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# Stakeholder-focused cost-benefit analysis in the water sector

## Guidance report

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# Acronyms and abbreviations

| | |
|---|---|
| **CBA** | cost-benefit analysis |
| **CRiSTAL** | Community-based Risk Screening Tool |
| **CSAG** | Climate Systems Analysis Group |
| **GHG** | Greenhouse gas |
| **GCM** | Global climate model |
| **IPCC** | ntergovernmental Panel on Climate Change |
| **LAPA** | Local Adaptation Programme/Plan of Action |
| **NAPA** | National Adaptation Programme/Plan of Action |
| **SODM** | Self Organising Map-based Downscaling |

# Tables, figures and images

# 1 Introduction

## 1.1 Background and purpose of this guidance document

These guidelines are intended to show how economic tools can be used for a stakeholder-focused approach to planning and evaluating adaptation to climate change. Using cost-benefit analysis (CBA) as an overall framework, this guidance document presents the basic steps of an approach that enriches traditional economic analysis by focusing on stakeholders in the water sector. The guidance is informed by a project involving case studies in Nepal, Bangladesh, Morocco, Malawi and Bolivia. These case studies, all located in areas facing the impact of climate change in the water sector, used stakeholder approaches to undertake economic analyses of adapting to climate change. The added value of the stakeholder-focused approach lies in the way that CBA is undertaken and its findings used to inform adaptation actions and policies.

More details on the basic conceptual framework for stakeholder-focused CBA can be found in a synthesis report[1] that shows how the approach was piloted in the five case studies. The focus of each case study was as follows:

- Morocco: Analysis of implementation of the Green Morocco Plan as a strategy for adaptation to climate change, focusing on the Tadla Perimeter.
- Malawi: Assessment of the costs and benefits of adaptation to climate change in Lake Chilwa.
- Nepal: Arrangements to coordinate adaptation actions upstream and downstream of Rupa Lake to tackle the effects of climate change and increasing environmental degradation.
- Bangladesh: Adaptation to climate change in Khulna city.
- Bolivia: Urban water provision under melting glaciers.

The pilot case studies were informed by a theoretical methodological framework on stakeholder-focused CBA developed by (please put reference to the methodological document, or a link to it). Case study teams were provided with the general methodological framework at an inception workshop prior to application, which they applied independently (with guidance) in different water sector adaptation contexts.

The aim of this guidance document is not to provide comprehensive instructions on CBA, but to illustrate particular elements of stakeholder-focused CBA that enhanced the quality of the applied research in these five case studies.

## 1.2 Defining adaptation

**Box 1: Types of adaptation**

Action research may reveal many forms of adaptation at different levels (household, community, catchment, municipal), ranging from specific actions on the ground to national policies and strategies. They reflect formal and informal definitions to varying degrees, depending on the context. Variation will be high in the water sector where issues range from too little to too much water, including water quality and the management of its use.

Understanding what adaptation means is the first critical step in adaptation action or analysis. Although there are formal definitions of adaptation to climate change in the literature, specific practical actions to address climate change and other existing needs are generally defined by the specific context. The IPCC Fourth Assessment Report provides a useful synthesis of the term, defining adaptation as 'initiatives and measures to reduce vulnerability of natural and human systems against actual or expected climate change effects. Various types of adaptation exist, e.g. anticipatory and reactive, private and public, and autonomous and planned' (IPCC, 2007). The different definitions and characterisations of formal and non-formal adaptation and the varying approaches to its implementation demonstrate that this is an emerging concept and subject to different interpretations and applications. Levina and Tirpark (2006) cites four separate definitions of the term taken from different sources:

- 'Adaptation – Adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities. Various types of adaptation can be distinguished, including anticipatory and reactive adaptation, private and public adaptation, and autonomous and planned adaptation' (IPCC Third Assessment Report, 2001a in Levina and Tirpak, 2006).
- 'Adaptation – Practical steps to protect countries and communities from the likely disruption and damage that will result from effects of climate change. For example, flood walls should be built and in numerous cases it is probably advisable to move human settlements out of flood plains and other low-lying areas' (website of the UNFCCC Secretariat in Levina and Tirpak, 2006).
- 'Adaptation – A process by which strategies to moderate, cope with and take advantage of the consequences of climatic events are enhanced, developed, and implemented' (UNDP, 2005 in Levina and Tirpak, 2006 ).
- 'Adaptation – The process or outcome of a process that leads to a reduction in harm or risk of harm, or realisation of benefits associated with climate variability and climate change' (UK Climate Impact Programme, 2003 in Levina and Tirpak, 2006).

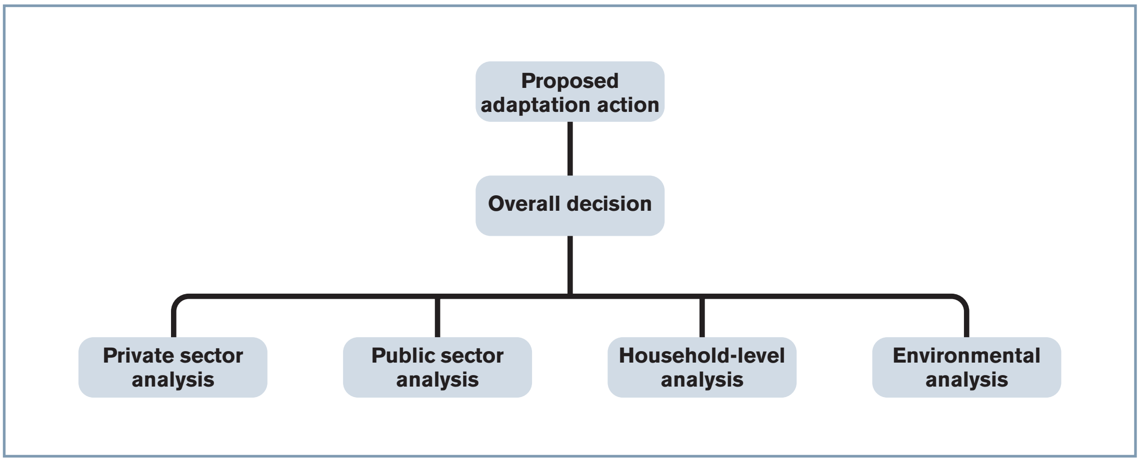
## 1.3 What is stakeholder-focused CBA?

Cost-benefit analysis is a systematic process that is used to calculate and compare the costs and benefits of a project, decision or government policy, and determine the positive or negative outcomes of a planned action over a period of time. In simple terms, CBA identifies, quantifies and adds all the positive factors (benefits), and then identifies, quantifies and subtracts all the negatives (costs). The difference between the two indicates whether it is advisable to pursue the planned action. Decisions are determined by indicators such as net present values, benefit/cost ratios, internal rate of return and payback period.

Actions in water-related adaptation settings are undertaken by several players, with different costs and benefits accruing to different stakeholder groups. Thus, governments may provide water infrastructures (such as dams) that benefit the public, while private companies may be involved in irrigation, supplying domestic water to city dwellers or using water to promote tourism. The environment also plays a role in regulating the quality and quantity of water in a catchment basin. The feasibility and sustainability of any adaptation project or policy will not only depend on the net difference between aggregate costs and benefits, but also on how they are distributed between stakeholders, and on stakeholders' willingness to be involved in the initiative. This is why a focus on stakeholders can deepen and enrich traditional economic approaches such as CBA.

Although there is no formal definition of stakeholder-focused CBA, it can be viewed as an extended form of CBA that covers four broad stakeholder groups: the private sector, the public sector, households and (where appropriate) the environment. Because decision-making tools are not equally applicable to every group, this larger framework needs to include multiple approaches to ensure that all groups are given sufficient consideration when possible adaptation options are evaluated. The analytical framework for stakeholder-focused CBA may be conceptualised as in figure 1.

**Figure 1: Proposed CBA framework with four stakeholder groups feeding into an overall decision about climate change adaptation interventions**




The process of applying stakeholder-focussed CBA itself may include one or more of the following activities:

- Involving stakeholders in analysing the costs and benefits of an initiative.
- Reflecting on the costs and benefits ascribed to different stakeholders in the analysis.
- Assessing the weight that different stakeholder groups place on different costs and benefits.

## 1.4 Summary of the key steps in stakeholder-focused CBA

Step 1: Assess expected future climatic trends and use that information to identify the impacts of climate change in the study area.

Step 2: Identify and engage stakeholders that are impacted by the climate change directly or indirectly.

Step 3: Identify adaptation strategies and actions to include in the analysis.

Step 4: Measure the costs and benefits, and determine how they will be distributed among stakeholders.

Step 5: Ground truth the findings with the stakeholders.

## 1.5 Potential outcomes of a stakeholder-focused approach to CBA

- Quantitative metrics of costs and benefits at aggregate level or by stakeholder group.
- Consensus among all stakeholder groups on which activities to pursue, based on participatory assessment of costs and benefits.
- The share of the costs to be met by each stakeholder group is based on their expected benefits.
- A range of adaptation actions that maximise the benefits for all stakeholder groups.

## 1.6 Key assumptions

- Economic analysis is an integral part of adaptation research, planning and action, rather than a stand-alone activity.
- Users of this guidance document have a good grounding in economic methods such as CBA, and in participatory research methods.

Stakeholder-focused CBA is used in an action-research and learning environment, and allows stakeholders to feed into different steps of the process.

The analysis is an iterative process whose steps do not need to be taken in any particular order.

## 1.7 Presentation of the guidelines

Though chronological order is not important, for the sake of clarity in this document, each step is presented separately, with an explanation of its purpose, a summary description of the approach to be used, and an example of the step taken from at least one of the five case studies on stakeholder-focused CBA. The case studies are for illustrative purposes only, as they implemented this approach on an experimental basis. Although the general approach and its principles are widely applicable, the details will vary according to the particular situation concerned.

### Key guidance message:

Outputs or outcomes will be determined by specific needs, which will vary from one setting to another. As stakeholder-focused CBA will not produce the same output in all cases, it is important to ask the following questions: Why are we doing this analysis in the first place? What will it help us or others achieve? What form should the output take?

# 2 The context: adaptation to climate change in the water sector

Climate change has the potential to impact on water sectors around the world in a wide variety of direct and indirect ways. Generally speaking, it is likely to affect the temporal and spatial patterns of moisture delivery and the physical form and quantity of moisture delivered over a given period of time. These changing patterns will probably lead to more frequent (and possibly more extreme) droughts and floods (NWCM, 2010; EEA, 2007; IDRC, 2010). Climate change will also cause sea levels to rise, with the potential knock-on effect of salinising coastal freshwater aquifers (EEA, 2007).

Water sectors around the world will need to adapt to the impacts of climate change on local and regional water cycles. Determining how this should be done will entail economic analysis that incorporates a wide variety of perspectives. This task will be complicated by several factors. First, few primary studies are conducted in low- and middle-income countries, which means that there is relatively little data on them; second, the need for the selection and implementation of adaptation actions to involve all of the many stakeholders in water use and management, and to take account of their different, often competing demands and roles.

Stakeholder-focused approaches start from the same basic principle, but differ from setting to setting as the purpose and conduct of each analysis is determined by its context. These guidelines are based on five case studies that share a common conceptual framework (stakeholder-focused CBA), but cover different aspects of adaptation to the impacts of climate change in several low- and middle-income countries. The approach taken in each study was determined by the purpose and scale of the adaptation, and reflects the physical, socio-economic and institutional circumstances and external drivers behind the assessment. The specific focus of each study was shaped by various factors, such as:

- The nature of the impacts of climate change and required adaptation in the study area.
- Whether adaptation options had already been formulated or needed to be developed from scratch with local stakeholders. The starting point of the analysis was determined by stakeholder awareness of climate change and its likely impacts and past experience with similar issues. Where basic information was not available, it had to be generated.
- Who will use the findings. The nature and depth of the analyses differ according to the end users and their specific needs. The findings and outputs of such studies may be used by governments (for planned or ongoing programmes), donors that want to fund adaptation, NGOs or local stakeholders themselves.
- Building on existing economic analyses. The starting point and type of analysis will be different if stakeholder-focused CBA is needed to supplement existing economic analysis.
- Whether the project was a new adaptation initiative or one that drew or built on existing development efforts. Analysis of previous strategies and actions to address climate variability or promote development in various sectors (ex-post analyses) in order to understand the costs and benefits of adaptation will use different data and methods from analysis designed to evaluate future strategies (ex-ante analysis).

The case studies that informed this guide show how stakeholder-focused CBA varies according to the context in which it is undertaken.

**Morocco:** This case study analyses the implementation of the Green Morocco Plan (a government-sponsored, multi-annual programme that aims to promote conversion from flood to drip irrigation) as a strategy for adaptation to climate change. It assesses implementation of an existing adaptation policy in the Tadla perimeter in order to inform subsequent promotion of the adaptation strategy in other regions of Morocco. Apart from providing useful insights into the government programme, the case study shows the value of stakeholder participation in the evaluation of non-monetary costs and benefits, and of including groups that are normally excluded from the implementation process even though their economic interests are at stake.

***Context: the case study assesses a pre-defined action based on national policy in order to inform efforts to scale up pilot initiatives in other areas.***

**Malawi:** Here, the case study examines the costs and benefits of adaptation to climate change in Lake Chilwa. It looks at the way that local stakeholders currently address the impacts of climate change and assesses the actual costs and benefits of adaptation, working on the assumption that stakeholders build on what they already know, and that any future adaptation actions will be based on local solutions.

***Context: adaptation is based on existing actions, with local players using previous coping strategies to increase their resilience to the impacts of climate change.***

**Nepal:** Arrangements to coordinate upstream and downstream adaptation efforts in response to climate change and increasing environmental degradation around Rupa Lake, Kaski. The team on this case study worked with stakeholders to identify and agree on a package of adaptation strategies that meet the needs of upstream and downstream stakeholders, combining economic and technical information to facilitate negotiations on a costed adaptation package. The technical details of adaptation actions are based on existing technologies and backed up by information on existing technical designs.

***Context: reaching local consensus on combined actions that affect different land and water users in different ways.***

**Bangladesh:** This case study looked at adaptation to climate change in Khulna city, building on a larger study funded by a regional development bank, which included traditional CBA. The team asked stakeholders to prioritise costs and benefits in order to identify adaptation actions with the most value for all stakeholders.

***Context: building on earlier CBA to prioritise specific actions according to the value different stakeholders place on them.***

**Bolivia:** The key issue here was that proposed actions for urban water provision under melting glaciers did not reflect the interests of all stakeholders, or feature demand-side adaptation actions such as increasing the efficiency of water delivery. The team worked with a complex set of stakeholders to build consensus on adaptation options that met their respective needs and values, and then involved them in the economic evaluation of two key options. A good deal of time and resources were invested in reaching out to stakeholders, before ascribing costs and benefits to actions that were supported by a limited number of stakeholder groups.

***Context: current proposals for adaptation actions do not adequately meet the needs of all stakeholders or include less costly complementary, demand-side adaptation measures.***

## Key guidance message:

It is essential from the outset to define the setting, purpose and starting point of the economic analysis, as these will vary from study to study. The availability of data also needs to be considered, and if the analysis is one component of a multidisciplinary research project, information needs should be identified at the beginning rather than the end of the process. In stakeholder-focused economic analysis, stakeholders should be familiarised with the economic dimension of the exercise at the start of the process.

# 3 Steps in stakeholder-focused CBA

## 3.1 Step 1: Assessing expected future climate change to identify the impacts of climate change and adaptation options

### 3.1.1 Localising climate projections in order to identify the impacts of climate change

In cases where adaptation strategies have not yet been identified, this step provides information that can be used with stakeholders to generate adaptation actions. Its purpose is to ensure that the adaptation strategies covered by the analysis are designed to address the impacts of climate change in the locality.

The possible impacts of climate change are identified on the basis of likely future climatic patterns. Such information is usually general, relating to a whole country or region, and is rarely specific to the area covered by a case study.

The impacts of climate change can be identified and verified at the local, national and international level, and determined by local knowledge and scientific data sources. Community-level approaches recognise the value of linking scientific and local expertise, with participatory assessments based on actual observation of current climate risks (Van Aalst, 2008) and local knowledge valued as a source of climate history and baseline data (Riedlinger and Berkes, 2001).

### 3.1.2 Local-level observation

The World Meteorological Organisation (WMO) has a directory of climate observation stations and a full list of National Meteorological Service members in each country. Many local weather stations keep records of historical trends in temperature or precipitation, and certain stakeholders can provide insights into observed climatic impacts and trends. However, in most poor countries such stations are not available and where they are, the data has not been collected for a long time and the quality is questionable. Given such a situation local stakeholders, including local communities and experts, may be able to identify trends in climate change and its impacts at the local and regional level. These include undocumented climatic trends and impacts that can be extracted using well-structured participatory methods. Such information has proven to be useful in identifying the actual climate change impacts at a local or regional level and supplements the scanty climate data that is used in climate change modelling. The main drawback of this local indigenous information is that it provides excellent historical data, but may not extrapolate climate impact in the future given climatic uncertainty.

### 3.1.3 Projections at the regional and international level

The Intergovernmental Panel on Climate Change Fourth Assessment Report (IPCC AR4) contains information about international-level climate projections in the Working Group I Report. This is available on the IPCC website (http://www.ipcc.ch/), which also shows regional-level projections (IPCC, 2007a).

The climate change projections identified by the IPCC vary from region to region. They include changes in temperature (both central values and extremes), rainfall, drought, ice-melt, El Nino events, monsoons, tropical cyclones and storms, rising sea levels and ocean acidification (IPCC, 2007a). The IPCC Working Group II Report on Impacts, Adaptation and Vulnerability includes regional reports on observed climate trends and their impacts on sectors such as agriculture, water resources, ecosystems and health (IPCC, 2007b).

**Box 2: IPCC emissions scenarios**

| Case | Temperature change (°C in 2090–2099 relative to 1980-1999)a | | Rise in sea level (metres in 2090–2099 relative to 1980–1999) |
|---|---|---|---|
| | Average | Likely range | Model-based range excluding future Rapid dynamical changes in ice flow |
| **Constant year 2000 concentrationsb** | 0.6 | 0.3 – 0.9 | NA |
| **B1 scenario** | 1.8 | 1.1 – 2.9 | 0.18 – 0.38 |
| **A1T scenario** | 2.4 | 1.4 – 3.8 | 0.20 – 0.45 |
| **B2 scenario** | 2.4 | 1.4 – 3.8 | 0.20 – 0.43 |
| **A1B scenario** | 2.8 | 1.7 – 4.4 | 0.21 – 0.48 |
| **A2 scenario** | 3.4 | 2.0 – 5.4 | 0.23 – 0.51 |
| **A1FI scenario** | 4.0 | 2.4 – 6.4 | 0.26 – 0.59 |

*a These estimates are assessed from a hierarchy of models that encompass a simple climate model, several Earth System Models of Intermediate Complexity and a large number of Atmosphere-Ocean General Circulation Models (AOGCMs).*
*b Year 2000 constant composition is derived from AOGCMs only.*

*Source: http://www.ipcc.ch/publications_and_data/ar4/wg1/en/spmsspm-projections-of.html*

The Climate Change Knowledge Portal 2.0 on the World Bank website also provides graphical information on historical and future climate trends, and information on the impacts of climate change in each country (http://sdwebx.worldbank.org/climateportal/index.cfm). Further data is available from the National Oceanic and Atmospheric Administration (http://www.ncdc.noaa.gov/cdo-web/). The Hadley Centre provides global temperature data for more detailed analysis (http://www.metoffice.gov.uk/hadobs/).

Another approach to generating data for use in identifying the impacts of climate change entails downscaling projections to the local level. This works on the basis that local climatic conditions are largely a function of the large-scale climate modified by some local forcing, such as topography.

### 3.1.4 How the case studies identified the impacts of climate change

Each case study used a combination of global models and climatic observation by local stations to generate downscaled climate envelopes, with assistance from the Climate Systems Analysis Group (CSAG) at the University of Cape Town (http://www.csag.uct.ac.za/). Information gathered from local weather stations was submitted to CSAG, who then prepared and interpreted the downscaled climate envelopes. The teams working on the case studies used this information, plus local observations, secondary literature and discussions with stakeholders to identify likely climate impacts and problems in the water sector over the next 30 years or so. In cases where impacts and adaptations were already known, this information was used to validate the projections.

### 3.1.5 Collection and analysis of data from local stations

The rest of this section describes the process of generating downscaled climate envelopes for the areas covered by the case studies. It includes some technical details that require a little background knowledge of climate modelling.

The first step is to collect local weather data from a local weather station to be sent to CSAG for further analysis. This data is used to generate information about:

- Seasonal rainfall: annual cycle of monthly rainfall (mm) for each station.
- Duration of seasonal mean dry spells: length of monthly mean dry spells over the year for each station.
- Seasonal daily maximum temperatures: monthly mean maximum daily temperatures for each station over the year.
- Seasonal days per month exceeding 32°C: days per month exceeding 32°C over the year.

The output of the analyses is simple and self-explanatory, enabling researchers to use it to identify adaptation strategies with local stakeholders.

### 3.1.6 Climate projections

Climate change projections are based on global climate models (GCMs), which attempt to simulate the global climate system by integrating known atmospheric physical processes that have occurred over time. These models simulate the sun's heating effect, heat and moisture fluxes from oceans, the effect of land surface and vegetation, and the effects of greenhouse gases on the atmospheric temperature profile. Various processes occur at scales that cannot be resolved by GCM numerics, and these are approximated through parameterisation. They include cloud radiative effects, convection and precipitation, boundary layer mixing and numerous aspects of surface heat and moisture fluxes. Many differences between GCMs are due to the different approaches to parameterisation, particularly for cloud radiative effects and precipitation processes. It is also important to be aware that GCMs vary in their ability to simulate a particular region; each GCM performs better in some areas than others.

### 3.1.7 Multi-model selection

Although it is tempting to pick the GCM that best represents the climate in the study region, this is not a valid approach as climate change projections are supposed to show an accurate response to changes in greenhouse gas (GHG) concentrations. A GCM that faithfully simulates the observed climate will not necessarily respond accurately to changes in GHGs. Since we do not know what an accurate response would be, we have to assume that all models present an equally likely response, and therefore it is recommended to use multiple models, hence the development of climate projection envelopes, which present the range of scenarios generated by various climate models.

***Model bias***

It is acknowledged that each GCM has a particular bias for a particular variable in a particular region. As this bias can be significant in the case of precipitation, it is important not only to consider raw GCM output fields when developing future projections, but also to look at the anomalies between GCM simulation for the 20th century and for periods in the future. These anomalies are calculated for each GCM and represent its response or delta for a given GHG forcing. Absolute values are still useful in showing GCM seasonality and the agreement between GCMs.

***Downscaling***

Downscaling is a method used to obtain high-resolution climate or climate change information from relatively coarse-resolution GCMs. Thanks to improvements over the last 10 years, many state-of-the-art GCMs are now able to resolve at a scale of around 100km. The resolution of GCMs from the CMIP3 archive is typically much lower, ranging from 200-400km. Even if the native resolution of a GCM is 200km, models usually perform less well at this level due to the simplified topography and representation of regional processes. They perform much better when aggregated up to large scales, such as 500-1,000km, but these scales are far too coarse for most users, who are looking at regional issues like water management and agriculture. Societies and ecosystems typically operate at a much finer level, hence the need for downscaling.

There are two main types of downscaling: dynamical and empirical. Dynamical downscaling uses a higher-resolution, dynamical model that covers a limited area. It follows the same principles as a GCM, but can be run at much higher spatial resolutions with moderate computation costs because of the limited domain. It offers a physically-based regional response to large-scale forcing, but can be as prone to problems with bias and error as GCMs.

Empirical downscaling uses various statistical methods to approximate the regional-scale response to large-scale forcing. The downscaled reports for the case studies in these guidelines used the Self Organising Map-based Downscaling (SOMD) method developed at the University of Cape Town, which recognises that the regional response is both stochastic and a function of large-scale synoptics. It generates a statistical distribution of observed responses to historical large-scale observed synoptic states, which are then sampled on the basis of GCM-generated synoptics to produce a time series of downscaled GCM daily values for the variable in question (typically temperature and rainfall). One advantage of this method is that it uses relatively large-accurate scale circulation fields (pressure, wind and humidity) rather than the more inaccurate grid-scale GCM precipitation and surface temperature.

### 3.1.8 Projections

This study used GCMs from the CMIP3 archive. Only nine of the possible 21 GCMs were suitable because the downscaling methodology requires daily archive fields. Each GCM has a number of simulations. The first, which simulates the 20th century climate from 1961-2000 forced by observed GHG concentrations, is the GCM representation of the observed climate period. It is important to note that the years in the 20th century simulations do not correspond to the real situation in the relevant years, so one cannot expect to see any likeness between a particular year in the 20th century simulation and the observational record for that year. The next simulations cover two periods in the future (2046-2065, and 2081-2100) and a GHG concentration scenario (future development scenario A2). Therefore, each GCM analyses a total of three GCM simulations, one in the 20th century and two in future periods. Each GCM simulation was downscaled to the location of the station, and appropriate climatological summary statistics were produced and presented in the form of climate projection envelopes. As noted above, these envelopes capture the range of GCM responses to GHG forcing and show the extent to which the different models agree or conflict with each other.

### 3.1.9 Understanding uncertainty and contextual factors

Climate change projections are subject to uncertainty, not least because they will be affected by international efforts to mitigate climate change by reducing emissions. The IPCC Special Report on Emissions Scenarios has shown that socio-economic changes affect levels of emissions and therefore influence the impacts of climate change; while socio-economic factors and changes will also impact on vulnerability. Despite international efforts to ensure that global warming does not exceed 2°C, there is evidence that the world may be heading towards an increase of 4°C by the end of the century (Betts et al., 2011). This means that the impacts of climate change could be much more severe than the projections generated by models from the lower range of scenarios.

## Key guidance message:

The possible impacts of climate change are identified on the basis of climatic projections. Due to the uncertain nature of these projections, analysis of adaptation actions needs to be based on a combination of local information and scientific data. It is important to consult other experts as much as possible to ensure that such analysis is not based on uncertain scientific projections or untested perceptions, both of which carry huge risks. Adaptation actions based on extreme projections or scenarios could lead to maladaptation and waste resources. Sensitivity analyses can help address this problem, but only to a limited extent. It is useful to discuss the ‘What ifs?’ of expected climate change and selected adaptation actions with stakeholders before proceeding with advanced economic analysis.

## 3.2 Step 2: Identifying and engaging stakeholders affected by climate change impacts and adaptation directly and indirectly

### 3.2.1 Identifying stakeholders

It is important to identify the stakeholders concerned to ensure that everyone's interests are represented in the collaborative process, data collection and analyses. The extent to which all stakeholders are identified and their interests taken on board will largely determine the acceptability and sustainability of subsequent adaptation actions.

The term 'stakeholder' is often used to refer to individuals or groups that have an interest or stake in a particular issue, and who may affect or be affected by a decision or policy relating to the issue (Freeman, 1984; Mitchell et al., 1997). In these guidelines, the term denotes all significant groups or entities that are likely to be directly or indirectly affected by climate change, take part in adaptation and be affected by adaptation actions (Bryson, 2003). The extent to which stakeholder groups are disaggregated into upstream and downstream groups, livestock farmers and crop producers, male- and female-headed households, national and local governments, etc., depends on the extent to which their interests differ. Greater disaggregation obviously entails additional engagement and analysis.

The following criteria to identify and select stakeholders can be used:

- Stakeholders' level of interest in the adaptation intervention.
- The degree to which they are affected by climate change.
- The input required for successful adaptation (financial material, labour, ideas, political/social support, etc.).
- The extent to which excluding or including certain stakeholders in the analysis would affect the overall effectiveness of the adaptation initiative.

This analysis features five main stakeholder groups in each case study site: households, community, the private sector, the public sector and the environment. Specific stakeholder groups were selected according to their local relevance and significance for the analysis, while recognising that each may have multiple sub-categories and that members of any one group may differ in terms of access, financial capacity, number, geographical vicinity and other factors relevant to water management.

Identifying and engaging with stakeholders is an iterative process that requires wide-ranging consultations. Starting with broad categories of stakeholder groups helps keep the process tractable and allows it to be refined as differences within the broad categories are identified. Certain stakeholder groups are sometimes excluded because they do not have an immediate positive input or are opposed to certain actions. Such groups should be included in stakeholder-focused economic analysis to ensure that the cost/benefit of their position is taken into account, and avoid possible problems that their exclusion would create in terms of meeting the cost of implementing actions. Table 1 presents examples of stakeholder groups that the case studies that informed these guidelines used.

**Table 1: Main stakeholder groups identified in the case studies**

| | NEPAL | MORROCO | BANGLADESH | MALAWI | BOLIVIA |
|---|---|---|---|---|---|
| **Household and community institutions** | Community/ cooperatives<br>Farmers<br>Community forestry representatives<br>Women's groups | Farmers<br>Agricultural workers | Residents of Khulna city<br><br>Community<br>Community groups | Small-scale farmers<br>Fishermen<br>Bird hunters<br><br>Social<br>Irrigation scheme<br>Fishing committees<br>Bird hunters association | Neighbourhood association (El Alto)<br>Vulnerable urban populations<br>Local communities |
| **Private sector** | Hotel upstream from the lake<br>Travel agencies | Drip irrigation companies | | | Water Company EPSAS<br>Branches of industry (milk production, farms) |
| **Public sector** | Four Village Devel-opment Committee secretaries<br>Kaski district development committee Secretary<br>Lekh Nath municipality office | Tadla Regional Of-fice of Agricultural Development (ORMVAT)<br>Water Basin Agency | Local government departments:<br>–Khulna City Council (KCC)<br>–Khulna Water and Sewage Authority (KWASA)<br>–Khulna Development Authority (KDA) | All Government departments | Vice-minister for Water and Sanitation<br>Vice-minister for Environment |
| **Environmental groups or experts** | Environmental expert from Pokhara City and universities<br>NGOs (Libird, Alliance for Mountain Conservation, Seed Nepal) | Beni Mellall University research unit on the use of environmental and agricultural resources | Environmental organisations and NGOs | Environmental NGOs<br>e.g. LEAD<br>Local university | Environmental activists |
| **Environment** | | | River water systems, fisheries, wildlife | Natural resources<br>Fish and birds | |

### 3.2.2 Approaches to stakeholder engagement

There is no uniform approach to stakeholder engagement. The case studies show that this is an ongoing process throughout the study that defines the outcome and format of the findings. Various methods were used to involve stakeholders:

- Rapid appraisals with key informants.
- Focus group discussions with individual stakeholder groups.
- Meetings with multiple stakeholder groups.
- Questionnaire surveys tailored to each stakeholder group.

All these approaches were used to initiate discussions on climate change and water in general, identify the impacts of and potential solutions to climate change, collect specific economic data, verify or validate findings, refine, adjust or change combinations of adaptation actions, discuss willingness-to-pay, build consensus on the way forward, and undertake numerous other activities. The case studies in Nepal, Morocco and Bolivia followed an iterative process that repeated various exercises with stakeholders.

## Key guidance messages:

Although engaging with stakeholders is time consuming, it is probably the most useful aspect of this approach to CBA. It is not a single step, but an iterative process that continues throughout the entire research exercise. Stakeholders can initially be divided into broad categories (private sector, government, local community, environment) that can be refined as the appraisals are undertaken and stakeholders engage in the process. The number of stakeholder groups that are included in the analysis depends upon the boundary of the system under analysis and the potential social, economic and environmental impacts of climatic stresses and adaptation interventions on these stakeholders. There is a trade-off between including all stakeholder groups on one hand and the analytical complexity and difficulty of reaching consensus on action that such inclusion creates on the other. This should be decided by each case study, in consultation other stakeholders.

The environment should be included as a distinct stakeholder group from the outset, to ensure that it is not omitted from the analysis because it does not have the same social, economic or political claims as other players.

## 3.3 Step 3: Identifying adaptation strategies and actions to include in the analyses

### 3.3.1 Identifying adaptation strategies

The purpose of this step is to develop a new or revised set of adaptation strategies or actions that will form part of the economic analysis. Where strategies have already been identified as part of an existing national or local adaptation policy or programme such as NAPA, LAPA or other project, stakeholder groups should be informed about them and consulted on their suitability and scope. Stakeholder verification is the key to the long-term success of adaptation actions, as analysis based on the literature, government plans or past projects may favour economically attractive actions that do not reflect the interests of certain groups.

In any setting, there will normally be a large number of possible adaptation actions that stakeholders can undertake individually or collectively, as isolated or combined actions. For example, crop planting times can be changed while appropriate varieties are developed and adopted, water supplemented and livelihoods diversified. A finite set of adaptation actions needs to be identified to keep the focus of analysis, but this does not preclude other concurrent actions.

Identifying adaptation strategies for analysis is not straightforward, as it requires a combination of climate information and analysis of measures that effectively address the expected impacts of climate change. Adaptation is a learning process. Some adaptation actions are designed to address existing problems caused by increasing climatic variability, and it is not always necessary to develop adaptation strategies from scratch, as some may already be in place. The three scenarios presented below are typical examples of the possible starting points for identifying adaptation actions or strategies to include in a stakeholder-focused CBA.

Scenario 1: There are no adaptation strategies or actions in place, in which case they have to be developed with stakeholder input. This scenario has the greatest scope for involving stakeholders in identifying both adaptation actions and climatic trends and impacts from the outset of the process. There are several tools for detailed adaptation planning at the sectoral or community level. These include, but are not limited to the following:

- Care Toolkit for Integrating Climate Change Adaptation into Development Projects
  http://www.careclimatechange.org/tk/integration/en/quick_links/tools/tools.html
- Community-based Risk Screening Tool – Adaptation and Livelihoods (CRiSTAL)
  http://www.iisd.org/cristaltool/download.aspx.
- Framework of Milestones and Indicators for Community-Based Adaptation
  http://www.careclimatechange.org/files/toolkit/CBA_Framework.pdf

In a research context, where time and resources are limited, adaptation actions can be identified through participatory processes that combine local and scientific knowledge of likely climatic trends.

Scenario 2: Previous research or development work in the area has identified some adaptation actions. In this case, they need to be confirmed with all stakeholders to ensure consensus. Detailed explanations will need to be given to any stakeholder groups that were not involved in identifying the actions.

Scenario 3: General adaptation strategies for the sector or region have been identified in official documents such as a national adaptation programme of action (NAPA). These may include generic strategies such as irrigation, more efficient water use, etc., in which case the specifics need to be worked out with stakeholders, taking local socio-economic and physical factors into account.

### 3.3.2 Adaptation scenarios in each case study

The particular setting of each case study defined the way in which the adaptation actions or strategies that were used in the analyses were selected and identified, as shown in the table below.

**Table 2: Selection and identification of adaptation strategies in the five case studies**

| Case study | Identification of adaptation strategy |
|---|---|
| **Morocco:**<br>Analysis of implementation of the Green Morocco Plan as a strategy for adaptation to climate change, focusing on the Tadla Perimeter. | The adaptation strategy used in the analysis was pre-defined by a government programme designed to address climate-related stresses (the Green Morocco Plan). |
| **Malawi:**<br>Assessment of the costs and benefits of adaptation to climate change in Lake Chilwa. | Surveys of stakeholder groups identified stakeholder strategies already in place to address existing climate-related stresses. |
| **Nepal:**<br>Arrangements to coordinate adaptation actions upstream and downstream of Rupa Lake to tackle the effects of climate change and increasing environ-mental degradation. | Adaptation strategies were identified through a series of consultations, using scientific, secondary and local information. Follow-up discussions with stakeholders redefined the initial combination of actions. |
| **Bangladesh:**<br>Adaptation to climate change in Khulna city. | This analysis considered adaptation strategies derived from the report by an earlier adaptation study in Khulna city. |
| **Bolivia:**<br>Urban water provision under melting glaciers. | Different stakeholder groups debated existing proposals for actions and used them to identify additional complementary strategies. |

Each case study analysed adaptation strategies that were selected after informed discussions with stakeholders, using climate information based on secondary scientific literature, climate envelopes and local knowledge.

### 3.3.3 Advantages of using a stakeholder-focused approach to identify adaptation actions

Working with stakeholders makes it possible to identify adaptation strategies that appeal to or serve the interests of diverse actors, from the private sector to subsistence farmers, bird hunters, fisher folk, etc. Getting different stakeholders to debate these strategies can generate further adaptation actions, such as in Morocco and Bolivia where this approach enabled stakeholders to identify additional adaptation activities that would add value to pre-determined government strategies at very little cost. In the case study from Nepal, stakeholder consultations led to a set of combined adaptation actions that differed from the separate actions that were initially promoted.

Key guidance messages:

When working with local stakeholders to develop adaptation strategies from scratch, development activities may be packaged as adaptation activities because certain adaptation actions and strategies directly or indirectly relate or contribute to development. It is important to be aware that some adaptation actions may only be attractive because they include a development or business component, and to avoid simply repackaging development projects as adaptation initiatives.

Identifying adaptation strategies is not a one-off activity. It is an iterative process that may need to be repeated after an initial economic analysis has been completed, to allow stakeholders to decide on different courses of action if the original proposals are too costly or lead to skewed distribution of costs and benefits.

## 3.4 Step 4: Measuring costs and benefits and their distribution among stakeholders

### 3.4.1 Measuring costs and benefits

The purpose of this step is to capture, as far as possible, all the direct monetary and non-monetary costs and benefits of selected adaptation actions. Given the limited availability of quantitative data on costs and benefits, and the time it takes to collect good quality data of this kind, this involves identifying and using data from a wide range of sources to meet the specific needs associated with the scenarios described above.

### 3.4.2 Setting the boundaries of analysis

It has already become apparent that adaptation to climate change takes various shapes and forms. Therefore, it is important to establish clear boundaries for the analysis. The costs and benefits that are measured must pertain to particular adaptation actions at a specific unit of analysis, at the level of the household, village, district, catchment and so on. Certain actions may combine public and private adaptation; such as when the government constructs a dam and individuals pay to use the water it supplies for irrigation or other purposes.

A stakeholder-focused approach either measures the costs and benefits for different stakeholder groups separately, or measures all the costs and benefits of the entire adaptation policy or action before disaggregating them to different stakeholders. In some cases, where an adaptation policy is implemented regardless of cost/benefit ratios e.g. where action is needed to save lives, government policy to pursue a certain programme is irreversible, or the government is already committed to paying the costs. In this case, measurement can focus on how the benefits are distributed among different stakeholders. When the policy is already determined, stakeholder groups can provide important information about the type of costs and benefits they prioritise and their preferences for monetary or non-monetary benefits. The measurement of costs and benefits will also vary depending on whether an ex-ante or an ex-post approach is used to assess an adaptation action. The former calculates the expected costs and benefits of a planned action, while the latter uses data from past actions to assess their actual costs and benefits.

### 3.4.3 Setting the boundaries of analysis

A combination of primary and secondary sources of data can be used to provide data for the analyses. The case studies used different sources of data as follows:

- Existing official documents such as development or adaptation plans (Nepal and Morocco).
- Previous economic studies on adaptation (Bangladesh, Bolivia).
- Surveys and participatory stakeholder consultations (Malawi, Nepal, Morocco, Bangladesh).
- Combinations (Nepal, Bangladesh, Morocco, Bolivia).

### 3.4.4 Contextualising data collection to fit purpose

Economic data is collected to fit specified policy, action or research purposes. Stakeholder-focused CBA has the unique ability to assemble relevant data to support decisions and actions. Where traditional CBA has already been undertaken, stakeholder-focused CBA can be used to shape the original analyses for qualitative decision making, such as the prioritisation of activities which is required to inform the allocation of scarce resources where there are trade-offs between the needs of different players. It can also be used to ensure that the distribution of costs and benefits allows different stakeholders to play their part in implementation, expecting a fair outcome on benefits. Examples of scenarios where different approaches to data collection were used by case studies in the collection of data on costs and benefits are summarised in table 3.

**Table 3: Approaches to data collection to fit different purposes**

| Case study | Main purpose of case study requiring economic data | Approach to data collection |
|---|---|---|
| **Bangladesh** | A comprehensive study on adaptation actions and CBA exists. This case study sought to identify those actions and strategies that maximize benefits to all stakeholders, given that not all can be implemented at once. | Value attached by stakeholders to the benefits from different actions. |
| **Morocco** | A government agricultural development programme involving converting to efficient irrigation, and that contributes to adapting to climate change needs to be upscaled and embraced by all stakeholder groups: large and small-scale farmers. The irrigation technologies that make the programme attractive to smallholder farmers. | The monetary and non-monetary benefits of conversion for different farm sizes, and conditions under which the programme is attractive to all farmers. |
| **Malawi** | Evaluating existing strategies to address climate change and climate variability. This will mostly inform other projects in the area, and thus has mostly research relevance. | Ex-post evaluation through interviews with local communities and enterprises. |
| **Nepal** | Collective identification and evaluation of adaptation actions that are economically viable and acceptable to stakeholders who use water resources for different purposes, in upstream and downstream locations. | Iterative scenario-based planning and analyses informed by government or official data on costs and benefits of actions as well as stakeholder perception of benefits and willingness-to-pay. |
| **Bolivia** | Stakeholder consensus on adaptation strategies: combinations of primary, supplementary, supply and demand side options. | Review of planned adaptation projects and facilitating stakeholder consensus. Mostly secondary data used to provide economic data. |

Measurement criteria:

- Scale or unit of analysis: this may be the household, catchment, village, etc.
- Public/private adaptation costs and benefits.
- Costs and benefits for stakeholders, aggregated for all stakeholders or disaggregated among different stakeholders.
- Distribution of costs and benefits among stakeholders.
- Stakeholder ranking of preferred costs and benefits.
- ex-ante or ex-post analysis.

### Key guidance message:

The end product is determined by the approach used, the detailed costs and benefits included in the analysis, and whether they are presented in quantitative or qualitative form. Even where costs and benefits have been estimated in detail, further stakeholder-focused analysis of the costs and benefits and their distribution could provide more critical information than the original analyses.

## 3.5 Step 5: Ground truthing

### 3.5.1 Ground truthing in stakeholder-focused CBA

The fifth step in this process involves ground truthing different variables from the previous steps in order to balance bottom-up local perceptions of environmental change, costs and benefits with top-down, academic or expert assessments of environmental change, costs and benefits. This is important to ensure that every element of the stakeholder-focused CBA is relevant and meaningful to the stakeholders who will be involved in implementing adaptation actions, and, wherever possible, supported by objectively verified information.

This balance is very important, but difficult to strike in analyses that are trying to project the costs and benefits associated with future climate change. This is because knowledge and behaviour based on previous climate patterns may be less appropriate to future climatic conditions, depending on the extent and speed with which climate change occurs. There are four main categories of information that practitioners need to ground truth in stakeholder-focused CBA.

- First is assumptions about different stakeholder groups' preferences for different types of adaptation actions and strategies.
- Second, which relates to the first, is the nature and magnitude of relevant costs and benefits identified by various stakeholders and/or researchers.
- Third is the type, magnitude and timing of expected/existing changes caused by climate change (depending on whether the analysis provides a retrospective or prospective valuation of adaptation actions).
- Fourth is the efficacy of the adaptation actions in addressing these climatic changes.

These four categories are vital for an accurate assessment of costs and benefits, and to strengthen stakeholder engagement or negotiations on the development and implementation of adaptation measures.

### 3.5.2 Examples of ground truthing from the case studies

Ground truthing was not included in the original theoretical methodological framework presented to the case study teams prior to case study research. That framework focused on establishing the minimum water quantity and quality provisions that each of the main stakeholder groups identified by the study would find acceptable under a climate change scenario. Its aim was to equip case study research teams with the information they needed to assess different adaptation strategies and facilitate negotiations between stakeholder groups.

In the event, none of the studies was able to establish the minimum acceptable requirements discussed in the methodological guidance document, mostly because of time and budgetary constraints. Fit-for-purpose was also a factor influencing its full application. The closest approximation to such standards were the expectations expressed by stakeholders in the Bolivian case study. What the case study reports do show, however, is the value of including a wide variety of stakeholders, identifying actual and perceived benefits, and ranking and/or valuing them. Because it was not possible to establish these minimum acceptable requirements, the role of negotiation in the case studies changed, as did the need to ground truth the four categories discussed above. In the absence of any theoretical guidance on ground truthing, each study handled the issue in different ways, with varying degrees of success.

The study in Nepal conducted the most detailed investigation into stakeholder perceptions of different adaptation strategies, using exercises to rank certain aspects of every option (including who pays for implementation) to determine each stakeholder group's preferred strategy. As a result, this study did not make the kind of assumptions about stakeholder preferences evident in the technical study that the Bangladesh case study followed up and ultimately challenged. It is worth noting that testing assumptions about the preferences of different stakeholder groups becomes less critical where there is minimal debate about which adaptation strategy is required (as in Morocco) or where other concerns prevail.

## Key guidance message (i):

When more than one adaptation strategy is possible, it is better to try to determine different stakeholder groups' preferences for each option rather than making assumptions about which is the preferred or most appropriate.

While investigating stakeholder preferences for different adaptation strategies and considering these strategies from various angles certainly provides a great deal of important information, it does not address the nature and magnitude of the costs and benefits associated with each strategy. The analysis in the Nepalese case study relied heavily on stakeholder perceptions of what the world will be like in the future. This is not necessarily a problem or cause for concern, but it does mean that the analysis overlooked any factors that might result from climate change interacting with various complex human/environmental systems. This case study would have been stronger if it had used additional sources of information on the costs and benefits of adaptation.

The importance of doing this is illustrated by the follow-up study in Bangladesh, which found that the stakeholder groups it consulted disagreed with the costs and benefits identified in the earlier technical study.

The Malawi and Moroccan case studies handled this issue well, using data from a number of individuals with first-hand experience of the adaptation strategies in question. While there is no guarantee that existing costs and benefits will remain the same over time, it is preferable to use data derived from first-hand experience rather than theory.

## Key guidance message (ii):

It is important to try to include multiple, independent assessments of the nature and magnitude of the costs and benefits of adaptation. Wherever possible, they should come from a range of sources.

The different approaches to ground truthing information on adaptation strategies (preferences, costs and benefits) are echoed in the way that the studies addressed the nature and timing of climate change. The Malawi case study mainly focused on climate change that has already happened and could use fairly high-resolution data documenting these changes, but still had to make assumptions about future climate change. In this case, there are justifications for these assumptions, but the results of the analysis will be brought into question if they prove to be inappropriate.

The other case studies, with the possible exception of the one from Bangladesh, are also burdened by uncertainty about the magnitude and timing of climate change. With no location-specific climate model data to rely on, the Nepalese case study had to use data on past trends and stakeholder perceptions of what climate change will be like. The Moroccan study had access to outputs from GCMs, but they are far from clear about the consequences of climate change on a small scale; and while the

Bolivian study could predict the disappearance of the glaciers with some certainty, it is less sure about the other impacts of climate change on the water sector.

## Key guidance message (iii):

Given the likelihood that there will be a high degree of uncertainty about climate change, practitioners should explicitly state their assumptions about the timing and magnitude of its future impacts, as these are critical factors when assessing the costs, benefits and effectiveness of adaptation strategies. Wherever possible, they should also use independently generated evidence to justify their assumptions.

It is also important to try to assess the effectiveness of adaptation actions in addressing the impacts of climate change. Although stakeholder engagement is a significant element of stakeholder-focused CBA, the 'business as usual' scenario also needs to be considered (social costs and benefits of not adopting an adaptation strategy). It is not simply a matter of determining whether the benefits of an adaptation strategy exceed its costs, but the extent to which it addresses the effects of climate change. This is significant because the analysis should also consider those impacts of climate change on the water sector that the selected adaptation strategy does not address.

None of the case studies included a formal 'business as usual' scenario analysis, and none is able explicitly to indicate the extent to which the preferred adaptation strategies would be able to address the impacts of climate change on the water sector.

## Key guidance message (iv):

Wherever possible, practitioners should also conduct a 'business as usual' analysis so that a transparent comparison can be made between the costs and benefits of adaptation and the situation without any intervention.

# 4 Conclusion

In theory, stakeholder-focused CBA is supposed to push the boundaries of traditional CBA. Conducting analyses to fit policy and action purpose, making stakeholders part of the decision-making process before concrete actions are taken or financed, and ensuring that all stakeholder groups are included a priori, enriches existing economic methods. This is especially true in the water sector where stakes are widely distributed among diverse stakeholders, and where issues range from too little to too much water. The five case studies served to provide a reality check on the applicability of an ambitious theoretical methodological framework, and to provide very useful perspectives on how this approach to CBA can be applied in different settings. In several countries under this project, the case study provided a practical platform for stakeholders, from government to local communities, to take on a different perspective to economic decision making, and to debate options that have practical relevance to them.

This guidance document therefore provides researchers and practitioners with practical scenarios and starting points for undertaking inclusive action-oriented analyses and processes that lead to actions and policies that have greater chances of wider acceptability and success. Innovation on the part of researchers and facilitators, rather than following rigid steps is the success to applying action-oriented stakeholder-focused CBAs.

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