit-Cost Analysis: Financial and Economic Appraisal using Spreadsheets. Cambridge University Press; New York.

options. This could be an iterative process and it requires early involvement by the economist within the multi-disciplinary team.

Equity considerations

Explain in greater detail who the target beneficiaries are and their socio income group. Poorer beneficiaries should be theoretically given a higher weighting in CBA, but the methodology is open to scrutiny and is contentious, so we do not recommend that this calculation is undertaken. Instead, the socio economic groups of the beneficiary groups should be clearly laid out in a semi qualitative way, and value judgements should be taken on the distributional impact of the project.

Welfare arguments in the absence of positive economic or financial returns

There may be a situation in which returns are negative, because costs are very high. This could be because of high initial outlays/capital costs due to hard to access areas which previously had no infrastructure at all. For these types of projects it is useful to explain the welfare and public interest arguments of the project in more detail. Taking these benefits as given, the next step would be a cost effectiveness analysis. This would require appraising all technological choices so that it is certain that the lowest cost option is chosen. Cost effectiveness indicators are helpful here (i.e. cost per unit of outcome).

Second order estimation

The less direct the benefits are, the less certain they are likely to be. This is a particularly a problem for projects which have a long term benefits horizon. The BCR and FRR estimated in the Appraisal will be a first order (central case) scenario, in which benefits with the greatest certainty only should be quantified. In some projects, there will be a second order of benefits which have less certainty than those in the first order round, but can be quantified. These should be added into a second order estimation, which is likely to give rise to a higher BCR, but fraught with less certainty, and should not be used as the “official figure.” Such second order rounds are useful for scenario analysis and when more information is required to make judgement calls on the efficacy of the project and its developmental benefits.

Wider non-quantifiable benefits

In marginal BCR cases could be explained the fact that a lot of the benefits simply can’t be quantified due to data constraints, attribution problems, methodological issues and uncertainty, rather than low levels of benefits *per se*. More effort than in the normal CBA guidelines is required here to identify the non-quantifiable benefits. Such examples are stability, peace dividend contributions, environmental externalities, household welfare, local multiplier effects, local governance effects, transboundary and climate resilient effects.

Innovation, piloting, demonstration

Some projects, despite not showing great economic or financial returns may be justified in going ahead, as they could be testing/piloting or demonstrating a new technology, which is forecast to reduce in cost over time. For this reason, learning from this project will be useful for future interventions, at which point the costs will be lower, BCRs higher and technologies more mature and stable.

Non-economic arguments

There may be strong arguments beyond economics that justify such a project. Such examples are stakeholder preferences, potential for strategic future engagements and entry points into bigger more beneficial projects, political will, and public interest. More effort needs to be applied here in bringing out these arguments.

Value for Money (VfM)

The conclusion, and associated recommendations, of every CRIDF CBA must include a statement of the VfM that will be achieved by the project. A VfM statement is an interpretation of the qualitative and quantitative outputs of the financial and economic appraisal. Where possible, the VfM statement should indicate the VfM of the project from the perspective of the project beneficiaries and from the perspective of the project owner/client

Cost-Effectiveness Analysis (CEA)

World Bank policy asserts that a Cost-Benefit Analysis (CBA) should be conducted for all projects under appraisal, with the single exception of projects for which economic benefits cannot practically be quantified and measured in monetary terms, in which case a Cost-Effectiveness Analysis (CEA) should rather be performed. [13]

CEA is an alternative evaluation methodology that focuses on assessing only the costs of technical project options to ensure that a given project objective is achieved through the least (financial and economic) cost option with the application of minimal resources.[14] The output of a CEA will consist of the cost-per-unit-outcome of the project for the preferred option against next best alternatives that achieve the same project objective/outcome.

For CRIDF, when the economic benefits of a particular project are very difficult to quantify and monetise or when there are significant data constraints, a CEA should be conducted in place of a CBA.

Lastly, in larger projects, a CEA may also be used to supplement a CBA, as a preliminary evaluation tool to screen out technical options.

VFM metrics to supplement standard NPV and BCR indicators

CRIDF's PDMPs from now on will have a sheet where the headline quantitative outputs are captured, as well as a slightly revised FVM sheet where key, project-specific VFM indicators are captured. These are not generally onerous to capture at the CBA stage.

Economic appraisals do not always provide enough information to make optimal choices. For example, an economic appraisal could potentially give rise to a positive result, but this could mask the fact that sub optimal expensive technology choices are being made; an expensive technology can still give rise to a positive economic return. For this reason, it is sometimes useful to cross check and triangulate economic appraisal findings with extra metrics, where possible. These metrics will show the unit cost of technologies, in situations where the output/outcomes are commodities, i.e. standardised valuations such as one unit of specific irrigation technology type. Examples of such metrics are given below:

- Technology (state type of technology) cost per hectare of irrigation
- Technology (state type of technology) cost per m^3 of new water access
- Technology (state type of technology) cost per MWh supplied

Estimating the above figures can be useful if benchmark figures are available from other projects. Whilst benchmarks are highly unlikely to be exact like for like comparisons, they can provide some useful triangulation.

[13] Independent Evaluation Group, (2010) "Cost-Benefit Analysis in World Bank Projects", The World Bank, Washington DC
[14] Conningarth Economists (2007) "A Manual for Cost-Benefit Analysis in South Africa with Specific reference to Water Resource Development" Water Research Commission

Methodology

Conducting a comprehensive CBA requires that the economist be involved in the project from an early stage in order to develop a good understanding of the target communities, their socio-economic context,, the corresponding project objectives, and the technical implementation options for the achieving the objectives. The technical team will also benefits from the early involvement of the economist as potential socio-economic costs and benefits of the various technical options as well as analyse their financial sustainability, can be raised in order to inform and guide further project design and development.

Table 3 presents an overview of the step by step methodology which should be employed in order to conduct a comprehensive CBA.

Table 3 **Methodology for conducting a CBA**

Key Steps	Explanation
Stage 0: Setting the context	
1. Set parameters of the analysis and outline the rationale for the intervention	Clear definition of the project scope, and specification of the rationale and objectives of the project (i.e. the market/governance failures that warrant the intervention), in order to define the project boundaries and constraints (time, location, stakeholders, etc.) within which the CBA is to be conducted.
Stage 1: Options Appraisal	
2. Specify technical options considered	Specify all the technical options considered for the execution of the project, and comment on the strength of the evidence base for each feasible option, reasons for rejection from the 'long list' to the 'short list'.
3. Produce 'short list' of options to include in CBA. Refer to the CRIDF Screen 2 process.	Conduct a high-level, multi-criteria assessment of options to produce a 'long list' which reduces further based on the parameters considered in the Screen 2 process. These include: Regionality and Transboundary; Climate; Technical; Cost; Funding; Environment; Social and Gender; Stakeholder; Project Management; Sustainability and Legacy; Compliance and Regulation. Based on the above, a short list of options is appraised using CBA to reach a preferred option.
Stage 2: Financial Appraisal for the preferred option against do nothing counterfactual	
4. Estimation of financial incremental costs and	At this stage, the economist should estimate the capital, operating and maintenance costs for the short list of project options. Further, the economist should specify the expected revenue streams for the project,

revenue flows over the project's economic life	including tariffs; user fees; levies etc. and any sources of financing (grants; loans; community contributions etc.).
5. Calculation of financial performance indicators	The economist should also estimate the FNPV, FIRR, and F-N/K Ratio based on the cost and revenue flow. If the project is deemed financially unviable, the economist should conduct the analysis for the 'with grant' and 'without grant' situation, in order to indicate the minimum grant/subsidy required to make the project financially viable (the break-even grant amount). Further, results based on variations in capital grants provided should also be presented, including the case where capital costs are covered by a grant in full.
6. Sensitivity analysis	Re-estimate the financial performance indicators by undertaking a sensitivity analysis by varying the assumptions and parameters to which the results are most sensitive. This is to test the robustness of the model to understand if positive returns will still be achieved with pessimistic scenarios regarding assumptions and parameters.
Stage 3: Economic appraisal for preferred option against do nothing counterfactual	
7. Identification of incremental socio-economic & environmental costs and benefits	Identification of the broader project impacts on society (costs and benefits), within the boundaries/parameters specified. This should include costs not borne by the project, e.g. transport costs incurred by beneficiaries, or any other costs borne by society.
8. Quantification & monetisation of socio-economic & environmental costs and benefits over the project life	Financial costs (investment and O&M expenditures) should be converted into to economic prices through the application of appropriate conversion factors. Financial revenues (tariffs/fees) should also be priced rather at their real value to society (e.g. the volume of water supplied should be priced not at the market tariff as in the financial appraisal, but at the willingness to pay for the incremental water supply). Those financial costs and benefits that are purely transfer payments within the economy (e.g. taxes / grants / subsidies) should be discarded. Quantify additional socio-economic/environmental impacts (costs and benefits) in relevant units, (e.g. hours collecting water saved due to improved access), and then monetise using appropriate proxies (e.g. opportunity cost of time). Ensure that such indirect costs and benefits are attributable to the project. Where appropriate, various valuation methodologies – Shadow pricing; Proxies; Benefit-Transfer; Willingness to Pay; Social Opportunity Cost;

	Long-Run Marginal Cost – should be used to quantify and monetise additional socio-economic/environmental impacts Costs and benefits which cannot be quantified and monetised should be recorded in qualitative terms and if possible ranked in order of importance.
9. Calculation of economic performance indicators	Using the base Social Discount Rate[15], the net cost and benefit streams of quantified impacts should be discounted to estimate the ENPV; ERR; B/C ratio; and N/K Ratio for the project.
10. Sensitivity analysis	Re-estimate the financial performance indicators by undertaking a sensitivity analysis by varying the assumptions and parameters to which the results are most sensitive. This is to test the robustness of the model to understand if positive returns will still be achieved with pessimistic scenarios regarding assumptions and parameters.
Stage 4: Sustainability Analysis	
11. Assessment of the sustainability of the project	Based on the results of the financial and economic appraisals, make an assessment of the on-going sustainability of the project, highlighting any key factors necessary to ensure the continued performance of the infrastructure/intervention. This may require a degree of local consultation, or key informant interviews around ability-to-pay and willingness-to-pay.
Stage 5: Reporting	
12. Interpretation and reporting of the results	The CBA report (as detailed in Table 4) should include: • Purpose • Key assumptions • Results • Sensitivity analysis • Inventory of non-quantified costs and benefits • Final recommendation on the preferred option based on full financial and economic appraisal (including VfM statement).

[15] More guidance on the appropriate interest rate to be used is provided in the section on **Discount rates** below.

Guidance on key technical issues in CBA

Options to be considered

At a minimum, the analyst should consider the preferred technical implementation option against the do-nothing counter-factual. A common omission in economic appraisal and CBA has been the lack of a robust comparison to project alternatives, and the 'without project' counterfactual.[16]

The options appraisal section of the CBA should assess each technically feasible option considered by the technical team, in terms of the appropriateness of each in terms of CRIDF's overarching priorities; the high-level costs associated with each; in order to recommend a preferred technical option. While a detailed financial and economic appraisal would not be expected for each technically feasible option, a high-level analysis which enables the justification of the choice of the preferred option is essential.

The financial appraisal section of the CBA should include a full cash flow analysis, i.e. analysis of all costs (i.e. outflows) and revenues (i.e. inflows) only for the preferred technical option. Similarly, the economic appraisal section of the CBA should include the quantification and monetisation of economic benefits only for the preferred technical option.

Data constraints

The primary difficulty in conducting a CBA is often the lack of data with which to quantify impacts. Data collection in itself can be a costly and resource intensive exercise that may not provide adequate value for money, particularly in the assessment of small, simple water infrastructure projects.

The level of detail required for a CBA (and therefore its resource-intensiveness) should correspond to the size and complexity of the particular project in question. As such, the cost of the CBA should be proportional to the value of the project. Hence, for larger projects a more in-depth exercise may be needed to gather data on the ground to understand specific values and prices. On the other hand, for smaller projects, carefully justified assumptions, proxies and shadow prices can be utilised to value prices. On the whole, the economist should exploit the most appropriate means for quantification and valuation of impacts (such as benchmarking with similar projects); and where conversion factors are available from relevant authorities, these should be applied.

Optimism Bias

Previous experience has shown that ex-ante analysis based on the working assumption that everything will go according to plan, imparts an upward bias (as frequent disruptions in infrastructure project are not unlikely). This phenomenon is referred to as an 'optimism bias' i.e., "*a demonstrated, systematic, tendency for project appraisers to be overly optimistic*"[17] and it can lead to the analyst making assumptions which overstate the potential benefits and/or understate capital and operating costs or timelines required to achieve outputs. When there is a high level

[16] Independent Evaluation Group, (2010) "Cost-Benefit Analysis in World Bank Projects", The World Bank, Washington DC
[17] Her Majesty's Treasury, (2003) "THE GREEN BOOK: Appraisal and Evaluation in Central Government"

of uncertainty surrounding the project, specific adjustments may be required to counteract optimism bias. For instance, project costs can be shown as a range, e.g. between USD 30 – 40 million. Further, sensitivity analysis on key assumptions must to be done for all projects to verify their robustness and account for optimism bias.

Discount rates

The discount rate is the percentage that is used to determine the present value of future cost and benefit streams.[18]

The financial appraisal should look at the relevant cost of capital as the discount rate – i.e. the relevant long-term borrowing rate in the project country. The cost of capital is used as the discount rate in the financial appraisal, as it indicates the opportunity cost of investing in the CRIDF project.

In the economic appraisal a social discount rate (SDR) should be used which "*measures the rate at which a society would be willing to trade present for future consumption*."[19] The SDR is difficult to calculate; hence institutions usually use a base rate across all projects:

DFID uses a standard rate of 3.5% for climate related projects

The Asian Development Bank uses 12% in most projects[20]

The World Bank and European Bank for Research and Development use 10% as a standard conventional cut-off rate for water and power projects in Southern Africa[21]

The Water Research Commission (WRC) for South Africa recommends a rate of 8% with possible variation between 6 and 10%, and argues that this rate conforms to the discount rate recommended by major international development institutions (such as the World Bank that has used a rate as high as 10%), whilst taking into account the macro-economic context of the country.[22]

A low discount rate generally favours projects with high initial capital costs and low future current costs, while the opposite applies to high discount rates. A high discount rate can discount long run costs to almost nothing within a relevant timespan of 10 to 15 years, for example.[23] Discount rates for projects with short time horizons (up to 10 years) should however not be controversial, as the costs and benefits of measures are usually felt within a reasonably short time, and the ancillary benefits of investment make projects similar to other public investments (World Bank, 2009).[24]

In summary, for the purposes of CRIDF projects in SADC, it is recommended that for

[18] Asian Development Bank (1999) "Handbook for the Economic Analysis of Water Supply Projects", http://www.adb.org/Documents/Handbooks/Water_Supply_Projects
[19] The World Bank (2008) "The Social Discount Rate: Estimates for Nine Latin American Countries", http://elibrary.worldbank.org/doi/pdf/10.1596/1813-9450-4639
[20] Asian Development Bank (1999) "Handbook for the Economic Analysis of Water Supply Projects", http://www.adb.org/Documents/Handbooks/Water_Supply_Projects
[21] Economic Commission for Africa (2012) "Cost-Benefit Analysis for Regional Infrastructure in Water and Power Sectors in Southern Africa" ECA Publications, Addis Ababa
[22] Conningarth Economists (2007) "A Manual for Cost-Benefit Analysis in South Africa with Specific reference to Water Resource Development" Water Research Commission
[23] Ibid
[24] Lunduka, R. (2003) "Stakeholder-focused cost-benefit analysis in the water sector, Synthesis Report", International Institute for Environment and Development (IIED)

Financial analyses: the relevant cost of capital (long-term borrowing rate) in the project country be used as the discount rate;

Economic analyses: two social discount rates of 3.5% and 10% are applied, in line with DFID practice and World Bank guidance respectively.

If the economist feels the need to deviate from the recommended rates, then s/he must consult with the CRIDF Infrastructure Finance Team a clear justification must be provided for the deviation.

Inflation – current versus constant prices

Current prices are price values that include the effects of general price inflation each year. **Constant prices** are price values from which any change (observed or expected) in the general price level (inflation) is omitted; hence all project costs and benefits over the life of the project in constant prices will reflect the value of money in the year when the project statement was made. [25]

It is up to the discretion of the economist whether to use current or constant prices in the financial appraisal.

If current prices are used in the financial appraisal[26], an appropriate inflation rate must be assumed throughout the project's life, and all future prices adjusted accordingly. The appropriate inflation rate should be the published inflation rate prevailing in the country obtained from the World Bank's databank or from the country's central bank. Alternatively, if the economist chooses to use to constant prices in the financial appraisal; then the discount rate for the financial appraisal must be adjusted for inflation.[27]

We recommend that constant prices be used in the economic appraisal. The use of constant prices means that the analysis does not take into consideration changes in prices because of inflation. This will be the case when it is assumed that inflation is general, meaning that all prices rise at the same rate, hence there is no need to include inflation in the calculation because it would mean compounding all the costs and benefits by the same factor. In the case of constant prices, relative price changes (such as wage increases unrelated to inflation, etc.) would however still need to be factored into the appraisals. The Social Discount Rate of 10% used in the economic appraisal is already adjusted for inflation, and hence constant prices can be used in the appraisal with no further adjustments.

[25] Ibid

[26] Asian Development Bank (1999) "Handbook for the Economic Analysis of Water Supply Projects", http://www.adb.org/Documents/Handbooks/Water_Supply_Projects

[27] Hence, the real interest rate must be used (as obtained from the World Bank's databank); or through the use of the following formula: (1+nominal discount rate) ÷ (1+inflation rate) – 1.

Fiscal corrections – taxes and subsidies

All payments should be included in the financial appraisal of the project (including direct and indirect taxes).

The economic appraisal however is conducted from the perspective of the whole economy, hence any payments that are simple a transfer of funds between two parties within the economy, should not be included.[28] Such transfer payments include direct taxes, subsidies, grants etc.). In the economic appraisal therefore direct taxes, subsidies, grants etc. are never taken into account. There are, however, instances when certain indirect taxes might be included in the economic appraisal when the tax can be viewed as an internalisation of a relevant externality through an addition onto prices or the project cost. [29]

Sensitivity analysis

The aim of the sensitivity analysis is to conduct a robustness check of the key assumptions to which the results are most sensitive. Examples of assumptions are discount rates used, project costs, number of beneficiaries etc. It helps the analyst in understanding to what extent these assumptions are shaping the perceived costs and benefits of the preferred technical option.

Attribution

In quantifying the socio-economic/environmental costs and benefits of the project, it is important for the economist to be mindful of attribution. Attribution refers to the extent to which the CRIDF project/intervention contributed to, or caused, a positive or negative impact/outcome. Particularly when quantifying the benefits of the project in the economic appraisal (improved health), the economist should clearly specify if other factors, or parallel interventions may also contribute to achieving such a benefit, and be careful not to overstate the benefit of the CRIDF project alone (improved WASH). For instance, in the example of improved health, only those diseased which are a direct result of poor sanitation should be considered, and the benefit of improved WASH should be limited to a conservative estimate of the decrease in the prevalence of such diseases as a direct result of improved WASH.

[28] Effectively a transfer payment (e.g. a subsidy or direct tax) will be cancelled out as a net zero impact on the economy as it will be counted as a cost to one party in the economy, and benefit to another party in the economy.
[29] Conningarth Economists (2007) "A Manual for Cost-Benefit Analysis in South Africa with Specific reference to Water Resource Development" Water Research Commission

CRIDF CBA templates

CBA Report

Taking into account the core components of a CBA described above, the CBA summary report should at least include the following sections:

Table 4 **CBA report template**

Section	Key points to be covered
Executive Summary	Summary of the CBA report which can be easily understood by non-economists
Introduction and Purpose	Introduction to the project and the purpose of the CBA, including the context and objectives of the project
Key assumptions	Outline of the key assumptions used in the financial and economic appraisal
Options Appraisal	Document all options that have been considered, including technically non-feasible options and reasons for discarding them; develop a short list of options for inclusion in the CBA (following CRIDF's Screen 2 guidance) – the output from which is a single, preferred option.
Financial Appraisal	• Expected quantitative outputs i.e. FNPV, FIRR; F-N/K Ratio • Proposed funding arrangement: sources of finance and application of funds
Economic Appraisal	• List all costs and beneficiaries - those able to be monetised, those able to be quantified but not monetised, and those that will be described qualitatively. • Expected quantitative outputs i.e. ENPV, B/C Ratio; ERR; E-N/K Ratio • Inventory of non-quantified costs and benefits
Sensitivity Analysis	Assessment of the robustness of the financial and economic appraisals, by presenting the variation in results from varying key assumptions and parameters
Sustainability Analysis	Based on the financial and economic appraisal results, Assessment of the sustainability of the project, and roadmap of how the sustainability of the project will be maintained

Risk Assessment	Identification of key financial and economic risks faced the project (institutional capacity; distribution of impacts, etc.) and corresponding recommendations for risk mitigation arrangements. This can be done in qualitative terms.
Conclusion/ Recommendations	Provide final recommendations based on the results of the comprehensive CBA, including any additions/alterations to the project that may be required. Sub-section: Value for Money statement

Executive summary table

A summary table, as shown below Table 5 should be included as part of the Executive Summary in the CBA report. This table serves to summarise key project information including any investment contribution from CRIDF for project implementation; total costs; the number of beneficiaries, financial and economic performance indicators; and relevant VfM indicators.

Table 5 **Executive summary table template**

Indicator	**Values/comments**	***Guidance***
Budget		
Total CAPEX (as modelled in the BCA)	£	*Fill in the lines which are relevant or else say N/A.* *Indicate values in the relevant currency for the project, and convert to £ - if different – for the purposes of CRIDF*
Project preparation and Technical Assistance by CRIDF		
Project preparation and Technical Assistance by external sources	£	
Capital expenditure financed by CRIDF	£	
Capital expenditure financed by external sources	£	
Total CRIDF budget	£	
Total external funding	£	
Total Budget	£	
Beneficiaries		
Direct beneficiary households	#	*Fill in the lines which are relevant or else say N/A.*
Indirect beneficiary households	#	
Assumed number of people per household	#	
Lifespan of benefits	#	*State the number of years that the benefits*

			will accrue over (referring to both the project life and lifespan of expected benefits if different).
Direct Economic Impacts (Quantitative and Qualitative)			
			List relevant direct costs and benefits (this includes social, environmental and economic)
Total Quantified Direct Net Economic Benefits	**(3.5% SDR)**	**(10% SDR)**	*This value should be discounted at 3.5% and 10% and indicated in the relevant currency for the project, as well as £ - if different – for the purposes of CRIDF.*
	£	£	
Indirect Economic Impacts			
	£		*List relevant, indirect costs and benefits attributable to the project (this includes social, environmental and economic).*
	£		
Total Quantified Indirect Net Economic Benefits	**(3.5% SDR)**	**(10% SDR)**	*This value should be discounted and in the relevant currency for the project, as well as converted to £ - if different – for the purposes of CRIDF.*
	£	£	
Financial appraisal performance indicators			

Financial Net Present Value (FNPV)	£		*Taken from financial appraisal.*
Financial Rate of Return (FRR)	%		
Financial Net Benefit/Investment Ratio (F-N/K Ratio)	#		
Economic appraisal performance indicators			
	(3.5% SDR)	**(10% SDR)**	*Taken from economic appraisal.*
Economic Net Present Value (ENPV)	£		
Economic Rate of Return (ERR)	%		
Economic Benefit-Cost Ratio (B/C Ratio)	#		
Economic Net Benefit / Investment Ratio (E-N/K Ratio)	#		
Sustainability and VFM			
Discuss the perceived sustainability of the project; and explain the financing plan for operations and maintenance going forward			*Provide explanation in words.*
CAPEX / ha irrigated			*If relevant to this project*
CAPEX / HH			*If relevant to this project*
CAPEX / litre water			*If relevant to this project*
Average Annual O&M costs			*If relevant to this project*
O&M / ha irrigated			*If relevant to this project*
O&M / HH			*If relevant to this project*
O&M / litre water			*If relevant to this project*

Key assumptions template

Summarise the assumptions which are pivotal to the results and may have a significant impact on results when varied.

Table 6 **Key assumptions template**

Assumption	Value/number
Discount rates	State only the main assumptions that have significant impact to the results when they are varied. Three examples are given here for illustrative purposes only.
Inflation Rate	
Project's Economic life	
Residual Value	Value at end of appraisal period (if design life = appraisal period, the residual value = zero)

Financial and economic appraisal template

Table 7 outlines the core template for conducting the financial and economic analysis. The specific costs and benefits included will vary with each project depending on the nature of the project (irrigation; WASH; IWRM; etc.), the project design, and the socio-economic context.

Table 7 **Financial and economic appraisal template**

FINANCIAL ANALYSIS					
Project Year	0	1	2	…	n
Financial costs (expenditures) flow					
Capital Expenditure					
Operation & Maintenance					
Refurbishment, etc.					
Financial benefits (revenues) flow					
• Water tariffs					
• Annual subsidy					
• Upfront investment grant					
• Community Investment contribution, etc.					

Net financial cost/benefit flow					
Discounted net financial cost/benefit flow					
FNPV*					
FRR**					
F-N/K Ratio					
ECONOMIC ANALYSIS					
Project Year	0	1	2	…	n
Economic costs flow					
Financial investment & O&M costs * appropriate conversion factors					
Negative externalities (environmental impacts from infrastructure construction; opportunity cost of water supplied to irrigation etc.)					
Economic benefits flow					
Incremental water supply (priced at real value/shadow price – as opposed to market tariff charged)					
Positive externalities (e.g. avoided environmental damage / pollution)					
Increased income (e.g. agricultural yield / time saved)					
Health benefits (avoided illness/death)					
Time saved, etc.					
Net economic cost/benefit flow					
Discounted net economic cost/benefit flow – at 3.5% discount rate					
ENPV* (3.5%)					
ERR (3.5%)**					
BCR (3.5%)					
E-N/K Ratio (3.5%)					
Discounted net economic cost/benefit flow – at 10% discount rate					

ENPV* (10%)	
ERR (10%)**	
BCR (10%)	
E-N/K Ratio (10%)	

*Excel formula = NPV (rate, value 1, [value2], [value 3]….)

**Excel formula = IRR (values, guess)

Distribution analysis of project impacts

For use either in the risk analysis or sustainability analysis, Table 8 provides a basic template to assist in identifying the distribution of project impacts through the identification of key stakeholders and the corresponding direct & indirect impact on each, outlining who the 'winners' and 'losers' of a project might be. Should there be significant discrepancies in the distribution of project impacts, which may affect the success and sustainability of the project; these should inform the CBA recommendations.

Table 8 **Project Impacts on key stakeholders**

Sector	Stakeholders	Impacts (Direct / indirect)
Private	• Households (e.g. small-scale farmers) • Private firms and investors	
Social	• Community groups (CBOs etc.)	
Public	• Government departments • NGOs • Donor partners	
Environment	• Natural resources (forests, land, water, etc.) • Ecosystems	

Conclusion

Through this document, CRIDF has not only endeavoured to provide clear guidance on technical matters, such as the choice of discount rates or inflation rates, but also on the focus areas of the CBA. Overall, CRIDF expects that this guidance document shall enable consistency of methodology between different CBA reports so that there is increased objectivity in the decision as to whether a project should move ahead; or in the choice of which project should move ahead to implementation.

The CBA's focus must not only be on presenting the financial cash flows and net profit situation of the project, but on highlighting both the quantitative and qualitative socio-economic costs and benefits to society from undertaking the project. In addition to the common financial parameters (NPV, IRR, B/C, N/K Ratio) the CBA should provide a qualitative perspective on the wider socio-economic benefits that may be difficult to value explicitly.

All CRIDF CBA reports are expected to conform to this guidance with deviation clearly justified in the context of a specific project. Finally, it is expected that all CRIDF CBA reports will follow the CRIDF Report Template (Table 4) and be accompanied by an excel sheet consisting of the financial and economic appraisal calculations.

References

The "*Key international guidelines", "Case-studies"* as well as the *"Additional references*", referred to below, all provide further detail on the methodology of conducting a CBA; the likely positive and negative impacts (costs and benefits) of investment project in the water sector in particular; and useful benchmarks in terms of pricing / impact valuation and assumptions.

Key international guidelines & useful reference reports

Asian Development Bank (1999) "**Handbook for the Economic Analysis of Water Supply Projects**", http://www.adb.org/Documents/Handbooks/Water_Supply_Projects

Conningarth Economists (2007) "A Manual for Cost-Benefit Analysis in South Africa with Specific reference to Water Resource Development" Water Research Commission

Economic Commission for Africa (2012) "Cost-Benefit Analysis for Regional Infrastructure in Water and Power Sectors in Southern Africa" ECA Publications, Addis Ababa

European Commission (2002) "**Guide to Cost-Benefit Analysis of investment projects**", prepared for Evaluation Unit, DG Regional Policy, EC

European Commission, Directorate General Regional Policy (2008) "**Guide to Cost Benefit Analysis of Investment Projects**", European Union Regional Policy

Independent Evaluation Group, (2010) "**Cost-Benefit Analysis in World Bank Projects**", The World Bank, Washington DC EU

Case studies

Asian Development Bank (1999) "Handbook for the Economic Analysis of Water Supply Projects": *Annex B: Rural Water Supply Project".*[30].

Glafkos Constantinides (2000) "*Cost Benefit analysis case studies in East Africa for the GPA Strategic Action Plan on Sewage*" (page 15-56), provides three case studies that clearly and concisely exhibit the process followed in conducting a CBA, for projects similar to those under CRIDF. This study is attached to these guidelines as Appendix A.

Additional references

African development Bank (2006) "**Financial Analysis and Appraisal of Projects**", The African Development Bank Guidelines for Financial Management and Financial Analysis of Projects

Belli, P. (1998) "**Handbook on Economic Analysis of Investment Operations**" Operational Core Services Network, Learning and Leadership Centre

[30] Also available at http://www.adb.org/Documents/Handbooks/Water_Supply_Projects.

Centre for the Study of Economies of Africa (2011) "Strengthening Institutions to improve public expenditure accountability – Cost Effectiveness and Benefits-Cost Analysis of Dome Water Interventions (the Case of Bauchi State, Nigeria)", Global Development Network

Campbell, H.F. and Brown, Richard P.C. 2003. Benefit-Cost Analysis: Financial and Economic Appraisal using Spreadsheets. Cambridge University Press; New York.

Department for International Development (2009) "How to Note: A strengthened approach to Economic Appraisals"

Her Majesty's Treasury (2003) "The Green Book: Appraisal and Evaluation in Central Government"

Hutton, G. & Haller, L. (2004) "**Evaluation of the Costs and Benefits of Water and Sanitation Improvement at the Global Level**", Water, Sanitation and Health Protection of the Human Environment, World Health Organisation, Geneva

Lunduka, R. (2003) "**Stakeholder-focused cost-benefit analysis in the water sector, Synthesis Report**", International Institute for Environment and Development (IIED)

Savva, P. & Freken, K (2002) **"Financial and Economic Appraisal of Irrigation Projects**", FAO Sub-Regional Office for East and Southern Africa, Harare, ftp://ftp.fao.org/docrep/fao/010/ai600e00.pdf

The Nairobi Work Programme on impacts, vulnerability and adaption to Climate Change (2011) "**Assessing the costs and benefits of adaption options – an overview of approaches**", United Nations Framework Convention on Climate Change

World Bank (revised 2009) "Template and Guidelines for the Project Appraisal Document (PAD)".

http://www-wds.worldbank.org/external/default/main?pagePK=64187835&piPK=64620093&theSitePK=523679&menuPK=64187283&siteName=WDS&pageSize=20&docTY=540656

World Bank (2013) "Project Appraisal Document: Kenya Water Security and Climate Resilient Project", report No: 72374-KE, Sustainable Development Department

World Bank (2014) "**Third National Urban Water Sector Reform Project, Nigeria**", report No: PAD396, Urban Development & Services Practice 2, Country Department AFCW2, Africa Region

World Bank (2009) "**Eastern Nile Watershed Management Project**", report No: 45017-AFR, Environment and Natural Resources Management, Sustainable Development Department, Africa Region

World Bank (2012) "Water Management and Development Project, Uganda", report No: 66411-UG

World Bank (2012) "**Shire River Basin Management Programme (Phase I), Malawi**", report No: 69041-MW, Sustainable Development Department, Southern Africa Country Department-3, Africa Region

CRIDF