GUIDELINES

GENDER-RESPONSIVE AND SOCIALLY INCLUSIVE CLIMATE COST-BENEFIT ANALYSIS

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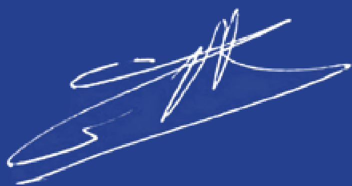
FOREWORD

As the world recovers and draws lessons from the COVID-19 pandemic, building a better and more sustainable future is seen by many Governments and citizens as imperative. The UNFCCC Conference of Parties (COP), both COP 26 and COP 27, have emphasized the need for scaling up climate actions and prioritizing the mitigation of climate-related risks for vulnerable sections of the population, including women, the poor, indigenous communities, and those living in areas particularly affected by climate change. As the United Nations Development Programme (UNDP) observes in countries across the world, climate change has a disproportionate impact on these vulnerable groups. Studies indicate that 80 % of people displaced by climate change are women[1]; 43% of the agricultural workforce[2] in developing countries are women and agricultural production is one of the sectors most affected by climate change.

Reducing climate risks for the vulnerable requires governments and other stakeholders to prioritize "protective" climate action and to integrate those action into national social, environmental, and economic plans and policies. Such an integration is increasingly happening in many countries. Finance Ministries, in particular, are factoring in climate change risks in national budgets and investment plans in order to reduce the economic and social costs that climate-induced disasters may bring to their countries.

To support Governments in implementing this new approach, UNDP has developed guidelines on how to incorporate gender and social inclusion into the cost-benefit analysis of climate change related plans and investments. These guidelines, which are based on experiences in the Asia-Pacific region and reflect global trends, are designed to help Government Officials to incorporate a gender and equity lens into the cost benefit analysis. They provide a systematic approach for assessing the costs and benefits of development projects related to climate change, taking into account the impact on vulnerable groups, in particular the poor and women.

We hope that these guidelines will serve as a valuable resource to Governments and all stakeholders, and will contribute to high impact climate actions that are gender-responsive and socially inclusive.



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United Nations Development Programme

1 How to Advance Women's Leadership in Climate Action | UN Global Compact

2 FAO- The State of Food And Agriculture 2010-2011

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About the Strengthening Governance of Climate Change Finance Programme

The Governance of Climate Change Finance Team of the UNDP Bangkok Regional Hub comprises experts specializing in SDG Finance, Governance, Development Finance and Political Economy, Climate Change, Public Financial Management and Development Effectiveness. The programme catalyses sustainable climate-related financing. It promotes self-sufficiency of development finance within country public financial management systems- both of which are keystones in achieving the goals of the 2030 Agenda.

The development of these Guidelines was commissioned under of the Project entitled "*Strengthening of Governance of Climate Change Finance to Enhance Gender Equality*", financially supported by Swedish International Development Cooperation Agency (SIDA) and implemented by Bangkok Regional Hub of United Nations Development Programme (UNDP)."

The Guidelines were prepared by Agha Ali Akram, Economist, with technical oversight and guidance by Asad Maken, Governance and Climate Finance Specialist and Radhika Lal, SDG Finance and Policy Advisor, UNDP Bangkok Regional Hub. For the second and final draft, Szilvia Lehel, Gender and Climate Finance Specialist led the write-up and finalization of the Guidelines on behalf of UNDP.

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The Guidelines were edited by George Perry, while Nattawarath Hengviriyapanich was responsible for the design and formatting of the publication.

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ABBREVIATIONS

ADB	Asian Development Bank
AF	Adaptation Fund
AR4/5	Assessment Reports of the IPCC (Fourth and Fifth respectively)
BAU	Business as Usual
BCR	Benefit Cost Ratio
BoB	Bureau of Budget (Thailand)
CAF	Compensatory Afforestation Fund
CBA	Cost Benefit Analysis
CC	Climate change
CCAP	CC Action Programme
CCAR	CC Annual Report
CCBA	CC Cost-Benefit Analysis
CCFF	CC Financing Frameworks
CCPB	CC Policy Bodies
CCSA	CC Screening and Appraisal
CCSAP	CC Strategy and Action Plan
COP	Conference of the Parties (of UNFCCC)
CPEIR	Climate Public Expenditure and Institutional Review
CSR	Corporate Social Responsibility
CTF	Climate Trust Fund
DRR	Disaster Risk Reduction
eCBA	extended Cost Benefit Analysis
EIA	Environmental Impact Assessment
ETS	European Trading System
GCF	Green Climate Fund
GCM	Global Circulation Model
GDP	Gross Domestic Product
GHG	Greenhouse Gas
IA	Impact Assessment
INDC	Intended Nationally Determined Contribution
IPCC	Intergovernmental Panel on Climate Change
L&D	Loss and Damage
LAPA	Local Adaptation Plan of Action
M&E	Monitoring and Evaluation
MCA	Multi-Criteria Analysis

MDB	Multilateral Development Bank
Mm3	Million cubic meters
MOAC	Ministry of Agriculture & Cooperatives (Thailand)
MoF	Ministry of Finance
MoP	Ministry of Planning
MTEF	Medium Term Expenditure Framework
NAF	National Adaptation Fund
NAP	National Adaptation Plan
NAPA	National Adaptation Programme of Action
NCF	National Climate Fund
NDC	Nationally Determined Contribution
NESDB	National Economic and Social Development Board (Thailand)
NPV	Net Present Value
OBA	Objectives Based Approach
ODA	Official Development Assistance
ONEP	Office of Natural Resources and Environmental Policy and Planning (Thailand)
PCCFAF	Pacific CC Finance Assessment Framework
PPP	Public Private Partnership
RoI	Return on Investment
SCC	Social Cost of Carbon
SD	Sustainable Development
SDG	Sustainable Development Goal
SIDS	Small Island Developing States
SNA	Sub National Authorities
SNC	Second National Communication (to UNFCCC)
SREX	Special Report on Extreme Events
tCO2e	Tons Carbon Dioxide Equivalent
UNCDF	United Nations Capital Development Fund
UKCIP	United Kingdom Climate Impacts Programme
UNDP	United Nations Development Programme
UNDRR	United Nations Office for Disaster Reduction
UNEP	United Nations Environment Program
UNESCAP	UN Economic and Social Commission for Asia and the Pacific
UNFCCC	UN Framework Convention on Climate Change
UNICEF	The United Nations Children's Fund
USAID	United States Agency for International Development
WBEACC	World Bank Economics of Adaptation to Climate Change
WRI	World Resources Institute

GLOSSARY

Adaptation

The process of adjusting to current or expected effects of climate change

Appraisal

Ex-ante evaluation

Climate Relevance (CC%)

The extent to which project performance is affected by climate change / The extent to which an action is devoted to delivering adaptation and mitigation, rather than mainstream economic, social and environmental benefits.

Downscaled

Climate change projections that apply to relatively small areas, below the level of detail provided in global or regional climate models

Losses and damages

The extent to which economic output will be lower as a result of Climate Change (net any potential benefits). This may be reflected in an increase in losses and damages from climate events (e.g., of crops, infrastructure, health etc.), reduced productivity (e.g., in crops, forests, water resources etc.) or indirect impacts on economic growth. In theory, it could also include social and environmental impact

Headline Scenario

The climate change scenario that is used for the main conclusions and may then be subject to sensitivity analysis

Mainstreaming

The process of integrating climate change into the routine processes of planning and budgeting

Maladaptation

An adaptive action that has lesser effect in combatting climate change, or in an extreme case may even lead to adverse effects due to the introduction of such measures

Mitigation

Reducing greenhouse gas emissions and thus, by definition, decelerating or ultimately halting climate change

Net Present Value (NPV)

The difference between the present value (PV) of the benefits (B) and costs (C): NPV = PV(B) – PV(C). Note that the basic decision rule for a single project, relative to the counterfactual, is to adopt the project if its NPV is positive

Opportunity Cost

The cost of not using a resource (e.g., land, labour) for another purpose

Proofing

Changing a project to protect its performance from climate change

Present value (PV) of costs

The sum of all costs, present and future, with each year's costs discounted at the selected rate.

Present value (PV) of benefits

The sum of all benefits, present and future, with each year's benefits discounted at the selected rate.

Scenario

A package of assumptions that produces a particular CCBA result

Sensitivity Analysis

Analysis of how results are altered as a result of a change in an assumption. It involves exploring the sensitivity of expected outcomes of an intervention to potential changes in key input variables. It can be used to test the impact of changes in assumptions and should be clearly presented in the results of appraisal

Social Cost of Carbon (SCC)

The social cost of carbon is an estimate of the economic costs, or damages, of emitting one additional ton of carbon dioxide into the atmosphere, and thus helps determine the benefits of reducing emissions.

ABOUT THESE GUIDELINES

WHAT ARE THE CCBA GUIDELINES AND WHAT PURPOSE DO THEY SERVE?

The aim of these *GUIDELINES on GENDER-RESPONSIVE AND SOCIALLY INCLUSIVE CLIMATE COST-BENEFIT ANALYSIS (CCBA)* is to facilitate factoring climate change impacts into a conventional project cost benefit analysis. As with other such economic assessment methodologies, it calls for identifying, quantifying, and, where possible and relevant, assigning a monetary value to the projected costs and impacts for the projects, policies, or initiatives from climate change, including, and particularly, in circumstances when these impacts occur over long term horizons.[3]

The fundamental argument for cost–benefit analysis (CBA) is that a financial perspective alone will not capture the gains to society at large, and that a further assessment of costs and benefits is necessary. Purely financial measures can be highly misleading as indicators of the social welfare improvements of a project because key outputs from many projects are either not sold on a market (for example, non-toll roads, solid waste management, reduction in air and water pollution, health improvements from water supply and sanitation), or are sold in distorted or controlled markets (for example, water and electricity sales subject to administrative pricing). Furthermore, even where project outputs are sold at commercial or market-clearing prices, for large projects with price effects, the benefits in terms of social welfare improvements (including gender equality) differ from project revenues.

3 It is important to recognize that there is considerable uncertainty regarding the range of possible climate change impacts and their severity. Good practice suggests that thus, adaptation measures need to be designed in a flexible manner so that they can be adjusted or reversed as new information becomes available. This is particularly important for adaptation options that have long-term implications, or for measures that typically have a long-life span, such as infrastructure. See UNFCCC (2011), ADB (2015)

In a growing number of countries, CCBA-type of approaches are a new feature in the existing process for justifying budget requests. Further, many international institutions now require this as a condition. For example, Asian Development Bank (ADB) policy requires climate-proofing as part of project design to try to mitigate the risk of environment impacts, including droughts, erosion, floods, to investments and projects.[4]

The role of the CCBA-related *economic analysis* is to support decision-making by assessing the economic efficiency of proposed investment projects, including 'climate proofing' investments[5]

In this context, a climate-proofing option is defined as an activity aimed at increasing the resilience of an investment/project to climate risk. Climate proofing must imply the consideration of modifications to a project design, such consideration being justified as a result of projected climate change.

In particular, these guidelines aim to serve as a tool for integrating climate change into planning and budgeting through the preparation of prioritized climate-informed budget submissions. They facilitate objective scoring of public expenditure, so that trends in climate-related investments can be monitored, demonstrating how such expenditures can prevent or moderate negative impacts from climate change.

These guidelines on CCBA, with an added focus on gender and social inclusion, can simply be integrated within the normal project planning and budgeting cycle of any government which would lead to more robust project evaluation and selection criteria and enhanced social impact.

WHO CAN USE THESE GUIDELINES?

These These CCBA Guidelines should ideally be used for all relevant public investments (including those undertaken by State Owned Enterprises) which are beyond a certain investment threshold (as explained in subsequent chapters) and appropriate for the national budget context. The Guidelines could also be used to inform public policies that affect private investments, such as regulations and incentives.

Additionally, private sector companies may find the Guidelines useful to better understand how to manage emerging risks to their investments in light of climate change, and what measures could be adopted to protect their profitability and establish forward-looking approaches for sustaining their competitiveness. More specifically, the Guidelines will help:

- Ministries of Finance to mitigate the risks to infrastructure, sectoral and project interventions from climate change through cost and benefit assessments necessary for and accruing through climate adaptation or mitigation measures
- Line Ministries to prepare budget and investment proposals that factor in impacts of climate change so that adaptation gaps in financing are identified and initiatives are better positioned to receive appropriate additional funding, either from national budgets or from national or international climate funds and/or international financial institutions. The relevant Ministry head may apply results of the analysis to structure conversations, review different scenarios, and also decide whether an adaptation/mitigation project is economically justified.
- Ministries of Planning for assessing proposals and exploring financing options, including tapping into climate finance.

4 See ADB (2017) para 18; also see ADB. (2015) for details of methodology and examples

5 It is important to acknowledge that there is some degree of subjectivity with regard to monetary values, and that all the factors that may be important cannot be valued in purely monetary terms. Thus, while economic analysis is a critical input for decision-making, it may be useful to complement it, particularly for some issues, by a multi-criteria analysis (MCA) methodology which recognizes that both monetary and non-monetary objectives may influence policy decisions. MCA can take on board environmental and social indicators side by side with economic costs and benefits and involves quantitative analysis (scoring, ranking and weighting) across the range of qualitative impact categories and criteria.

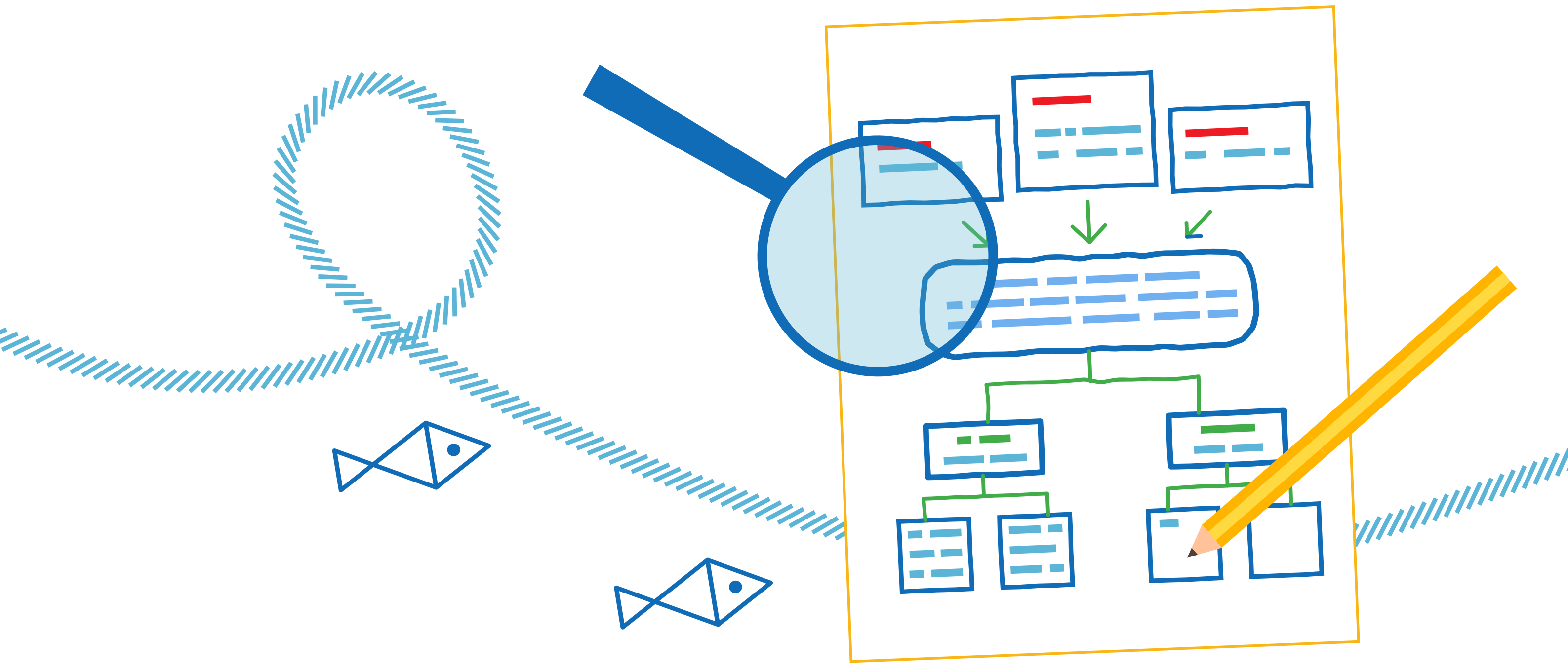
WHAT IS THE SCOPE OF THE GUIDELINES AND HOW WERE THEY DEVELOPED?

The Guidelines complement other screening tools and regular economic costing methodologies used for projects, and are not a substitute for them. The Guidelines draw on the practical experience and steps taken by some pioneering Ministries of Finance (such as in Thailand and Cambodia)[6], as well as experience from UNDP, its partners and other institutions and relevant experts.[7]

These Guidelines are also revised to integrate gender and social inclusion consideration in CCBA. While they are primarily intended intended for the countries in Asia-Pacific region, the approaches and examples presented certainly may also be useful and relevant to countries from other regions.

WHAT DO THE GUIDELINES ENTAIL?

The Guidelines describe a *range of methods* for estimating benefits when taking into consideration climate change adaptation and mitigation in project planning that is based on investment thresholds, and alongside this, the extent of climate relevance/impact for the investments concerned. It provides options for different levels of analysis based on the preparedness and understanding of climate vulnerabilities, and willingness of a country to mainstream climate change in project planning. Furthermore, the Guidelines provide an introduction to more detailed cost benefit analyses for larger investments, as well as options for more rapid/light assessments based on expert opinion for smaller initiatives.



6 These Guidelines elaborate on the useful and forward-looking guidance materials developed for budget submissions by Thailand in 2015 and draw on consultations with the key line Ministries of the Governments of Thailand and Cambodia to capitalize on lessons learned. See Government of Thailand and UNDP (2015). This is supplemented by material from other sources.

7 See, e.g., ADB (2015); USAID (2013); EU (2015)

1. INTRODUCTION

1.1 RATIONALE

Climate Matters

Conventional cost benefit analyses (CBAs) have been a time-tested method to guide decision-making and analysis of budget proposals. CBAs work on the premise that the assumptions or key parameters inherent to the analysis do not undergo fundamental changes, or in cases where they do, the changes are within normal range of sensitivities, and hence the benefits from the project could reasonably be predicted.

However, globally the frequency of extreme weather events is found to be on the rise, and the Asia-Pacific region is found to be extremely vulnerable to both extreme weather events and geophysical shocks, and is also seen as one of the most vulnerable to future climate change.[8]

Climate change is introducing a thus far underexplored element to CBAs that could have a significant effect on the final outcome of the analyses. In particular, long-term projects that have correlation to the effects of changes to climate over periods of time (e.g., temperature, precipitation, extreme weather events, etc.) will be more affected by the vagaries of climate change and hence need to incorporate climate change into their CBAs. Such projects may include physical infrastructure (such as a bridge or road) or a long-term policy instrument (such as insurance for farmers). Infrastructure will be exposed to a changing climate, e.g., a bridge designed with today's climate as a reference may perform poorly as the climate changes over time, even with the inclusion of built-in safety margins in the design.

8 See UNESCAP (2019) Report, which underscores that disasters in the Asia-Pacific region have been growing in intensity, frequency and complexity. According to the report, in 2018, almost half of the natural disaster events that took place across the globe, occurred in the Asia-Pacific region.

Estimated annual economic losses for the region were approximately USD 675 billion (2.4% of the region's GDP), of which USD 405 billion were drought-related agricultural losses. Asia accounts for nearly 31% of weather, climate, and water-related disasters globally, for nearly half of all deaths and one-third of associated economic losses.

A total of 3,454 disasters were recorded, with 975,622 lives lost and $2 trillion reported in economic damages.

Taken from: Atlas of Mortality and Economic Losses from Weather, Climate and Water Extremes, from 1970 to 2019.

Various institutions and stakeholders may also need to think about their performance as the climate changes, e.g. a crop insurance scheme's payout stream may alter as the climate changes. Therefore, the design of such long-term projects must incorporate elements that enable them to perform better or at least maintain their performance as the effects of climate change manifest.

This is not to say that short-term projects need not take into account climate change in the CBA. With extreme weather events becoming more frequent and more severe, short-term projects, such as building a flood prevention barrier, or a cyclone shelter, will also need to factor climate change into CBAs, preventing them from losing out in depicting the actual benefits of such projects.

Gender and Social Inclusion (GESI) Matter

It is understood globally that climate change would affect the marginalized sections of the society disproportionately.[9] Climate change has a greater impact on those sections of the population, in all countries, that are most reliant on natural resources for their livelihoods and/or who have the least capacity to respond to natural hazards, such as droughts, landslides, floods, and hurricanes.

Women commonly face higher risks and greater burdens from the impacts of climate change due to underlying gender inequalities, particularly in situations of poverty, and the majority of the world's poor are women.10 In the aftermath of disasters, women are more likely than men to be displaced, to be sexually assaulted, to be victims of violence and to face other human rights violations.

In many regions, women are more likely than men to conclude formal education early, making them less informed about climate change and less likely to be involved in decision-making that will affect vulnerability. Similarly, a gendered sociocultural ethos does not encourage girls to learn skills such as swimming and tree-climbing that help people to survive during floods.[11]

Women are also more affected by drought and water shortages, often bearing the burden of having to spend significant time travelling to distant water resources and returning home to provide water for their families.[12]

Crucially, women tend to possess fewer assets and depend more on natural resources for their livelihoods. For example, in the Asia-Pacific region. Nearly 58 percent of the economically active women work in the agriculture sector, yet between 10 to 20 percent of women hold secure tenure to the lands they farm (FAO, 2011), with regional variations.[13]

The majority of employment opportunities for women in the Asia-Pacific region outside the agriculture sector is informal, with much of it located in urban areas. The share of women working in the informal sector ranges from 45 per cent to more than 80 percent (ADB and ILO, 2013). Women's unequal participation in decision-making processes and labour markets further compound inequalities and often prevent women from fully contributing to climate-related planning, policy-making, and implementation. The sectoral composition of women workers has consequences on their access to productive resources, safe working conditions and security of tenure has multiple repercussions, particularly in the gender and environment linkages.

9 "Differences in vulnerability and exposure arise from non-climatic factors and from multidimensional inequalities often produced by uneven development processes (very high confidence). People who are socially, economically, culturally, politically, institutionally, or otherwise marginalized are especially vulnerable to climate change and also to some adaptation and mitigation responses (medium evidence, high agreement). This heightened vulnerability is rarely due to a single cause. Rather, it is the product of intersecting social processes that result in inequalities in socioeconomic status and income, as well as in exposure. Such social processes include, for example, discrimination on the basis of gender, class, ethnicity, age, and (dis) ability.": IPCC, 'Summary for Policymakers', in Climate Change 2014:

10 Poverty deepens for women and girls, according to latest projections | UN Women Data Hub

11 Nellemann, C., Verma, R., and Hislop, L. (eds). 2011. Women at the frontline of climate change: Gender risks and hopes. A Rapid Response Assessment. United Nations Environment Programme.

12 Please refer to: https://www.climatechangenews.com/2020/03/08/power-structures-gender-make-women-vulnerable-climate-change/

13 In a number of countries, less than 10 percent of agricultural landholders are women. These include Bangladesh (at 4.6 per cent in 2008), Fiji (at 3.6 per cent in 2009), the Islamic Republic of Iran (at 5.9 percent in 2002) and Nepal (at 8.1 per cent in 2002). Countries with a larger proportion of women agricultural landholders, which ranges from 23 per cent to 30 per cent of total agricultural landholders, include Armenia, Georgia, Niue, Samoa, and Thailand (ESCAP, 2016a)

Yet, women can (and do) play a critical role in response to climate change due to their local knowledge of and leadership in sustainable resource management and leading sustainable practices at the household and community level. At the local level, women's inclusion at the leadership level has led to improved outcomes of climate-related projects and policies, while on the contrary, if policies or projects are implemented without women's meaningful participation it can increase existing inequalities and decrease effectiveness.[14]

Thus, there is an urgent need to integrate climate change into the design and financing of activities, policies or investments related to agriculture, infrastructure, urban development, coastal management, and interventions in geographic areas/sectors where climate change is likely to have significant impacts. It is also important to look into climate change planning from the perspective of 'Gender and Social Inclusion (GESI)' to make the planning process more inclusive as well as more responsive to the most vulnerable population.

A focus on resilience and risk-informed planning and budgeting is on the rise

Fortunately, there is growing recognition of the need to not only ensure that investments in infrastructure are more resilient, but also of the importance of considering synergistic national and regional investments in disaster risk reduction and climate change adaptation.

Governments are looking to proactively assess the implications of potential climate change impacts, and weighing the costs of inaction and suffering the impacts vis-a-vis implementing options for risk mitigation and climate-proofing measures. Moreover, governments are considering not just the potential direct impacts on public goods, infrastructure, and services, but also the indirect impacts on taxes and expenditures.

Cost benefit analyses (CBAs) with climate change (CCBAs), and gender-responsive perspectives integrated into them, are the tools that are being deployed in this regard. In fact, these Guidelines elaborate on the useful and forward-looking guidance materials that were developed by Thailand for their budget submission process in 2015, and also build on consultations with key line Ministries of Governments of Thailand and Cambodia to capitalize on lessons learned.

CCBA need to be considered as an iterative process

At the outset, it should be noted that CCBAs are not without challenges. Even in cases where it is clear that climate change will impact a sector or infrastructure or have implications for the budgeting of institutions for programmes, predicting the magnitude and frequency of impact is subject to some degree of uncertainty. How to justify costs to the public for a seemingly expensive adaptation measure when it is at times not clear that the risk will materialize to the extent anticipated and whether there could be other alternatives?

Evidence certainly points to cost savings and a variety of benefits from proactive disaster risk reduction and adaptation. As Tröltzsch et. al. (2016) make clear, there could effectively be a two-pronged approach to deal with the uncertainties involved:

i. A focus on immediate actions to address *current risks of weather and climate extremes* (so called low- and no-regret actions, which provide immediate economic benefits, as well as future benefits, under a changing climate)

ii. The integration of adaptation into immediate decisions or activities with long life-times which involve a greater focus on *climate risk screening and the identification of flexible or robust options that perform as well as possible under uncertainty*.

Given the risks but also the uncertainty of the frequency and scale of events and impacts, the EU's Economics of Adaptation (ECONADAPT) project[15] underscores a number of different dimensions of a proactive focus on adaptation in this regard:

- Decision-making related to investments is a dynamic process which responds to new climatic and socio-economic conditions with a strong focus on *iterative risk management and learning*

14 See: https://unfccc.int/gender

15 Please see: https://econadapt.eu/about-project.html

- Strategic scoping, phasing and prioritization proactively considers responses adapted to current climate variability and future climate change over longer periods of time
- Practical adaptations developed as portfolios of measures, which could allow (current and) future society to deal with unforeseen events, with greater resilience and in robust and flexible ways, and where investments would involve a broader set of response types than a project style optimization approach typically allows for.

Thus, in the event that the cost-benefit analysis cannot provide an upfront justification for the full investment at the present time, the CCBA exercise can be repeated in light of new developments even as adaptation measures are designed in a flexible manner so that they can be adjusted or reversed as new information becomes available.[16]

Further, CCBAs, similar to conventional CBAs, do not systematically take on board non-economic criteria that may be relevant for choosing among different options. The use of both CCBA and non-economic analytical tools (e.g., multi-criteria analysis, MCA) may be useful for structuring policy and community discussions regarding the trade-offs between options as opposed to CCBAs being viewed as the sole rule for making budgetary decisions. Gender and Social Inclusion is one such criterion which should be considered integral to CCBAs to establish a more robust system of decision-making.

The CCBA supplements other appraisal techniques such as:

- **Multi-Criteria Analysis (MCA) – (CIFOR 1999, DCLG 2009, USAID Jan 2013, UNEP DTU 2015, Gianoli et al, 2018);**
- **Environmental Impact Analysis (EIA) and Health Impact Assessment (HIA) – (IEMA 2016, IISD 2016); and**
- **Poverty and Social Impact Analysis (PSIA) – (World Bank 2009)**

The results of any study – and the estimates of the costs and benefits of adaptation or mitigation they produce – have the potential to be misleading if viewed in isolation. It is important for any study to be transparent about the assumptions used and implications of these on potential decisions. Finally, one of the principal aims of investigating the costs and benefits of adaptation and mitigation is to help allocate resources, and to inform national adaptation planning by governments through to local decisions.

In particular, the use of iterative climate risk management to consider uncertainty has emerged, which considers climate and non-climate risks as a dynamic set of risks. It is often difficult to compile and compare estimates, because of the different approaches being used. Studies use different methods, objectives, metrics, and assumptions. No method is absolutely right or wrong and they all have strengths and weaknesses according to the objectives of the exercise and the specific application.

Therefore, the focus is on aiming for utilizing most state-of-the-art approaches, rather than providing absolute estimates of the costs of adaptation and mitigation. The following sections introduce the various steps related to preparing and conducting a CCBA, as well as establishing a basis for monitoring and evaluation, with dedicated attention to social welfare (GESI) considerations and distributional impacts.

1.2 WHERE DO CCBAS FIT IN AND WHAT ARE THE STEPS INVOLVED?

Integrating climate change into cost benefit analysis for planning and budgeting is critical, and these Guidelines can be used to make the case for using CBA in budget submissions. Additionally, by adopting CCBA-informed proposals and climate budget tracking methodologies, policymakers can not only make informed choices but also track trends in climate expenditure and impacts to ensure accountability.

16 ADB (2015) underscores that uncertainty about climate change does not invalidate the conduct of the economic analysis of investment projects, although it does call for a different type of decision-making process in which technical/substantive and economic expertise combine to assess options and present decision makers with the best possible information on the economic efficiency of alternative designs of investment projects. It cites the following example with regard to flexible design: while current sea level rise and storm surge scenarios may not warrant the construction today of sea dikes suitable to projected higher sea level and stronger storm surges in a distant future, the base of the sea dike may nonetheless be built large enough at the time of construction to accommodate a heightening of the sea dike at a later point in time.

FIGURE 1. PLANNING AND BUDGET CYCLE FOR GOVERNMENTS

STEP 1	STEP 2	STEP 3	STEP 4
Assessing climate change vulnerability and impacts including on GESI	**Appraising adaptation and selecting adaptation options**	**Implementing adaptation options**	**Monitoring and evaluating adaptation action and learning**
1. Identify Climate change vulnerabilites to project components 2. Identify bio-physical risks 3. Identify socio-economic risks 4. Assess impact on investment	1. Establish Adaptation Objective 2. Identify all potential adaptation options 3. Conduct consultations 4. Conduct economic analysis of adaptation options 5. Proritize and select adaptation options	1. Prepare relevant budget proposals 2. Implement budget proposals	1. Design Monitoring and evaluation plan, including performance indicator 2. Feedback into policy-making and knowledge management

A typical planning and budgeting process within the government system would comprise the following:

i. *context-sensitive climate risk screening at the concept development stage to identify projects that may be at medium or high risk;*
ii. *climate change risk and vulnerability assessment during preparation of projects at risk;*
iii. *technical and economic evaluation of adaptation/ mitigation options;*
iv. *identification of adaptation / mitigation options in project design; and,*
v. *monitoring and reporting of the level of risk and climate-proofing measures.*

This planning and budget cycle is followed by most governments. Thus, CCBA and GESI analysis could easily be incorporated within the normal project planning and budgeting cycle of any government, which would, in turn, lead to more robust project evaluation and selection criteria. Ideally, this should be done at the beginning of the planning/project cycle to inform choices, including those relating to climate-proofing.

However, it should be noted that this does not require that decision makers need to commit to making all the needed investments at that time. It does imply, however, as ADB (2015) points out, that decisions about project design and the adoption and timing of climate-proofing measures must be informed by the possible socio-economic and environmental impacts of climate change in the initial phases of the project cycle, and that any decisions of an irreversible nature are avoided.

This is what is referred to as ensuring that the project is “ready” for climate proofing, if and when required, and adaptation financing will be phased through the project’s life-cycle. The CCBA guidelines should ideally be used for all relevant public investments (including those undertaken by State Owned Enterprises) which are beyond a certain threshold (as explained in subsequent chapters) and appropriate for the national budget context.

The guidelines could also be used to inform public policies that affect private investments, such as regulations and incentives. Additionally, private sector companies may find it useful to use this guidance as it may help them better understand how to manage the emerging risks to their investments in light of climate change, and what measures could be adopted to protect their profitability and establish forward looking approaches for sustaining their competitiveness.

1.3 CLIMATE CHANGE SCREENING

Chapter 2 in this document describes the **screening and appraisal process** which determines which projects or portfolios need to undertake CCBA and the level of detail required. Faced with limited resources, all countries must prioritize their climate actions (adaptation and mitigation) and spending. To meet this challenge, decision-makers can seek to pinpoint the most cost-efficient measures for using scarce public resources, including identifying "no regrets" options for mitigation and "low regrets" options for adaptation[17]. This exercise will assist with the (re-)design of the programmes and associated investments in infrastructure in either of two ways:

a. reduce or eliminate the potential economic or non-economic losses from impacts and risks that current and future CC impacts may cause and/or
b. enhance those measures which aim to contribute positively to an adaptation or mitigation response.

Thus, **the first criterion** for applying the CCBA guidelines for project evaluation is determing *whether the climate relevance of the projects are justifiable, i.e., is it at significant risk from climate change and/or contributes to addressing it through adaptation and mitigation.* A project is viewed as being climate relevant if it is likely to be significantly impacted or is an adaptation project - i.e. it aims to prevent or moderate harm arising from climate change or a mitigation one - i.e. reducing green house gas (GHG) emissions and contributing to and contributes to national and global efforts to combat climate change.

The table below provides examples of adaptation and mitigation activities and their relevance. It is worthwhile to note that there could be some projects which will have high relevance from sustainable development (SD) perspectives but low climate change relevance. Such projects may not be subjected to CCBA guidelines in the initial stages.

Assessing the economic, environmental, and social costs and benefits of adaptation plays a critical role in informing the second (planning) stage of the adaptation process. Assessment of costs and benefits informs planners about when and where to act and how to prioritize and allocate scarce financial and technological resources.

The relevance to climate change of policies and programmes depends on the responsiveness to the estimated current and potential impacts of climate change on different population groups (the poor, vulnerable and disadvantaged groups, women, and children), different geographic areas, and different institutional capabilities to deliver services.

17 The "no regrets' aspect of climate risk management means taking climate-related decisions or action that make sense in development terms anyway, whether or not a specific climate threat actually materializes in the future, which is achieved by building resilience to changing economic, social and environmental conditions.
There is, however, no agreed definition of low-regret options, and definitions include:
i) options that are no-regret in nature, but have opportunity, transaction or policy costs;
ii) options that have benefits (or co-benefits) that are difficult to monetise;
iii) low-cost measures that can provide high benefits if future climate change emerges;
iv) options that are robust or flexible, and thus help with future uncertainty. DFID (2014) –
This report uses a pragmatic definition of "low-regret" – that focuses on promising options for early adaptation. This includes options that are effective in addressing the current adaptation deficit, but also future-orientated, low-cost options that build resilience, flexibility, or robustness, as well as capacity-building and the benefits it provides through the value of information. *DFID (2014), Early Value-for-Money Adaptation: Delivering VfM Adaptation using Iterative Frameworks and Low-Regret Options, UK Department for International Development, London.*

TABLE 1. ADAPTATION AND MITIGATION PROJECTS AND LEVEL OF CLIMATE CHANGE RELEVANCE

Type	Adaptation Projects	Mitigation Projects
High CC relevance	• Vulnerability analysis • Community resilience planning • Protection for floods & sea level rise • Drought resilient crop varieties • Flood proofing roads, irrigation etc.	• Research on cost effectiveness of reducing GHG emissions • Studies on losses and damages from not mitigating GHG emissions • Public awareness of GHG emissions
Mixed CC and SD relevance	• Biodiversity corridors • Irrigation schemes • Community forestry • Untargeted water/sanitation • Forward plans for tackling climate-related diseases • Urban plans to reduce vulnerability	• Renewable energy • Reforestation • Energy efficiency • Public transport
Low CC relevance and high SD relevance	• Unsustainable groundwater use • Promoting water intensive crops	• Roads that increase pollution

Source: Experience from CPEIR and CCFF work in Southeast and South Asia

Some programmes are wholly relevant, such as those developing climate change adaptation and mitigation policies or researching the impact of climate change. However, some programmes that address the development gap and already existing climate challenges may only provide additional benefits under climate change circumstances. To appreciate how resources are dedicated to policies and programmes responsive to the impact of climate change, it is thus useful to weigh the collected allocation and expenditure data (CPEIR Methodology, 2018).

The second criterion for applying CCBA guidelines is the scale of the investment. The scale of investment of the project determines the extent and details involved in the CCBA. This threshold is maintained through considering the practicalities of details required in the assessment. Given that CCBAs are potentially costly and consume both human as well as technical resources, countries typically outline specific thresholds, over which a formal CCBA is called for and below which other tools can be used. This is elaborated in the Box 1 dedicated to budget thresholds.

BOX 1. BUDGET THRESHOLDS FOR CLIMATE CHANGE ANALYSIS

Budget Thresholds for CC Analysis

Ireland: The Public Spending Code recommends the use of various types of analysis and different thresholds:

- below €0.5m: a simple assessment required;
- between €0.5m and €5m: elements of a preliminary and detailed appraisal for projects;
- between €5m and €20m: multi criteria analysis (MCA) required; and,
- over €20m: cost benefit analysis (CBA) or cost effectiveness analysis (CEA) is required.

Thailand: A CCBA is required for all projects that cost more than THB 50m (at the time of writing) that are affected by climate change. For project investment over THB 1,000m, a full analysis is required. For projects between THB 50m and 1,000m, a range of practical options for CCBA that can be completed easily and rapidly can be used.

2. A QUICK TOUR OF THE GENERAL PRINCIPLES AND BUILDING BLOCKS FOR CCBAS

2.1 INTRODUCTION

The goal of a Cost-benefit Analysis with Climate Change (CCBA) is to assist decision-makers in clearly understanding how projects/ initiatives are at risk of being impacted by climate change and to assist them in making choices between different alternatives, through the quantification of the economic costs and benefits of adaptation and mitigation projects – which is a critical factor for budget allocations and decisions.

Cost-benefit Analysis *with climate change* requires an assessment of how benefits and costs change over a long-run project-relevant period (for instance from 2020 through to 2050) factoring in climate change.

Analysis can be done using *quantitative* cost benefit analysis to establish a project level benefit-cost ratio by using as much hard evidence as possible; or, it can be done in a *qualitative* manner, with varying types of qualitative assessment.

A Cost-benefit Analysis (CBA) has been a long-favoured tool, particularly when needing to place a monetary value on non-tangible items (as well as its general purpose of summing up the potential rewards and then subtracting the associated costs to assess what the overall benefits are); albeit, placing a monetary value can be problematic, as discussed below. As a result, there is much guidance available on how to best execute CBA and these guidelines do not aim to duplicate them (Chutubtim 2001; World Bank 2009; World Bank IEG 2010; HMG 2011; UNFCCC 2011; ADB 2013; 2017).

There are also a number of tools and methodologies related to undertaking economic analysis and costing the impacts of climate change/assessing climate risks across different business sectors and industries and identifying and analyzing climate change adaptation options under uncertainty (e.g., GIZ, ADB (2015), USAID (2013), EU's ECONADAPT.

When assessing potential social impacts, a key limitation associated with the traditional CBA model is the inherent incommensurability between the economic rationale of the CBA and social change rationale underpinning the human rights' goals of gender equality and social inclusion. The traditional CBA is based on economic rationale that compares alternatives and makes choices based on monetary valuation.

However, there is no monetary value assigned for 'goods' like an improvement in women's social status or position and such monetary valuations undermine the concept of justice and fairness. Social inclusion considerations are important to consider the marginalized, discriminated, and vulnerable people within a population.

These guidelines draw on insights, examples, and lessons from these to illustrate how to promote the integration of climate change into conventional cost benefit analysis with an additional focus on gender and social inclusion.

Therefore, along with a clear articulation of project activities, the steps in CCBA are as follows.

1. Define project timeframe and discount rate
2. Select the Climate Change (CC) scenarios to be used (e.g., IPCC, downscaled, trend-based scenarios);
3. Define how the parameters, both physical (e.g., yields) and behavioural (e.g., enterprises) as well socio-economic considerations (based on vulnerability assessments), and how the inputs (i.e., project expenditure) lead to the outputs (e.g., changes in yields, water flows, electricity, disease cases, etc.);
4. Define how the project changes these parameters, both with CC and without CC;
5. Estimate the total value of costs and benefits, with and without CC;
6. Incorporate gender and social inclusion into model;
7. Estimate the CC relevance (CC%), defined as CC benefits as a proportion of total benefits; and,
8. Conduct sensitivity analysis.[18]

(Note that the building blocks of the economic assessment process are discussed in more detail in **Chapter 3**).

The above seven CCBA steps lead to an estimation of the *economic cost of climate change* (before any consideration of any form of adaptation or mitigation). This is measured as the reduction in the Net Present Value (NPV) of the project as a result of climate change, [NPVp(NoCC) - NPVp(CC)]. What is relevant is to compare and assess the effectiveness of proposed climate-proofing (CP)/ adaptation/mitigation measures - i.e., where the economic impact of a climate-proofing measure is estimated as the difference between NPVp(NoCP) and NPVp(CP). The net benefit of climate proofing is estimated as [NPVp(CP) - NPVp(NoCP)].

Since CCBA is considered to be an iterative approach as explained in the earlier chapter, once the first analysis is done, it would be prudent to revisit the analysis to ensure that the most recent and relevant information has been used so that the results represent current best knowledge.

Before outlining how the approach can be applied to different themes, the focus will be on working through the steps through a running example which is totally hypothetical, to illustrate the core ideas being conveyed and to integrate the various building blocks of the analysis.

Running Example: Our example is of a group of 100 farmers, managing a total of 1,000 acres of rice fields in a region called Riceland. They currently rely on existing annual precipitation patterns for their summer rice harvest. The climate in Riceland is expected to get a little bit hotter, with rainfall expected to get more erratic by the middle of the century. To simplify this analysis, we will divide the rice season into two halves - early season and late season, each of which requires a specific quantity of water for a successful rice harvest.

Further, we will say that Riceland's government is considering investments in adaptation and mitigation. Specifically, for adaptation they are considering installing a gravity driven irrigation and drainage canal network for those 100-farmers. The irrigation system will be supplied water from a local reservoir built specially for farmland irrigation (this already exists and has sufficient water available at all times for Riceland farmers). The project life span is 30-years (assuming a start date in 2020).

18 Refer to glossary for a brief explanation of some of these terms, as well as contextual explanation throughout the text

At the same time, the project's mitigation action has to do with how farmers apply water. With climate-resilient water application guidance from local extension services, along with improved drainage, rice paddy will be inundated for shorter durations reducing the total methane emissions. In this case, the project would have costs associated with the mitigation activities (added training costs for extension officers, additional labor hours spent by extension officers in conveying climate-resilient irrigation practices, and improved drainage system costs), and assessing the benefits that accrue from avoided emissions. Socio-economic profiles of farmers need to be considered, including access to irrigation systems and climate information, educational capacity, land ownership, etc. to better inform the assessment of cost and benefits. In terms of the mechanics of cost-benefit analysis, this is parallel to the analysis for adaptation. For the purpose of this guideline document, we will use the above example to illustrate CCBA.

2.2 CONCEPTUALIZING CBAS FOR ADAPTATION AND MITIGATION

All CCBAs require a clear delineation of:

- The baseline with and without factoring in of factoring in climate change impacts
- The definition of the situation without and with the adaptation investments.

This is useful because cost benefit analysis quantifies the marginal net benefits of the project being analyzed, i.e., the difference between the marginal benefits and marginal costs of the adaptation and mitigation. This means that we must carefully quantify the additional costs of adaptation and mitigation, and the additional benefits accrued from the adaptation and mitigation compared to the baseline.

The goal of adaptaion is enhancing adaptive capacity, strengthening resilience and reducing vulnerability to climate change. The goal of adaptation is to reduce loss and damage from climate change. Without accounting for a changing climate in CBA, the analysis will be incorrect and generate a biased net benefit estimate. To assist conceptualizing this, please consult Figure 2.

FIGURE 2. THE MARGINAL NET BENEFITS FROM ADAPTATION

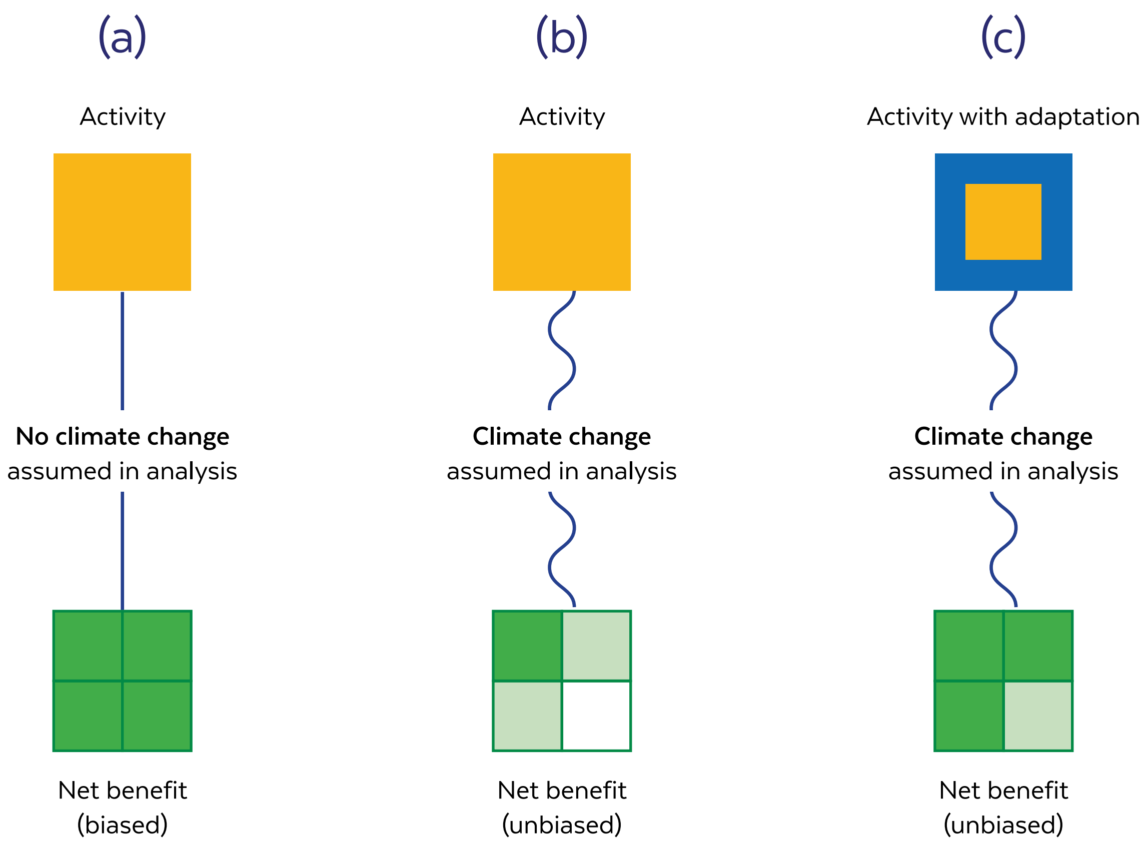


Figure 2 highlights three analytic possibilities. Panel (a) of Figure 2 shows business-as-usual CBA for some activity (activity is shown in orange, climate trajectory is shown by the blue line that connects to the net benefit shown as a group of green boxes). The activity – e.g. farming – has not had any adaptation proposed for it. Moreover, the analysis (CBA) does not assume any climate change. This analysis results in a biased net benefit estimate.

Panel (b) shows the correction: the analyst corrects the CBA by introducing and integrating climate change into it, which results in a less biased net benefit estimate.

Finally, panel (c) suggests the net benefits calculated once an adaptation to the activity has been made (the thick blue outline on the orange activity box), in light of climate change.

Conceptualizing mitigation net benefits is relatively more straightforward. Mitigation activities directly reduce emissions that would otherwise contribute to a changing climate. Therefore, a scientifically valid estimate of reductions in emissions is needed from a credible source (a specialist). The reduced emissions must be valued at a recognized social cost of carbon (with non-carbon emissions equated).

Running Example: Let us operationalize this in our minds. Without accounting for climate change (panel (a) of Figure 2), we calculate incorrect net benefits. We correct our analysis by carefully thinking through the link between agriculture and climate – namely water availability from precipitation (see next section ahead and Figure 2) including the integration gender considerations in establishing links between CC, agriculture sector, and water security – and calculate net benefits from agriculture accounting for climate change (panel (b) of Figure 2). Finally, we introduce a proposed adaptation strategy into the analysis and calculate net benefits accounting for the adaptation (panel (c) of Figure 2).

It is clear that in a world where we accept climate change and need to rationally choose adaptation intervention, we must account for climate change in our analysis. So, panel (a) of Figure 2 is a scenario that ought not to occur in the analysis of adaptations. Also note that, by definition, mitigation projects address climate change and the CBA for such projects hinges on an accurate estimate of emissions avoided and the price of those abated greenhouse gas emissions. Therefore, the project's net benefits increase by increased benefits accrued from emissions reductions.

2.3 PROJECT TIMEFRAMES AND CHOICE OF DISCOUNT RATES

The first thing we must do is define the adaptation project's timeframe. What is the relevant time horizon for this project? When considering adaptation strategies to respond to climate change to climate change, it is important to understand and define timeframes explicitly, since the best response to climate change requires careful phasing of projects and a focus on projects that have long term impact (e.g., infrastructure, research, and institution-building).

Most projects involve a few years of investment, followed by a stream of costs and benefits. Whenever more than one period of time is involved in our analysis, we employ discounting. Future benefits and costs are discounted to enable comparisons in present value terms, i.e., the future tends to be worth less than the present. Discounting reflects a combination of society's impatience (the pure rate of time preference) and the value that investment can generate (a goods discount rate).

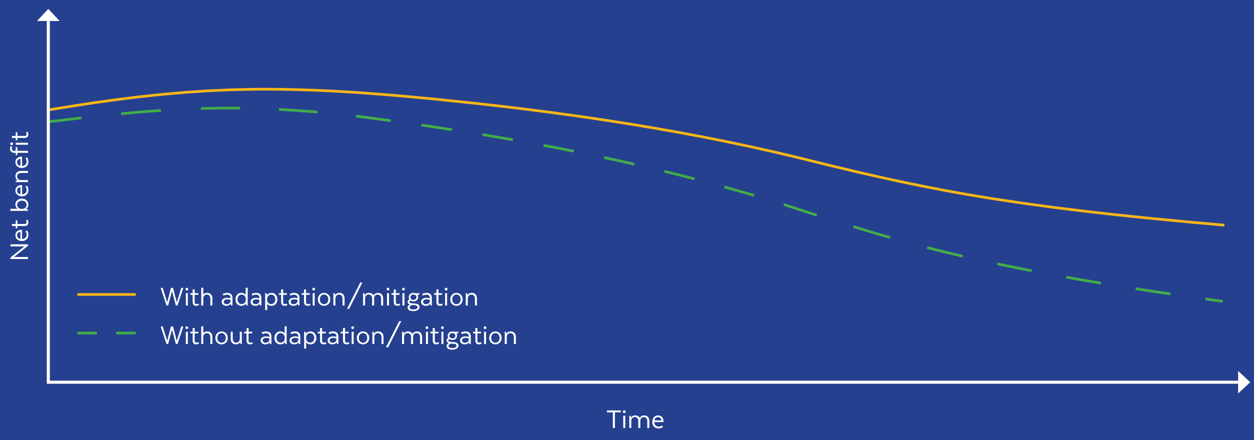
2.4 WHAT SOCIAL DISCOUNT RATE SHOULD BE USED?

The choice of appropriate social discount rates is anchored in welfare economics, which assumes that the marginal value of an additional dollar of net benefits is smaller when the recipients of those benefits are richer. If an economy is growing over time, the recipients of future benefits of a project will be richer. As a result, future benefits are valued less than those that occur in the present, when recipients are worse-off.

Thus, if growth is expected to be positive over the life of the project, future beneficiaries will be richer than current individuals, and future benefits should be discounted accordingly. The social discount rate actually measures, "the rate at which a society is willing to trade present for future consumption" (Lopez, 2008). As such, the social discount rate is especially important for projects whose benefits are only apparent after many years to decades, like green infrastructure projects.

The use of a low social discount rate supports the view that we should act now to protect future generations from climate change impacts. In other words, more importance is given to future generations' wellbeing in cost-benefit analyses.

FIGURE 3. THE MARGINAL NET BENEFITS FROM ADAPTATION AND MITIGATION OVER TIME



In theory, the discount rate should equate to the real interest rate, which is a good indicator of the opportunity cost of capital.[19] The rate hitherto used by many development banks was in the neighborhood of 10%.[20] In this context, a discount rate of 5% is viewed as being consistent with the practice in many countries to use lower discount rates to promote longer term decision-making (HM Treasury, 2011 #537). It also reflects the more stable macroeconomic conditions prevailing in countries in recent decades.

There are significant variations in public discount rate policies practised by countries around the world, with developing countries, in general, applying higher social discount rates (8–15%) than developed countries (3–7%). These variations reflect the different analytical approaches followed by various countries in choosing the social discount rate that the divergence reflects differences in the perceived social opportunity cost of public funds across countries and in the extent to which the issue of intergenerational equity is taken into consideration in setting the social discount rate.

For qualitative analysis, the assessment of time is often important, but rarely explicit. Many advocates of sustainability give a high value to projects that deliver long term benefits because they believe that conventional development undervalues the long-term implications of development.

Running Example: Figure 3 shows the stream of marginal net benefits with and without adaptation and mitigation. This is the key comparison for cost benefit analysis, accounting for climate change. Again, we accept that climate change is a reality that we must adapt to and/or mitigate through abatement of emissions. The key question to answer is how best to adapt and how best to abate.

19 For example, over most of the last 10 years, the Thailand central bank policy interest rate has been less than 5%, and the government bond rate has also been less than 5%, at a time when inflation has been 1% to 4%. This suggests that 5% is, in fact, significantly higher than the opportunity cost of capital.

20 See ADB (2015), para 194. ADB currently uses a social discount rate (SDR) of 9% as the minimum required EIRR for all investment projects in transport, energy, urban development, and agriculture. Previously, it used 12%. The revision takes into consideration continued increases in the income levels of developing Asia, lower foreign borrowing costs compared with the past, and the growing importance of environment protection projects in ADB lending that tend to have very long-term impacts, all suggesting the need for a lower SDR. The rate is viewed as acting as a rationing rate to ensure efficiency in the use of its resources and to serve as a proxy for the opportunity cost of capital in individual developing member countries (DMCs).

Further, for social sector projects, selected poverty-targeting projects (such as rural roads and rural electrification) and projects that primarily generate environmental benefits (such as pollution control, protection of the ecosystem, flood a lower discount rate of 6% can be applied as the minimum required EIRR on the grounds that (i) social sector projects and poverty-targeting projects often have many unquantifiable benefits; and, (ii) many environmental protection and conservation projects have very long-term impacts that justify a lower discount rate.

Where there is evidence that the 9% (or 6%) discount rate is not appropriate for an individual country, a national economic discount rate can be calculated for the country concerned. If a national economic discount rate is estimated, it should be applied to all projects in that country, rather than only selectively. See *Appendix 18* of said document.

To make this concrete, think of our farmers in Riceland, specifically their agricultural net benefits without and with the irrigation and drainage adaptation and climate smart irrigation mititgation. The orange line shows the pathway of net benefits in a business-as-usual scenario, while the blue line shows the pathway of net benefits in a scenario with the irrigation, drainage, and extension services focusing on climate-resilient approaches with adequate GESI integration.

2.5 CLIMATE CHANGE SCENARIOS

Next, we will need information on climate change that can be fed into our analysis. You can turn to existing evidence where possible, but contract specialist studies for larger investments where detailed results are critical. The scenarios for climate change should be based on as many sources as possible, including the following:

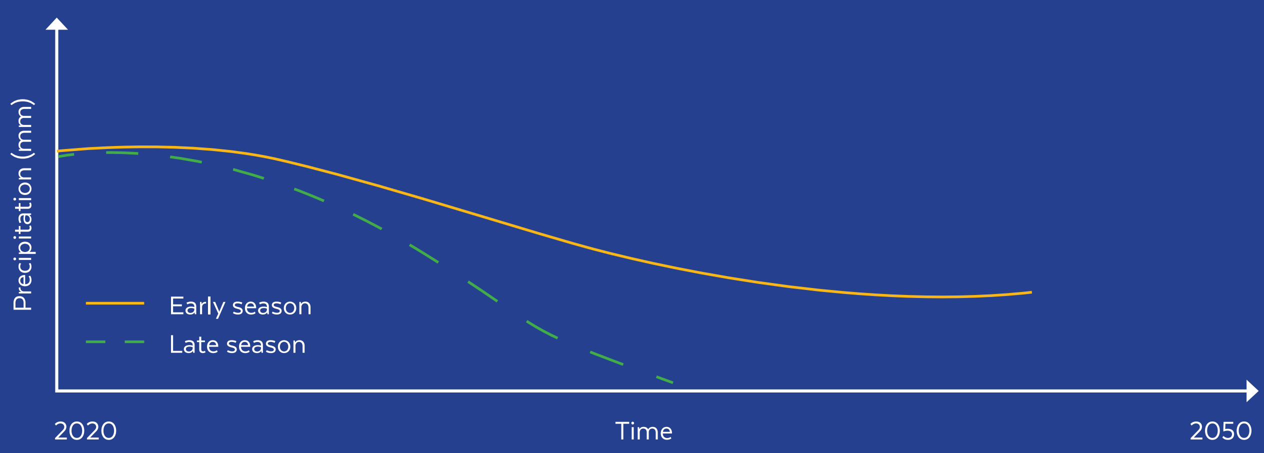
- IPCC climate change analysis is the starting point. Ideally, projections should be based on the Sixth Assessment Report (AR6; or the latest available at the time of consulting this document) and should use the RCP2.6 scenario (Lee et al 2021) to avoid overstating the case. IPCC scenarios may be sufficient for more rapid CCBA;
- Downscaled projections of climate change are now available, such as in the case of Thailand and should be used for projects that are based in one geographical area. These will be necessary for more detailed CCBA (e.g., as required for large investments). Particular care must be taken in analysing extreme events, which may require some integration of hydrological modelling with climate change modelling; and
- Where historical records are available for three decades or more, these should be analyzed to assess whether past trends are consistent with future projections.

Given the uncertainty of climate change projections, you should undertake the analysis using one main scenario (your "headline" scenario) for climate change and then repeat the analysis with at least one alternate climate change scenario. The headline scenario should normally be an optimistic scenario (i.e., RCP2.6 or B1, as suggested above), with little climate change. The sensitivity analysis may refer to another scenario to demonstrate how adaptation and mitigation change the benefit cost ratio for more severe scenarios (see Section 2.7 for more discussion).

Running Example: What does the above mean for our analysis of Riceland? Mainly that we must extract a trajectory of relevant climate information for the project period. The climate parameters of interest to us are temperature and rainfall patterns for Riceland during the summer rice season.

We discover from downscaled projections (for simplicity, we only concern ourselves with the headline scenario) that the quantity of precipitation during the growing season will decline by 50% in the early season and that late season will become dry. We generate a year-wise evolution of precipitation quantity in early season and late season (see Figure 4). Thus, we have for each point in time relevant to the analysis the evolution of a key model parameter (precipitation).

FIGURE 4. EARLY- AND LATE-SEASON PROJECTED PRECIPITATION CHANGE



2.6 DEFINE PHYSICAL AND BEHAVIOURAL MODEL

Next, you will need a clear representation of the relationship between key physical parameters (e.g., yields obtained, fuel consumed, water supplied, hectares of forest, or GHG emissions) and behavioural parameters (e.g., farmers' choices or institutional sustainability) and how they modulate model inputs and outputs.

Ideally, the model is quantitative, especially for larger and more complex analyses, but, in many cases, it may be a simpler, qualitative description of the key parameters and the relationships between them. If the model is quantitative, line ministries may require specialist help to draw on the latest options for building a CBA with climate change integrated into it. For less involved options, the model is simply a way of clearly presenting the consensus on how climate change affects the parameters that determine project performance. Any adopted model must ensure sex-disaggregated data collection and take into consideration discriminatory gender and social norms that account for the behavioral parameters, understanding context and ensuring meaningful engagement of key stakeholders in the development of the model.

The best existing knowledge on project impact should be used to construct the model. Ideally, rigorous impact evaluation estimates exist for the context being studied e.g., farmer net revenues from use of a new technology. Often times such estimates are not available, in which case evidence from other contexts may need to be transferred to the context under analysis.

Climate projections are highly variable (different models and scenarios suggest a variety of possible climate pathways). Uncertainty is most easily dealt with by using the mean values of selected scenarios. However, scenarios need to be used carefully as policy makers usually only consider a high and low scenario, each of which may include a package of different assumptions (e.g., on climate change, on yield response, and on prices).

Chapter 3 describes a range of techniques and sources of evidence and how to select the most appropriate given the nature and scale of the project.

Running Example: To make this concrete, let's refer to our running example of farmers in Riceland. At this point we need a quantifiable relationship between farmer input and output. Given our set up, we have farmers whose rice growing depends on water availability – from precipitation – during the early- and late-season. Figure 5 shows a simplified baseline model that will help our analysis. It specifies that farmer effort combined with water lead to rice yields which are sold on the market. The end result is net revenue for the farmer along with emissions of GHGs from rice paddy fields.

This is a highly simplified model, but even here we see that it is up to the analyst to build sophistication. For instance, how is farmer effort modeled? What empirical literature can be consulted to characterize the hours spent by farmers and the yields they achieve?

FIGURE 5. INPUT-OUTPUT MODEL

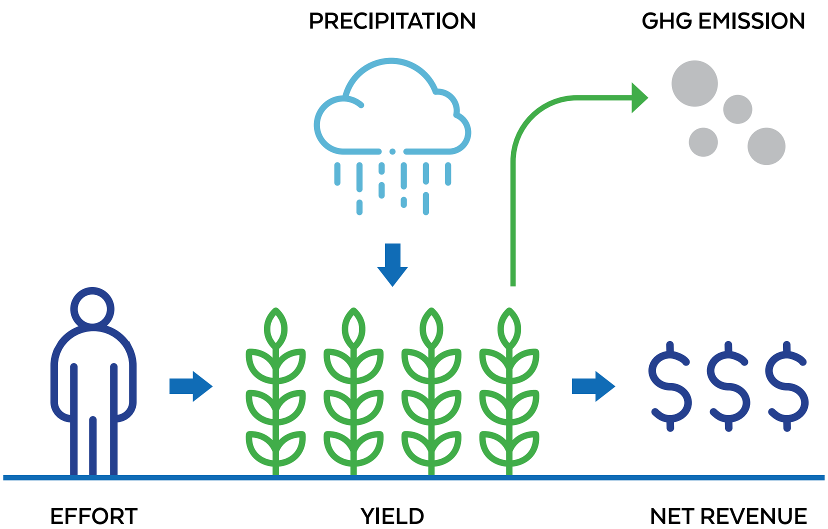
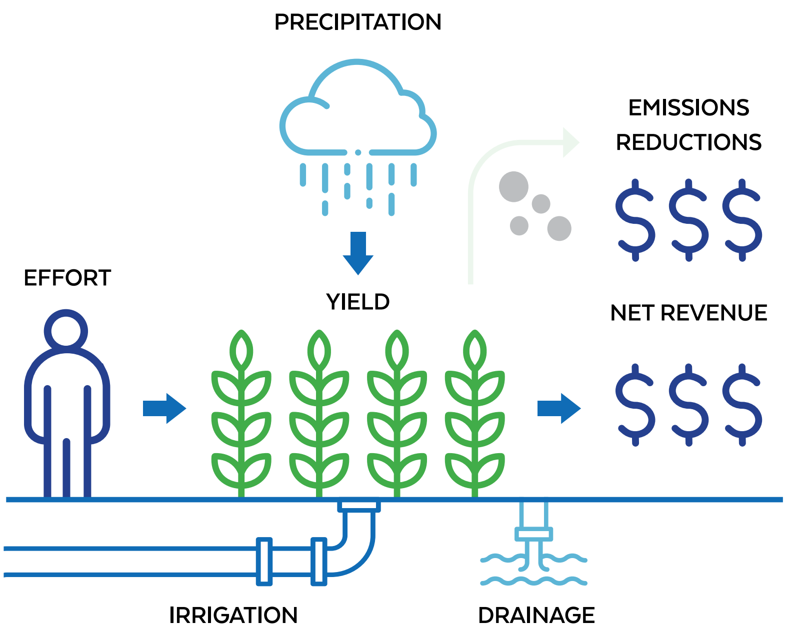


FIGURE 6. MODEL OUTPUT OVER TIME AS CLIMATE CHANGES

Similarly, the yield function can be made more and more sophisticated, both in terms of the extent of inputs and the detail in which those interactions are described. Thus, yield is (quite obviously) a function of more than just farmer effort and water – yield depends on temperature, pest control, seed varieties used, fertilizer application etc. And, each of these can be described ('modelled') in greater or lesser detail, e.g., farmer effort could just be crudely associated with yield or it could interact with farmer education, experience and other farm inputs. In fact, you might build a model where farmer effort is affected by climate change. The level of sophistication will depend on the analyst and the resources available to them.

The model must actually be forward-looking, i.e., it must have embedded in it a changing climate. We accept that the climate is changing therefore, our model must reflect this. Figure 6 demonstrates this with a series of panels, each depicting a point in time, starting with the year 2020 and ending in the year 2050. Note how climate, represented by the blue-outlined precipitating cloud fades as we approach 2050 – depicting our climate scenario finding of lower precipitation in the future. As the climate changes, farmer net revenues start to decline ("fade").

FIGURE 7. MODEL OUTPUT OVER TIME AS CLIMATE CHANGES

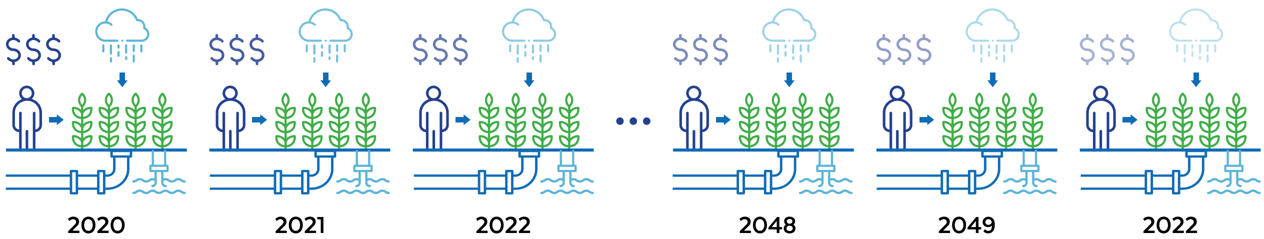


The next step in model building is adding in adaptation and mitigation. In the case of Riceland, the adaptation is providing irrigation and drainage to farmers, and mitigation in the form of climate smart irrigation practices (along with the improved drainage). This is shown in Figure 7: the blue irrigation water; light blue drainage; and the green arrow above the rice crop is no longer there, suggesting emissions abatement.

The depiction is highly simplified. The quantity of water supplied by the irrigation canal system must be clearly specified, as must the availability of drainage. More sophisticated modeling could specify the timing of flows, which may impact farmer yields. Again, the sophistication of the modeling depends on the analyst and resources available.

And as before, we must quantify the net benefit from adaptation over the lifetime of the project. Just as we showed in Figure 8, we extend the with-adaptation model through to its logical end date. Figure 8 shows the model at work in a year-wise fashion, calculating net revenues with the irrigation and drainage adaptation, climate-smart irrigation mitigation activities and a changing climate. As before, changing climate is represented by the fading blue cloud alluding to reduced precipitation with a changing climate.

FIGURE 8. MODEL OUTPUT OVER TIME AS CLIMATE CHANGES WITH ADAPTATION



2.7 IMPLICATIONS OF PROJECT AND CC ON PARAMETERS

All CBA/Impact Assessment, including CCBA, requires a clear definition of the situation without and with the investment. For CCBA, the analysis also needs to compare the situation with and without climate change. Adaptation interventions are based on the recognition that climate change affects all aspects of human, social, and economic development, and they aim at facilitating adjustment to expected changes in climate and its effects.

Box 2 demonstrates the four types of activities and their significance.

BOX 2. FOUR TYPES OF ACTIVITIES

- Type A activities are activities which become more valuable to beneficiaries. Examples might include flood protection and soil moisture management, which are already useful and become more useful. These activities may not need to be changed and the project may simply expand the funding;
- Type B activities are activities which become badly affected by climate change, but the project improves the performance of the activity and provides some protection from climate change through proofing of the activity. Examples might include irrigation and strengthening roads;
- Type C activities are mainly mitigation activities, which usually involve some additional expenditure (e.g., direct investment, grants, or subsidies). If there is no climate change, then the reduction in GHG emissions has no value and the expenditure on mitigation is wasted. With climate change, the mitigation benefits should be higher than the costs, if the investment is to be worthwhile. Table 2 discusses how to value GHG emissions; and,
- Type D activities are activities which increase the risk of adverse climate-related outcomes for beneficiaries, and these are termed 'maladaptation' projects (e.g., construction in flood plains, without proofing, and roads that accelerate deforestation).

All CBA/Impact Assessments require a clear definition of the situation with and without without the specific investments. For CCBA, the analysis also needs to compare the situation with and without climate change. In adaptation projects, climate change is an identified factor with potential harm for beneficiaries. However, any intervention may make the project more useful for the beneficiaries (e.g., if the project provides protection from current rainfall variability) or less useful (e.g., if the project increases vulnerability to current rainfall variability).

Table 2 illustrates this with three types of projects, Type A, Type B, and Type C.

TABLE 2. EXAMPLE OF WITH AND WITHOUT GRID FOR CLIMATE CHANGE AND PROJECT

	Type A Activity (Adaptation no proofing)			Type B Activity (Adaptation with proofing)			Type C (Mitigation project)		
	No CC	With CC	Diff.	No CC	With CC	Diff.	No CC	With CC	Diff.
Without project	1.9	2.1	11%	1.9	1.7	- 11%	1.9	1.9	0%
With project	1.9	2.1	11%	2.3	2.2	- 4%	1.7	2.1	24%
Difference	0%	0%		21%	29%		-11%	11%	

Note: Figures in the cells are illustrative and could come from a CBA (e.g. BCR) or a qualitative scoring assessment.

2.8 VALUE OF COSTS AND BENEFITS

In the above discussion, one important component is the price used, i.e., the value of costs and benefits. We must assign a monetary value to the costs and benefits associated with each project component. Goods and services (which constitute model components) that are bought and sold in the market are relatively easy to value: We use their market price and use inflation rates to account for future prices.

Valuing non-market goods is challenging, i.e., goods we cannot buy in the market, such as clean air or a national park. Goods and services that are not bought and sold in the market require special techniques to estimate their value. Economists have developed a large number of methods that estimate the economic value of non-market goods. These methods can be grouped in two broad categories: (i) revealed preference methods; and, (ii) stated preference methods.

Revealed preference methods rely on observed behaviors of people to understand how much they value a non-market good, and include the travel cost method and hedonic method. Stated preference methods use surveys to estimate the value of non-market goods by asking people how much they would be willing to pay for a non-market good or service. Stated preference methods must be applied very carefully to get unbiased estimates of value.

Ideally, one would undertake these valuation methods in the relevant context to measure those specific values. This is not always possible. The next best alternative is to collect values from nearby studies from other countries and adjust the values for income. For many non-market services, it is reasonable to assume that non-market values vary across countries in proportion to per capita income.

For mitigation, the relative importance of reductions in GHG emissions depends on the value associated with those emissions. The markets for carbon have been volatile and are well below the social cost of carbon (SCC), so it can be useful to undertake sensitivity analysis around the price of carbon. In more qualitative assessments it is typical for expert judgement to imply a very high value on GHG emissions close to (or exceeding) the social cost of carbon (see Box 4).

Beyond fixing a value on goods and services, cost benefit analysis for government projects uses the economic costs and benefits, i.e., market prices may need to be adjusted to reflect additional concerns while some parameters may not have market prices and require valuation methods. In addition, economic analysis excludes transfers within country (e.g., taxes, duties, fees and subsidies).

BOX 4. THE CARBON MARKET AND THE SOCIAL COST OF CARBON

It is common practice to use carbon markets as an indication of the value of carbon because these reflect the potential financial gains from GHG reduction. Until recently, carbon markets were dominated by the European Trading System (ETS), which initially traded at over 30 $/tCO2e. However, the ETS has suffered from over-supply and verification problems and prices have dropped to about 7 $/tCO2e.

The ETS now accounts for only about a third of global carbon trading and there are numerous regional and national schemes, with a very wide variety of prices, covering about 13% of total global GHG emissions (ECOFYS and World Bank 2014).The commitments announced in COP21 in Paris, in 2015, should help to strengthen markets. Taking this more optimistic view of the mid-term prospects for the carbon market would suggest that a market price of about 25 $/tCO2e would be reasonable.

The SCC, i.e., the optimal carbon price, or carbon tax, is the calculated price of carbon emissions that will balance the incremental costs of reducing carbon emissions with the incremental benefits of reducing climate damages and is determined by dividing the total expected loss and damage by the total projected GHG emissions. There have been various studies to estimate the SCC.

The Stern Report suggested that a value of about $50/tCO2e is a conservative estimate. Other studies have suggested a value of over $100/tCO2e. Estimates of the SCC are normally made at a global level in order to avoid the political issues of which countries should take most responsibility for reducing GHG emissions. Countries that are vulnerable to climate change should argue that a higher SCC should be used in making decisions on mitigation projects.

Running Example: How does this play into our example of Riceland? Let us try to understand the valuation of benefits in this case. The benefit of the proposed canal irrigation and drainage system is increased yield, while the benefit of the proposed mitigation activities (climate smart irrigation practices and drainage) reduce methane emissions. What we would like ideally is to know yields in Riceland both with and without the irrigation and drainage system, for the variety of climates that the farmer will experience over the project timeframe (the range of climates from 2020 to 2050).

In the best case scenario, a study – maybe a sophisticated agronomic model or a statistical model – will exist that provides the information we require. This information may not be available however, in which case we may need to turn to evidence from other locations (not ideal). Similarly, for mitigation benefits, we require a biophysical model parameterized to locally relevant specifications to quantify methane reductions.

For costs, we can value the installation and maintenance costs of the irrigation and drainage system along with the additional cost of extension worker time to train and teach climate smart irrigation practices to farmers. Those should be quite easily had from system designers.

The other major cost is farmer effort. Ideally, we would like to survey farmers in Riceland to quantify their typical costs. A sophisticated modeling of costs might try to infer how farmer effort and costs might change with the installation of the irrigation and drainage system (perhaps this installation requires regular maintenance which adds to the farmer's work burden), how much additional time they spend to ensure adherence to climate smart irrigation practices, all with a changing climate (perhaps lower precipitation in the late season tends to reduce humidity which improves productivity thus reducing costs; or perhaps the reduced precipitation hardens the ground, requiring more tilling).

2.9 INCORPORATING GENDER & SOCIAL DIMENSIONS INTO THE ANALYSIS

In general, social sustainability is designed to avoid or mitigate risks of adverse impacts while also seeking to maximize social benefits. The social impacts and risks usually cover the following seven issues:

a. *Assessment of environmental and social impacts and risks,*
b. *Community health and safety,*
c. *Indigenous peoples/ communities,*
d. *Land acquisition, displacement and resettlement,*
e. *Cultural heritage,*
f. *Labor and working conditions,*
g. *Potential conflicts and conflicts resolutions, and*
h. *Environmental impacts and risks.*[21]

Current and projected climate change will exhibit impacts on numerous systems and sectors that are essential for human livelihoods. This strengthened demand for adaptation efforts necessitates access to a range of robust and transparent assessment approaches to enable decision makers to efficiently allocate scarce resources.

For adaptation to be successful, it should ideally be undertaken within a comprehensive and iterative process of social, institutional and organizational learning and change. Assessing the costs and benefits of adaptation options is an important part of this process, with a focus on identifying the most appropriate interventions for reducing vulnerability, enhancing adaptive capacity and building resilience.

There are two situations that present themselves for a gender and social analysis. First, as a priority area for policymakers, climate policies may specifically target women, people with disability, indigenous, and marginalized groups. This requires that we deliberately consider these groups of people as beneficiaries in the eligibility criteria of an adaptation/mitigation investment. Annex 3 provides a useful checlist for GESI integration. This is important, because women and men are not a monolithic group.

The intersections of class, ethnicity, disability, age, and indigenous status are all important considerations because the costs and benefits will not necessarily be distributed equally across different social statuses. For instance, poor, indigenous, rural/isolated, illiterate, disabled, migrant women are twice, sometimes three times more disadvantaged than their better-off, educated urban counterparts.

When project teams set out to locate beneficiaries, they would draw from both women and men, integrating those with differentiated needs to be included as beneficiaries into the target frame. This is beneficial from the point of view of the project (and sustainable development of the country) that it would serve to protect the most vulnerable population from climate change and also add to poverty alleviation of the most disadvantaged.

Also, as explained earlier, the poor and marginalized are likely to be more affected by climate change and hence would require more support to retain livelihood options. It is not too complicated to estimate in the project design specifically when it is observed that the poor and marginalized are often the ones with the smallest land parcels which are less fertile and most likely also at the furthest reach of irrigation projects. Also, due to relatively poorer socio-economic conditions, the ability of collective bargaining for equitable resource allocation is low for this segment.

The second situation is more a question of measurement and keeping track. In this case, an adaptation/mitigation may not target women or those marginalized groups specifically. Instead, as an analytic outcome, we ensure that we collect **disaggregated data**, on various social categories, for example of women, people with disability, indigenous beneficiaries and quantify their net benefits. In terms of the analysis, this might mean simply apportioning some of the total net benefits to various groups of beneficiaries, or it might drive us to produce a more sophisticated model for various categories of men and women beneficiaries, i.e., we model groups of men and women beneficiaries separately.

21 *Green Growth Assessment & Extended Cost Benefit Analysis, as available at: http://gggi.org/site/assets/uploads/2019/01/FINAL-2018-eCBA-Handbook_EN.pdf*

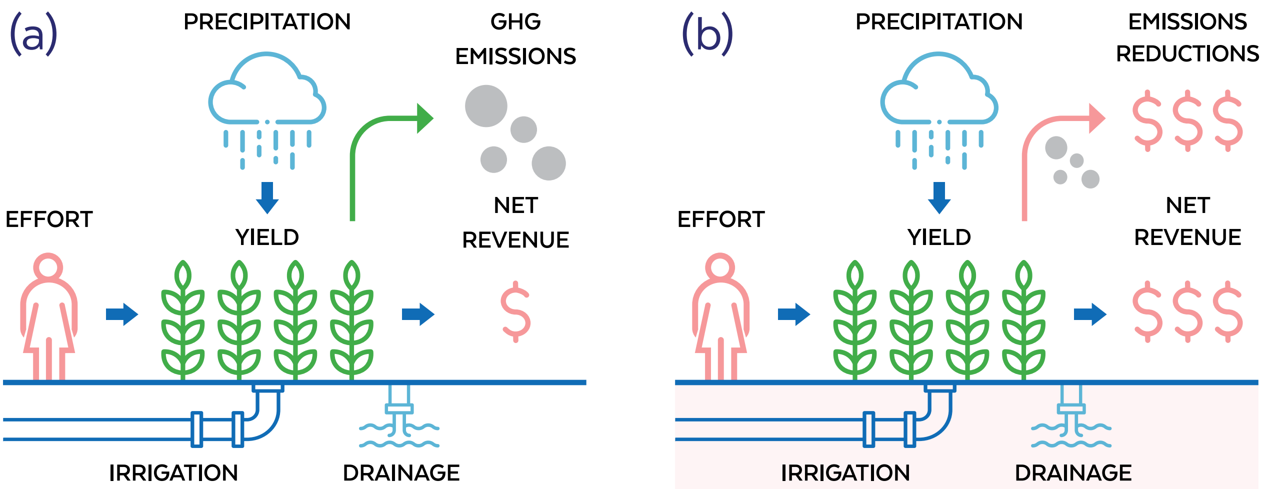
FIGURE 9. PROJECT TARGETING WOMEN FARMERS

However, in absence of targeted interventions, this type of planning may not cater to equitable growth of the most deserving population and merely be an accounting mechanism without any actual significance in improving the benefits of the project. From an accounting perspective, this may however still show higher benefits accruing to the marginalized due to the lower baseline.

Running Example: in the first case, design tweaks would be necessary in the adaptation and mitigation process to cater to the most marginalized. For our example, the adaptation and mitigation project targets both women and men farmers in Riceland. So, let's say that of the 100 farmers in Riceland, 50 are women farmers. It could be that these 50 women farmers are the targeted recipients of both the adaptation investments (irrigation and drainage system investments) and mitigation investments (climate smart irrigation practices training along with better drainage), and our model demonstrates net benefits to them (see Figure 9). This is not implausible – it could be that being a woman farmer correlates with smaller plot sizes, and that connecting these smaller plots to irrigation and drainage systems and networks of extension workers (for climate smart irrigation practices training) requires tweaks to the design of these systems.

This method would need to estimate the actual benefits due to a targeted intervention and take into account the equitable distribution of resources. Thus, our analysis may provide reason to modify the design of an adaptation project in order to allow that the net benefits for women rice growers become larger. This again is not too difficult to estimate if the beneficiaries are correctly identified.

FIGURE 10. ADAPTATION AND MITIGATION DESIGNS THAT INCORPORATE WOMEN FARMER'S REQUIREMENTS



The second situation requires us to model men and women beneficiaries separately but is design-wise straightforward. Let us say that after extensive research we find that women farmers do benefit substantially from irrigation and drainage systems, even though there are no specific design features to enable this. This is depicted in Figure 10.

Panel (a) depicts low net revenue from an adaptation that has not been designed keeping in mind the needs of women farmers: the projects irrigation input and drainage system do not properly connect to women farmers' plots.

Additionally, extension workers are not able to provide customized training on climate smart irrigation practices to women farmers, thereby resulting in incomplete abatement (i.e., residual emissions beyond what is expected). All of this results in lower net benefits depicted by the single dollar sign.

On the other hand, panel (b) shows high net revenue from an adaptation and mitigation design that takes into consideration women farmers' needs, circumstances and capacities.[22,23]

2.10 THE CLIMATE CHANGE RELEVANCE SCORE (CC%)

The CC% is defined as the proportion of total benefits that are associated with adaptation and mitigation. If the benefits without climate change are termed A and the benefits with climate change (i.e., including adaptation and mitigation) are B, then CC% = (B -A) / B.

22 For greater insights: this publication provides a detailed analysis of three climate change adaptation projects, with insights on how a gender-aware design contributes to the interventions' cost-effectiveness. Empirically sound evidence demonstrates that projects that adequately integrate gender result in more cost-effective outcomes in terms of strengthening communities' adaptive capacity. See: https://asiapacific.unwomen.org/en/digital-library/publications/2017/09/understanding-cost-effectiveness-of-gender-aware-climate-change

23 See also case study in Annex 1 on how gender-responsive climate CBA is conducted on seaweed farming in Zanzibar.

TABLE 3. LIKELY RANGES FOR CLIMATE CHANGE BENEFITS COMPARED WITH OTHER BENEFITS[24]

	Green Development						
	Sustainable Development			Climate Change CC%			
	EC%	SO%	EV%	MI%	AD%	Total	Type
HIGHEST CC RELEVANCE							
CC Planning, Management, Capacity, Studies	0	0	0	100		100	
Hydrometeorology, Early Warning	40-50	10-20	0	0	33	33	A
Livelihoods for CC Vulnerable Households	40-50	10-20	0	0	33	33	A
Coastal Protection from Sea Level Rise	0	0	0	0	100	100	
Protection from Saline Intrusion	20-50	10-30	5-10	0	25-75	25-75	
Irrigation and Drainage	50-70	5-20	0-5	0	10-33	10-33	B
Flood Protection/Proofing	40-50	10-20	0	0	33	33	A
Disaster Risk Reduction and Management	25-50	25-50	0-10	0	33	33	A
MIDDLE CC RELEVANCE							
Agriculture, Rural Development, Food Security	40-50	10-20	0-10	0-5	5-20	5-25	C
Forestry Protection	5-10	5-10	60-95	5-15	0-10	5-25	C
Forest Management	20-50	5-20	30-50	5-20	5-20	10-40	C
Renewable Energy	70-90	0-10	0-10	5-20	0-5	5-25	D
Energy Efficiency	70-90	0-10	0-10	5-20	0-5	5-25	D
LOWER CC RELEVANCE							
Livelihoods for General Households	50-70	20-30	0	0	5-10	5-10	B
General Infrastructure (roads, urban ...)	90-99	0-10	0	0-1	1-5	1-5	
Sanitation and Waste	20-30	20-30	50-75	0-5	5-15	5-20	
Water Quality	50-70	20-30	0	0	5-10	5-10	B
Public Health for Climate Sensitive Diseases	30-50	30-50	0	0	5-10	5-10	
Public Transport	60-80	10-20	5-10	1-5	0	1-5	D
UNCERTAIN							
Fisheries, Aquaculture	40-50	10-20	0-10	More research needed			
Biodiversity, Wildlife, Eco-tourism	0-25	0-10	75-100	Variable/site specific			

Notes: EC% = economic growth; SO% = social development; EV% = environment; MI% = mitigation; and AD% = adaptation
Source: Based on experience from CPEIR and CCFF work in Southeast and South Asia over the last 4 years.

24 These benefits can be further nuanced according to GESI considerations.

All the options for CCBA will assess the relative importance of climate related benefits, compared with other benefits. This applies regardless of the level of evidence available (e.g., community consultation, expert opinion, quantitative analysis, etc.) ,or the technique used (i.e., CBA, OBA or MCA). There is some international experience with this work, which suggests that the results are likely to fall within the ranges presented in Table 3.

The table shows that there are some similarities in how climate change affects different sectors. For example, in type A sectors, the majority of benefits are related to floods, drought or rainfall variability and so gradually increase until they are double the current levels, in 2050. Type B are similar, but also include some benefits that are not affected by climate change and so have lower CC%. Type C give a wide range of benefits and the balance between these depends on local biophysical and socio-economic circumstances. Type D are all related to energy and CC%s are strongly affected by the relative costs and emission factors for different energy sources.

2.11 SENSITIVITY ANALYSIS AND SCENARIOS

A fundamental issue in conducting CBA of adaptation and mitigation options is the treatment of uncertainty pertaining to climate change and the handling of multiple climate projections. In particular, the conduct of sensitivity analysis in the context of climate change is significantly different to the conduct of 'traditional' sensitivity analysis.

Climate change and risk prevent the use of expected values and must be based on scenario-based analysis, which would consider risk assessments and future climate projections. Long-term adaptation or mitigation investments require assigning probability distributions to different climate change scenarios in order to possibly further analyse the sensitivity of the results.

In addition, costs or benefits of slow-onset adaptation or mitigation options, occurring in long-term time horizons (e.g., 25, 50 and 100 years) are difficult to quantify and the choice of the discount rate affects the NPV outcomes. Assumptions made in the analysis should be based on empirical data, supported by strong evidence, validated with key experts, and described in a transparent manner. Cost benefit analysis is subject to a great degree of uncertainty and should always explore the sensitivity of the results to different assumptions.

Parameters that need sensitivity analysis include:

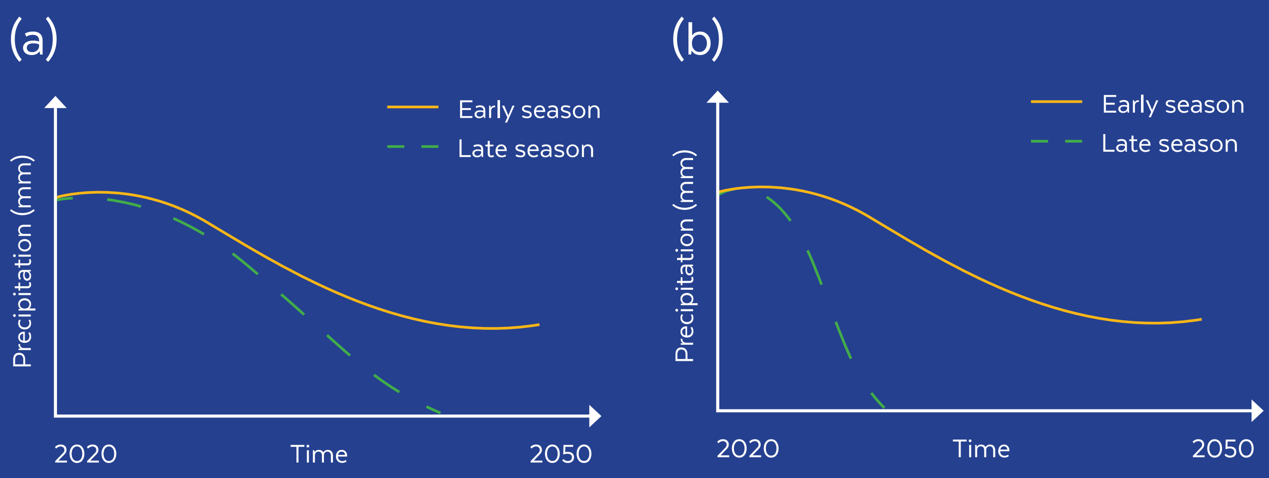
- Use of different climate change scenarios, including the extent, probability, and timing of change.
- Biophysical sensitivity to climate change (e.g., yields, flood damage and health impacts), using as wide a range of climate and impact models as are available and feasible given the resources available to the analyst.
- Carbon density of energy sources displaced by energy efficiency or renewables.
- The extent of adaptation that beneficiaries will undertake regardless of project investment.

What is the value of doing this? First, it provides a range of net benefit estimates. It lets the decision maker know what the upper and lower bounds of project net benefits will be. Decision-makers have a limited adaptation budget. Moreover, they have a broader sense for net benefits from a range of adaptations and they will need to decide if the lower bound on net benefit estimates is acceptable given the other adaptation options available to them.

Second, if the adaptation performs very poorly in one (or more scenarios), it may require that we revisit the design of the adaptation. The adaptation may not have been designed for all climate possibilities, but it must perform adequately for the ones that we, as analysts, believe are most likely.

Running Example: For our example in Riceland, we may want to run our model with a few different climate scenarios to understand the range of net benefit values we get. Let's say that there are too high likelihood climate change scenarios, as depicted in Figure 11: one where late season precipitation reduction occurs later on in time (panel (a)), while in the other it happens sooner (panel (b)).

FIGURE 11. ALTERNATE CLIMATE SCENARIOS



Knowing these scenarios, we can run at least two different versions of our model – including the adaptation, i.e. the irrigation and drainage systems, and mitigation, i.e. climate smart irrigation practices – each using the two predicted climate pathways.

The value of doing this is that we start to bound our estimates of net benefit – we may find that climate pathway (a) suggests lower net benefits because the drainage system is not able to drain excess water away as effectively as in scenario (b). What we find is that in both cases the net benefits are positive.

What if we had instead found that the adaptation and mitigation perform very poorly in scenario (a) – that it generates a negative net benefit estimate? When we present this to the decisionmaker for this project, they may suggest that we modify the adaptation and mitigation investment designs so that they perform satisfactorily in both climate scenarios.

A CCBA thus enables policymakers to decide on long-term benefits of project activities under climate change scenarios. In some cases, it will also help policymakers to make informed choices on targeted beneficiaries such as to meet the country's Sustainable Development Goal strategies, specifically for Goal 1: No Poverty, Goal 5: Gender Equality, Goal 10: Reduced Inequality, and Goal 13: Climate Change.

The next chapter provides the technical options for conducting a CCBA.

3. CARRYING OUT A CCBA – CONSIDERATION OF TECHNICAL OPTIONS

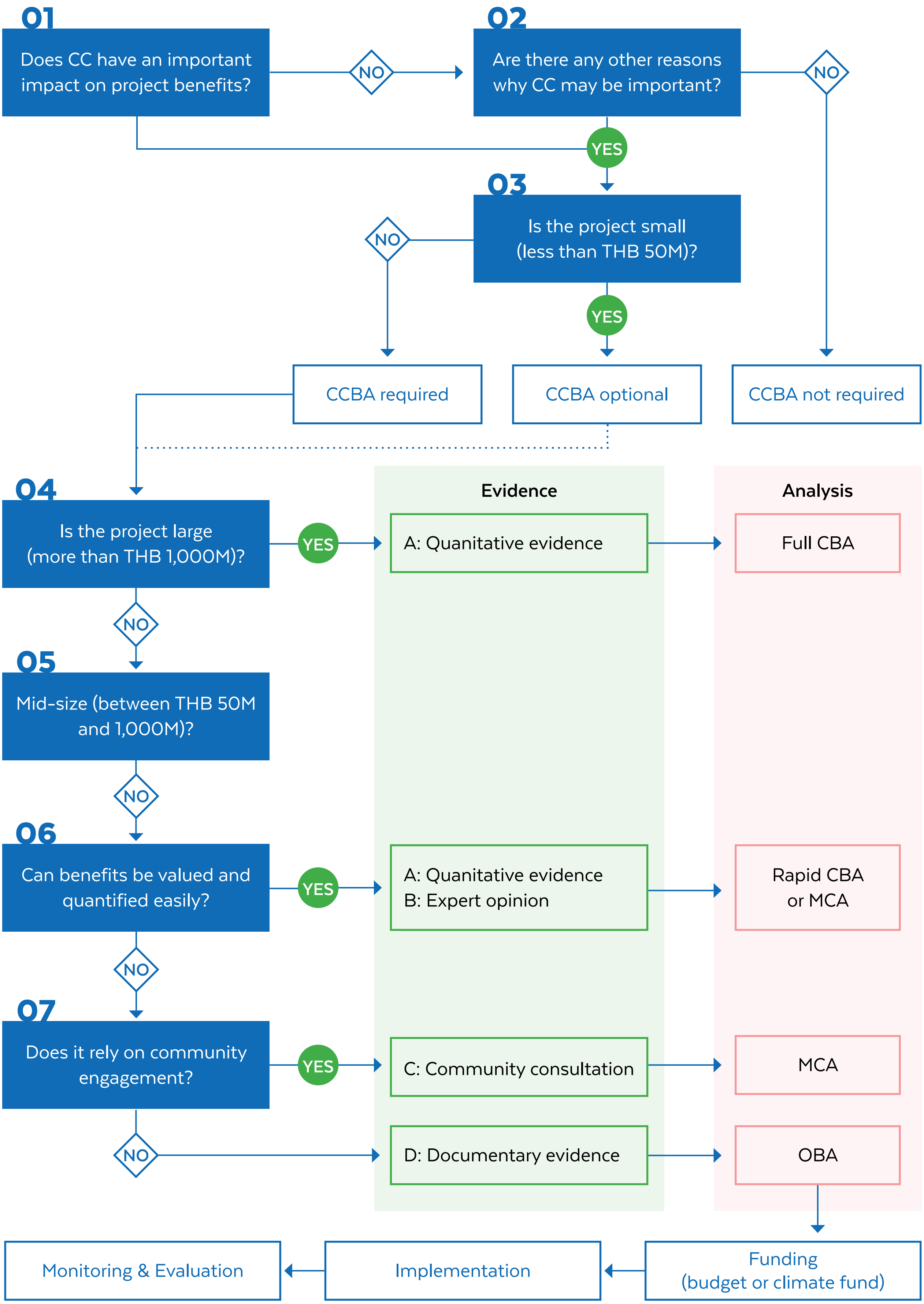
3.1 OVERVIEW OF THE STEPS

Climate cost benefit analysis starts with screening for climate impacts and climate relevance of programmes/project activities, followed by deciding on the threshold of project investment which will determine the details (type of evidence and methodology) of the analysis to conduct the CCBA. This is demonstrated in Figure 12 with the example of Thailand. The project investment thresholds should be determined by the respective governments depending on the scales of investment prevalent in the country.

The flow chart describes seven steps, starting with two steps that consider the nature of a project and whether it is affected by climate change. For those projects that are affected by climate change, there are then three size classes – small, medium, and large – which dictate the type of evidence and analysis required.

For small projects, a full quantitative cost benefit analysis is optional. For large projects, a full cost benefit analysis is required. For medium-size projects, there is the option to undertake a rapid analysis, based on expert opinion, or using other sources of evidence to assess benefits.

FIGURE 12. SCREENING AND SELECTING APPROPRIATE EVIDENCE AND ANALYSIS

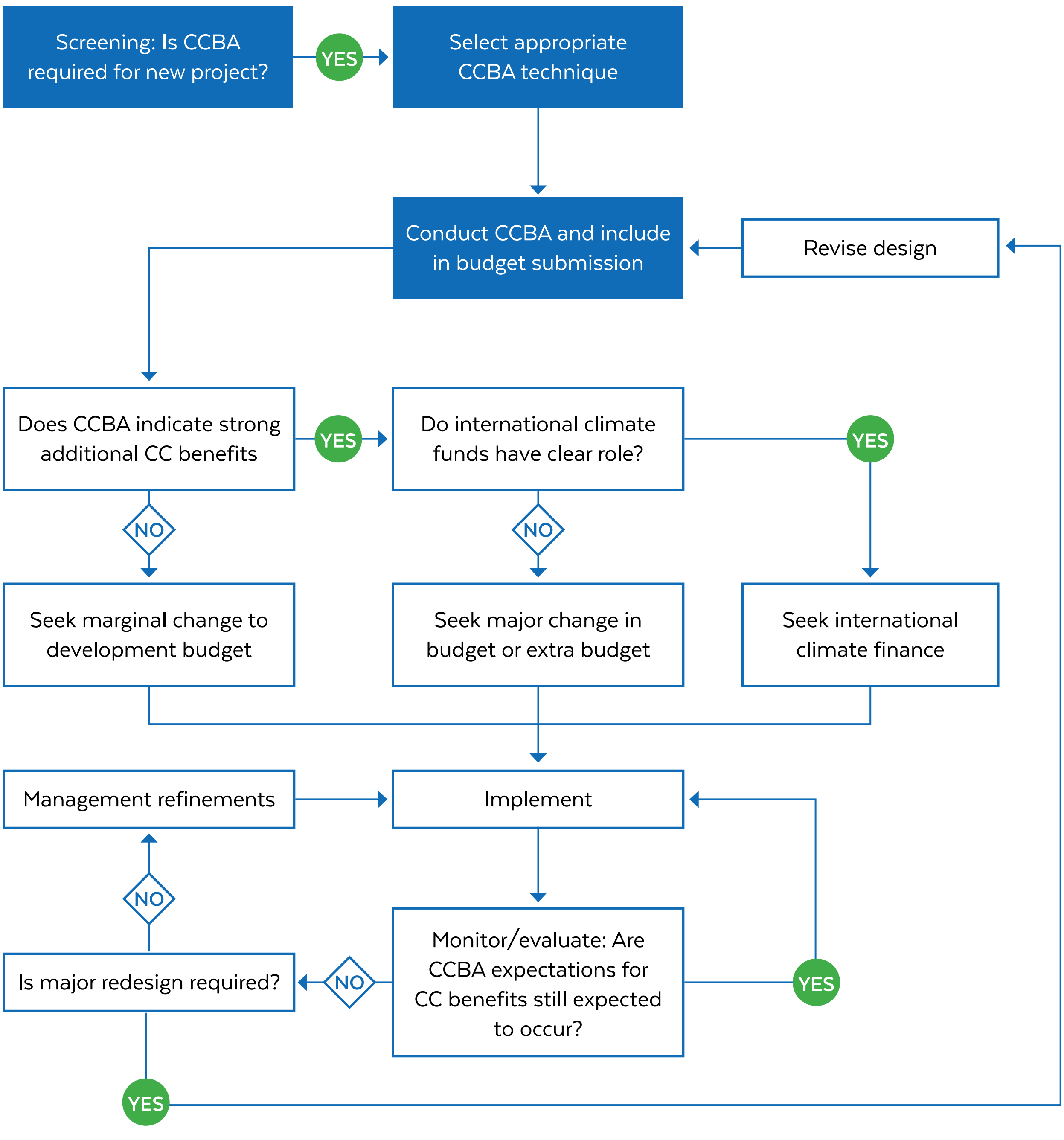


The CCBA process should generate evidence that will help in funding applications, either in the national budgets or to international climate funds. By definition, CCBA should be able to identify adaptation steps and the adaptation funding gaps which could then form the basis for funding applications to external climate funds.

Also, CCBA being an iterative and dynamic process, ensures that the benefits from adaption that were projected to take place in the analysis actually occur. If during implementation a project is found to be not delivering the projected adaptation benefits, then the design of the project or programme may require rethinking. This is not unusual considering that there could be many unforeseen circumstances under which the initial assumptions of the CCBA do not hold any longer and may need to be reconsidered in the presence of additional or new information.

This iterative process is demonstrated in the diagram below:

FIGURE 13. CCBA FLOWCHART



3.2 SCREENING FOR CC IMPACTS AND IDENTIFICATION OF PROJECTS WITH ADAPTATION AND MITIGATION POTENTIAL

Screening is typically used to assess whether further work on CCBA is justified, to select those programmes that require some form of CCBA and help decide what level of CCBA should be used. There are three steps in the screening process that identifies which investments require cost benefit analysis with climate change.

Screening Step 1. The first step in identifying projects/programmes for CCBA is to determine whether such programmes/projects are affected by CC. A broad categorization of sectors and activities that are likely to be affected by climate change is provided in Table 4.

The table also provides lists sectors that are unlikely to be affected substantially by climate change and hence do not require climate cost benefit analysis. Table 4, however, is not an exhaustive list and further activities could also be considered for CCBA depending on country specific climate vulnerabilities.

TABLE 4. SCREENING REFERENCE TABLE

Sector	Activities Likely to Require CBA with Climate Change
Information services **Capacity building** **Research**	• Information services relate to weather and climate, including advisories for agriculture and disaster management • Capacity building specifically related to public response to CC • Research on the impact of CC on the sector or of the effectiveness of public policy
Coastal protection **Saline intrusion**	• Protection against sea-level rise • Protection against saline intrusion affected by CC
Agriculture **Rural development** **Food security**	• Protection against flood or drought • Protection against unpredictable/unseasonal rainfall • Introduction of drought resistant seeds • Significant reduction in GHG emissions from agriculture • Supporting livelihoods for households vulnerable specifically to CC
Irrigation **Drainage** **Watersheds**	• Irrigation that protects against more variable rainfall • Response to watershed challenges affected by CC • Flood protection
Water supply **Water quality**	• Reducing the threat of CC to water quality (e.g., from floods) • Reducing the threat of CC to water security
Forestry	• Preventing deforestation and improving forest productivity • Promoting forestry incomes for CC vulnerable households
Fisheries	• Responding to known risks of how CC will affect fisheries
Biodiversity	• Responding specifically to CC risks for biodiversity • Not general biodiversity, unless responding to CC risks
Health **Education**	• Forward capacity building for CC sensitive diseases, including research, infrastructure, and institution-building • Climate resilient infrastructure for schools, clinics, hospitals etc. • Education that is specifically related to CC

Sector	Activities Likely to Require CBA with Climate Change
Urban planning	• Reducing flood loss/damage (e.g., flood protection, land use) • Reducing GHG emissions from waste • Reducing health costs from waste, when these are affected by CC • Reducing GHG emissions significantly
Infrastructure **Housing**	• Proofing against increased costs of rehabilitation or maintenance • Energy efficiency of buildings
Disaster Risk Management	• Risk proofing, Disaster risk financing, Early warning systems, Preparedness for Response
Energy **Industry & transport**	• Renewable energy[25] • Energy efficiency
Sector	• Activities Unlikely to Require CCBA
Sectors unlikely to require CCBA	• General governance (e.g. parliament, cabinet, justice, interior, defence, and foreign affairs) • Commerce, trade and finance (except climate change insurance) • Education and health (unless explicitly related to climate change as above) • Culture, religion and sports

Screening Step 2. Table 4 provides a good indication of which sectors are likely to require cost benefit analysis with climate change, but the list is not exhaustive. Therefore, in this second step we must determine if there are other reasons to think that climate change might have an important effect on the stream of costs and benefits of the proposed project. This more general question is often answered by reference to the country's (or specific sectors in some case) vulnerability analysis and by an assessment of how the proposed public expenditure will affect that vulnerability (or be affected by such vulnerabilities) and associated impacts on resilience and key constituencies.

It is important to set out project's context of vulnerability to climate change resulting from the specific, socio-economic context and geographical location it is conducted. Such context is set out in existing analyses,[26] which can be incorporated in the explicit intention to be addressed, tracking the estimated incremental cost or investment associated with any discrete project component that addresses current and expected effects of climate change within the project's vulnerability context.

Screening Step 3. Cost benefit analysis with climate change should only be done for investments which are over a certain threshold of investment. This is necessary since CCBA is resource consuming and is unlikely to provide marginal benefits vis-a-vis cost for projects/programmes of smaller size.

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25 Further resources on good practices on gender integration in renewable energy policy: https://www2.unwomen.org/-/media/images/unwomen/emp/attachments/2020/11/unep_renewable%20energy%20guideline_v2.pdf
https://www2.unwomen.org/-/media/images/unwomen/emp/attachments/2022/09/gender-responsive-re-programmes-released-2.pdf?la=en&vs=4845

26 National Assessments: - Climate Change: Vulnerability Assessments, Poverty Assessments / Participatory Poverty Assessments; national sample surveys; Demographic and Health Surveys; National Development Plan documents; Donor country report; Country reports for the Commission on the Status of Women (CSW); donor gender assessment reports.
International assessments: - UNDP Climate Change Country Profile http://www.geog.ox.ac.uk/research/climate/projects/undp-cp/ - World Bank Climate Risk and Adaptation Country Profiles, Global Climate Change and Vulnerability - IPCC 5th Assessment Report 2014 - Impacts, Adaptation and Vulnerability http://www.ipcc.ch/report/ar5/wg2/ ; http://ipcc-wg2.gov/AR5/ - IPCC AR5 Working Group2, Chapter 13 (Livelihoods and Poverty) http://ipcc-wg2.gov/AR5/images/uploads/WGIIAR5-Chap13_FGDall.pdf -, World Bank Living Standards Measurement Surveys

This threshold is also intended to ensure that at least the major investments undergo some form of climate proofing before focusing on smaller fund sizes. This threshold should be determined by the country (or ministry or department) undertaking the CCBA depending on the size of investment that the country deems most important to protect from climate vulnerabilities. The threshold should also be determined through consultation within the respective line ministries/ departments and external experts if deemed necessary.

BOX 5. EXAMPLE OF THAILAND

For Thailand, the threshold of investment for mandatorily conducting a CCBA has been determined as THB 50 million. The THB 50 million threshold applies either to the level of public or private investment that will be generated by public policies, such as regulations or incentives.

Investment managers may choose to do a cost benefit analysis voluntarily for small investments (THB 50 million or less) if they believe it will help with the design and/or justification of the investment in budget negotiations.

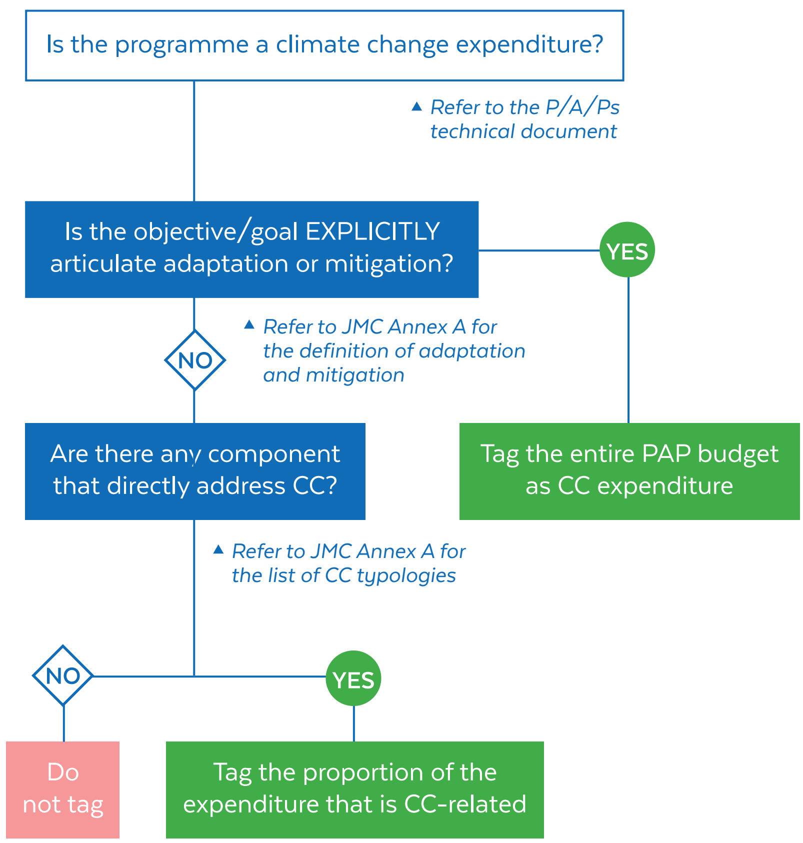
Projects between THB 50 million and THB 1,000 million constitute the vast majority of funding applications and require application of rapid analysis, rather than a full cost benefit analysis, which will reduce the burden on project designers. Project exceeding THB 1000 million will require to do a full-fledged CCBA.

3.3 CHOOSING THE TECHNIQUE

Cost-benefit Analysis with Climate Change (CCBA) can be conducted quickly, based on practical knowledge about an investment, or it can take several months and involve substantial time and skills obtaining new primary evidence and conducting detailed analysis.

There are five main types of CCBA. The choice of evidence and analysis depends on the scale and nature of the investment. Selecting the most appropriate level of CCBA will depend on the purpose of the CCBA within the planning system and the nature and size or cost of the programme. In some cases, multiple levels of CCBA can be applied.

FIGURE 14. CLASSIFICATION OF CLIMATE CHANGE PROJECTS IN PHILIPPINES CLIMATE BUDGET TAGGING IN PHILIPPINES



These are described briefly below and outlined in more detail in the sub-chapters that follow.

a. **Screening CCBA** work is used to determine what level of CCBA is warranted, if any. It typically asks questions about scale and vulnerability and refers to policy statements. Screening CCBA is in practicality the first two screening steps of the CCBA as described in figure 12 and in the previous sections.

b. **Classification** is used for broad reviews of CC relevance, such as those used for CPEIRs and CCFFs. The easiest way of doing classification CCBA is by referring to Table 4. An initial classification of the whole budget can be done in one day, though it can take longer if the analysis extends into consultation of project documents.

   The analysis may rely on documentary evidence and Objectives Based Assessment (OBA) and assessing whether climate change has featured explicitly or implicitly in the design of the investment. This is typically used in broad reviews that cover large numbers of investments. Expert opinions may also form the basis of classification based CCBA. Simple budget tagging exercise are examples of this type of CCBA.

The first two forms of CCBA are good starting points in bringing in climate change concerns into the planning and budgeting process. A government may choose to identify and demarcate certain expenditures as climate relevant expenditures following these categorizations and considering the scale of the investment, decide on conducting further analysis for a complete CCBA following any of the three methods below:

c. **Qualitative CCBA** retains the key principles and is structured and consistent, but it can be done rapidly relying primarily on expert opinion, in a discussion lasting about one hour. It is only required for programmes that are already classified as CC relevant and would normally be sufficient for smaller programmes, possibly covering about 80% of all CC programmes at a national level and almost all programmes at local government level.

   The analysis would rely on participatory consultation for evidence, using a form of Multi-criteria Analysis (MCA), with the criteria related to the main parameters that determine the costs and benefits. It may also be appropriate in the early stages of larger programmes, to define the key processes by which CC affects programme performance and hence leading to more detailed hybrid or quantitative CCBA.

d. **Hybrid CCBA** provides a mixture of qualitative and quantitative CCBA, using the latter where possible (often for the economic benefits) and supplementing this with structured qualitative evidence. It typically takes about one day per programme.

   As experience grows with CCBA, most qualitative CCBA will gradually involve some reference to more quantitative evidence, if only through the instinctive familiarity of key stakeholders with this evidence. Initially, hybrid CCBA is likely to be appropriate only for a minority of the portfolio of CC programmes.

e. **Quantitative CCBA** integrates an assessment of the implications of CC to routine CBA and can provide substantial additional justification for funding applications analysis. Since it aims to value all benefits, this level of analysis is normally reserved for large programmes or those significantly affected by CC. In most countries, this would not be appropriate for programmes costing less than $5 million, although some line ministries may choose this level to improve the chances of getting approval for smaller projects considered of high importance.

   Quantitative CCBA often requires at least several days of effort depending on ready availability of local data and prior studies. It should ideally be integrated into a conventional CBA either through dedicated additional expertise or by using existing CBA team members with CC valuation experience. Compared to traditional CBA, quantitative CCBA is also more likely to draw upon probabilistic models given the large range of physical uncertainties associated with climate impacts.

3.4 CONDUCTING THE COST-BENEFIT ANALYSIS

Defining How the Project Works: A clear statement of the costs and benefits associated with a project and how these are affected by climate change are required for analysis, as described in chapter 2. The way in which inputs lead to outputs may be considered a 'model'.

For a quantitative cost benefit analysis, this relationship is mathematically defined. Your analysis should quantify inputs with their costs, and outputs with their benefits and how climate affects them.

BOX 6. EXAMPLES OF MODELS OF HOW PROJECTS WORK

Examples of Models of How Projects Work:

- The response of crops to temperature or moisture can be based on crop models that assess the relationship between biophysical parameters, including climate, and the productivity of crops. The way projects change crops and farming practices then alters the crop models.
- For renewable energy, the project model involves the relationship between the energy source (e.g., water, solar, biomass and wind) and the amount of energy produced.
- For flood protection, the model often requires some hydrological modelling of storage and flow rates associated with different infrastructure and management options, which can be used to predict flood levels.
- For health, the model is typically a relationship between a climate variable (typically temperature) and the probability of a health challenge.

Quantitative CCBA: For projects of higher investments and over a relevant threshold (THB 1,000 million in case of Thailand), with significant climate change implications, the relationship between input and output along with how these are modulated by climate must be specified in a quantitative model. The project 'model' can be simple, e.g., farm models based on crop budgets; or, complex, e.g., integrated assessment models that combine biophysical modelling with economic behaviours.

Cost-benefit Analysis with Climate Change quantifies the marginal net benefits of an adaptation project. This means that the marginal costs and marginal benefits of adaptation must be quantified, so that marginal net benefits can be calculated. This is vitally important to keep in mind. Thus, the additional cost (marginal cost) of an adaptation must be estimated along with the additional benefit (marginal benefit) of that adaptation. Moreover, these must be calculated with clear modeling of climate change impacts to them.

Ensuring that climate change is adequately modeled in the analysis is absolutely critical. The key questions to answer are: how would net benefits have evolved without any adaptation? And, how would net benefits have evolved with the proposed adaptation project? In both of these, the stream of net benefits over time are necessarily modulated by climate. A very clear sense of climate impacts on the systems being studied is needed.

BOX 7. EXAMPLES OF QUANTITATIVE ANALYSIS

Examples of quantitative analysis include the following:

- Crop response models need data on local conditions, which may come from research data or field data. Consider a range of crop models to ensure that results are not dependent on a single model.
- The relationship between flood levels and damage can be derived from actual data over recent decades, based either on surveys or on data from insurance or government compensation schemes.
- Risks associated with increased frequency and severity of soil loss and landslide can be based on data from trends in soil loss in recent decades, correlated with weather conditions in the area.
- The impact of climate on disease threat can be based on observations of the frequency of disease in different locations, after controlling for any other factors that might vary between the locations.

Quantitative CCBA differs from hybrid CCBA in that all key variables are quantified, in one way or another. It may be necessary to resort to more qualitative sources for some elements of the analysis, especially if there are non-market costs and benefits, but the aim is to use quantitative analysis as far as possible and to convert qualitative evidence into scores that can be integrated in the quantitative analysis with some degree of objectivity.

Hybrid CCBA: This provides a bridge between qualitative and quantitative CCBA, allowing a gradual strengthening of qualitative analysis, to the extent that evidence and skills are available. Thus, while the modeling of cost and benefits of the project remain the same as the quantitative analysis, for projects that have lower investment than the threshold value, the sources of evidence may be more varied.

Generally, some quantitative evidence will be available that experts can share and vet to improve the quality of the assessment. Additional evidence may come from case studies, existing surveys and other research.

Ideally, the evidence will be local, but international evidence may also be useful for validating key assumptions, though it may need adjusting to local conditions. In practice, much applied CBA relies on expert opinion that synthesizes a mix of sources but accepts the more subjective assessment of evidence. Where the evidence is less clear, it may be sensible to conduct more sensitivity analysis to clarify which assumptions have the biggest impact on the results.

Preferably, expert opinion should be used to determine the key relationships between inputs and outputs and so make it possible to estimate costs and benefits. If the project model is more subjective, the parameters may be considered as 'criteria' in a multi-criteria assessment (MCA). One solution to this is to create a hierarchy that allows a wide range of criteria, but which groups them under the five dimensions of sustainable development (Dubash, Raghunandan et al. 2013).

These can be analysed using scoring and weighting systems. However, experts are often more familiar with the individual details surrounding specific parameters, rather than the overall impact on costs and benefits, so MCA approaches require careful management, especially to ensure they are not affected by optimism bias.

One option with MCA while relying on expert opinion is to ask experts to assess the importance of adaptation to climate change without requiring a specification of the project model.

Another challenge in relying on expert opinion is to find experts who have experience of projects in different climate conditions. There are also challenges associated with some experts becoming enthusiastic about particular technologies or projects without necessarily being aware of all the real-world constraints that can affects the success of the project.

BOX 8. EXAMPLES OF ANALYSIS BASED ON EXPERT OPINION

Examples of analysis based on expert opinion include the following:

- If official crop data is not available, or if it comes from sources that are considered weak, then it is normally possible to find agronomists with experience from a range of conditions, who will be able to provide guestimates for key parameters.
- If there is no quantitative evidence on flood protection, it should be possible to obtain expert opinion from people who are familiar with how businesses and households have been affected.
- Evidence for energy projects can often rely on the opinion of experts who are familiar with installing and using the technologies in different circumstances.
- For health programmes, it will usually be possible to find doctors who have sufficient experience to estimate the increased threat of climate sensitive diseases.

Qualitative CCBA: These methods require experts (which may include beneficiaries) to estimate the relative size of the costs and benefits and of how CC affects these. Ideally, these qualitative estimates should be structured around the use of MCA techniques, where the criteria act as proxies for the main costs and benefits (CIFOR 1999, DCLG 2009).

In theory, qualitative CCBA will include participatory appraisal to learn from the expertise of beneficiaries. As with quantitative cost benefit analysis, there is a long history of participatory appraisal and there are many guides, manuals and sourcebooks for participatory appraisal (ODI 2001; World Bank 2003; Care 2009; IUCN, IISD et al. 2012). These describe a very wide range of techniques that are available for eliciting views in an informative and objective manner.

Some have been specifically adapted to address climate change, including community maps; timelines; causal flow diagrams; climate analogues, which take people to other climates (Chaudhury, Kristjanson et al. 2012); and, the 'community-based risk screening tool – adaptation and livelihoods' (IUCN, IISD et al. 2012), The Climate Vulnerability and Capacity Analysis (CVCA) tool,[27] The Self-evaluation and Holistic Assessment of climate Resilience of farmers and Pastoralists (SHARP) tool,[28] gender-sensitive vulnerability assessments,[29] and more specifically, the practical guidance on Participatory, Gender-responsive Climate Cost-benefit Analysis.[30]

Some general principles for use of participatory MCA in CCBA are presented in Box 9.

BOX 9. GOOD PRACTICE IN PARTICIPATORY CCBA

a. Ensure participants understand the scientific evidence on CC and bio-physical sensitivity.
b. Clarify the difference between CC and current climate variability.
c. Ask participants to comment on changes in climate over the last few decades and on whether these changes are consistent with future projections.
d. Ask participants to explain how past changes in climate have affected their livelihoods.
e. For each proposed project, ask participants to define the various benefits from the project.
f. Ask participants to score the relative importance of each benefit.
g. For each benefit, ask participants to score how much they expect this to change with CC.
h. Estimate the climate relevance score (CC%) and discuss with participants whether this is consistent with their more intuitive and subjective views.
i. Discuss the implications for any CC policies (e.g., Community-Based Projects or Local Adaptation Programmes of Action (LAPAs).
j. Review the key features of vulnerability and whether the conclusions of the participatory CCBA are addressing these issues and, if not, whether the analysis should be revised, or new activities should be considered.
k. Discuss whether there should be any changes in systems to manage climate projects.

Participatory appraisal also uses a type of MCA to compile and structure the evidence, but the criteria are the net benefits generated by the adaptation project and the MCA is done by subjective assessment of the net benefits.

In some cases (e.g., for flooding), trends in climate over the last three decades are very similar to those projected for the next three decades, which makes it easier for stakeholders to appreciate climate change. But most CCBA will have to provide this capacity building before consultation can be useful.

Technique D: Project Documents and Objective-based Approach (OBA). If there is no data and expert opinion or participatory appraisal is not possible, then it may be possible to obtain a first rough estimate of the degree of climate relevance by consulting project documents and assessing whether climate change has featured explicitly or implicitly in the design of the investment.

This approach is typically used for broad reviews, such as with project databases or Climate Public Expenditure and Institutional Reviews (CPEIRs), where there are insufficient resources to do a CCBA on every project, even if the simplest techniques were used (Fozzard and Steele 2014; Limskul, Sirisamathakarn et al. June 2012).

Table 5 gives a typical example of guidance for scoring climate relevance based on the explicit or implicit objectives.

27 Available here: https://www.care.org/news-and-stories/resources/climate-vulnerability-and-capacity-analysis-handbook/
28 Available here: https://www.fao.org/3/cb3505en/cb3505en.pdf.
29 Available here: https://www.fao.org/3/i7654en/i7654en.pdf
30 Available here: https://climatefinancenetwork.org/publications/guide-gender-responsive-climate-cba/

TABLE 5. TYPICAL GUIDANCE FOR OBJECTIVES BASED ASSESSMENT (OBA) OF CLIMATE RELEVANCE

Level	CC% CPEIR	CC% CCBA	Guidance
High	>75%	>33%	CC is the explicit primary objective
Mid	25%-75%	15%-33%	Include a mix of activities, only some of which are CC relevant
Low	10%-25%	5%-15%	CC is a secondary objective, or one objective amongst several
Marginal	<10%	<5%	CC is a very minor objective, often only implicit
No	0%	0%	Unaffected by CC

The CC% scores indicated in Table 5 are substantially higher than those in Table 3. This reflects the fact that subjective assessments typically overstate the importance of climate change, either through lack of evidence and experience or through deliberate exaggeration of climate relevance in order to improve changes of access to climate finance. Therefore, wherever possible, OBA should be validated at least roughly, with other evidence Table 3. As a rule of thumb, the indicative scores used in the CPEIRs can be halved to make them comparable with scores based on CCBA.

3.5 LIMITS OF CCBA AND THE NEED FOR A COMPLEMENTARY APPROACH

Simpler CCBA exercises are very helpful for governments to focus on climate change adaptation and mitigation measures that could be mainstreamed with normal planning and budgeting processes. Comprehensive qualitative CCBAs are necessary for safeguarding the benefits of larger and critical investment projects through resilient and inclusive planning.

While acknowledging the need for a comprehensive CCBA, it needs to be recognized that climate-optimal outcomes are not the only top priority for governments/proponents. There are several other considerations that a government has to confront due to multiple interests in execution of development programmes. Further, due to uncertainties in climate projections, the outcomes of CCBAs could throw up results that need to be taken judiciously.

There could be several arguments against CCBA considering that:

- costs of climate-proofing now are estimated to be large relative to the expected benefits; and/or
- costs (in present value terms) of climate-proofing (e.g., retro-fitting) at a later point in time are expected to be no larger than climate-proofing now; and/or
- expected benefits of climate-proofing are estimated to be relatively small (if climate events do not materialize).

Thus, the approach towards CCBA should be dynamic and iterative and CCBAs should be revisited when new evidence presents itself that could alter the results of the initial CCBAs.

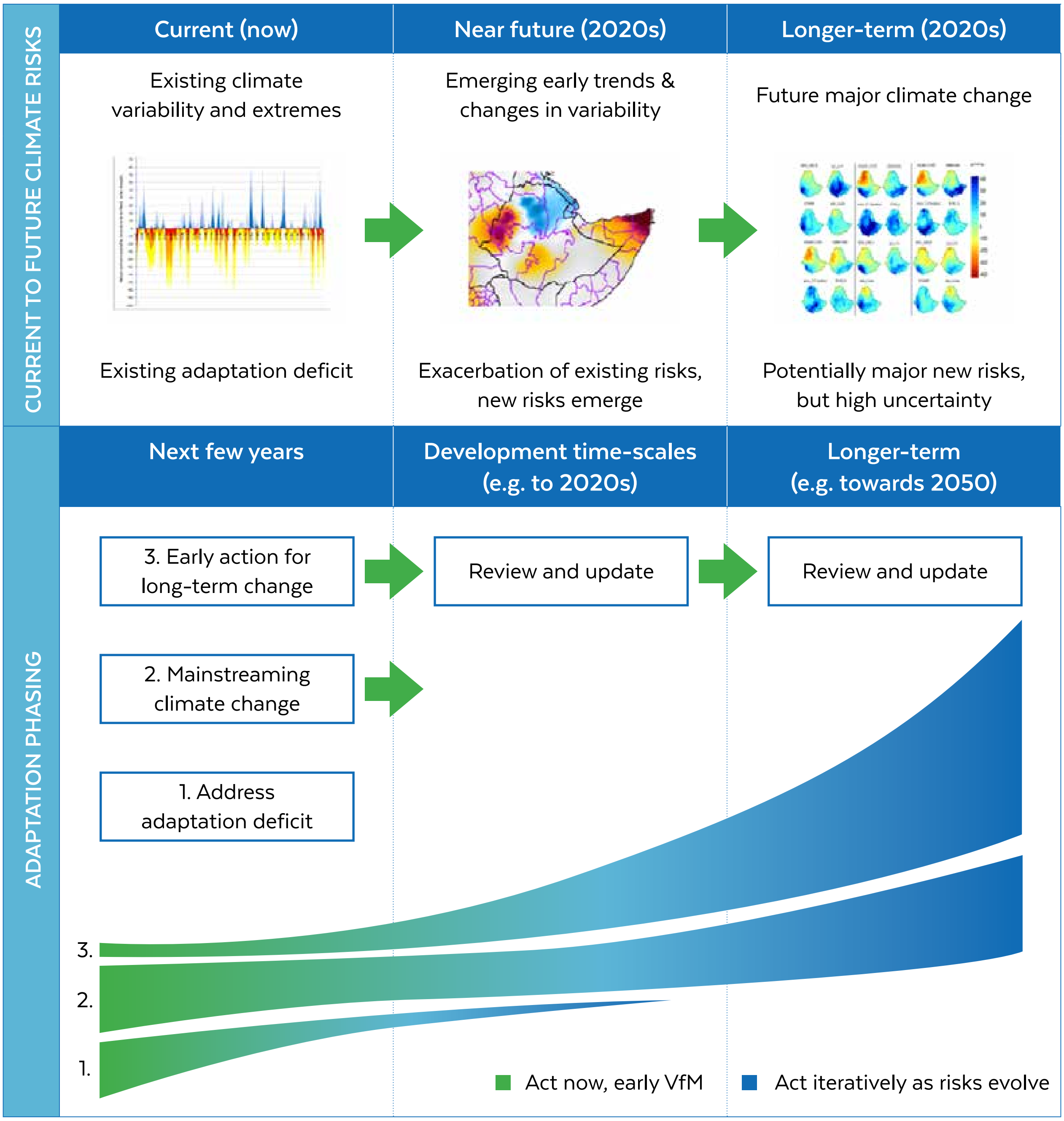
The diagram below highlights the approach of initial adaptation planning and mainstreaming and iterative course correction as and when more evidence present itself.

CCBA is thus only one of the tools available to a government to focus on adaptation (and mitigation) planning. The economic analysis informs decision-makers and policymakers about the economic efficiency of projects or policies. There could be other criteria that are equally important to any government. These could include:

- The physical or biological impacts;
- Economic efficiency;
- Distributional equity;
- Social and cultural acceptability; and,
- Operational practicality.

These other factors may be critical to the government's decision-making which call for the complementary use of MCA and other methodologies There is, thus, a need to explore other approaches that can support CCBA results. In a scenario with relatively greater certainty around options and costs, CBAs, cost-effectiveness analyses, and multi-criteria analyses can be used.

FIGURE 15. ADAPTATION PLANNING APPROACH



Source: Watkiss et al 2012

As the degree of uncertainty around responses and climate parameters increases, there is a need to iteratively assess performance of options, and inform medium to longer term actions. Other approaches like real-option analysis and portfolio analysis are used for decision making, accepting a high level of uncertainty.

Each of these approaches has relative advantages given data availability, planning context and skill (Tröltzsch et al., 2016), as shown below:

FIGURE 16. MAIN STRENGTHS AND LIMITATIONS OF ECONOMIC TOOLS TO SUPPORT ADAPTATION DECISION-MAKING

METHOD	STRENGTHS	CHALLENGES	DEALING WITH UNCERTAINTY
Cost-benefit analysis	Most useful when climate risk probabilities are known and sensitivity is small. Also where clear market values can be used	Valuation of non0market sectors/non-technical options. Uncertainty limited to probabilities risks/ sensitivity testing	Does not explicitly deal with uncertainty, but can be combined with sensitivity testing and probabilistic modeling
Cost-effectiveness analysis	As above but for non-monetary sectors and where pre-defined objectives must be archived	Single headline metric difficult to identify and less suitable for complex or cross-sectoral risks. Low consideration of uncertainty	Does not explicitly deal with uncertainty, but can be combined with sensitivity testing and probabilistic modeling
Multi-criteria analysis	When there is a mix of quantitative and qualitative data	Relies on expert judgment or stakeholders, and is subjective, including analysis of uncertainty	Can integrate uncertainty as an assessment criterion, however usually relies on subjective expert judgment or stakeholder opinion
Iterative risk management	Useful where long-term and uncertain challenge, especially when clear risk thresholds	Challenging when multiple risks acting together and thresholds are not always easy to identify	Deals explicitly with uncertainty by promoting iterative analysis, monitoring, evaluation and learning
Real-option analysis	Large irreversible decisions, where information is available on climate risk probabilities	Requires economic valuation (see CBA), probabilities and clear decision points	Deals explicitly with uncertainty by analysing the performance of adaptation for different potential futures
Robust decision-making	When uncertainty and risk are large. Can use a mix of quantitative and qualitative information	Requires high computational analysis and large number of runs	Explicitly incorporates uncertainties and risks, in particular, systemic dependent risks, to derive robust solutions
Portfolio analysis	When number of complementary adaptation actions and good information	Requires economic data and probabilities. Issues of inter-dependence	Deals explicitly with uncertainty by examining the complementarity of adaptation options for dealing with future climates

Source: (Tröltzsch et al., 2016)

3.6 ADMINISTRATIVE FEASIBILITY; MONITORING AND EVALUATION

The primary role of monitoring is to provide evidence that allows the managers of expenditure to refine their management. However, monitoring also allows government to aggregate the progress of each investment into a national level monitoring, which then helps to assess whether strategic objectives are being met and whether the prioritization given to climate related investments should be accelerated or relaxed.

Adaptation. The most holistic impact indicator for all adaptation investment is the the reduction in harm, the reduction in the risk of harm arising from climate change, or the realization of benefits from addressing climate change. However, this may not be the most practical indicator since climate change in itself, and subsequently its impacts, is a long-term phenomenon.

Even in the most climate vulnerable countries, the economic cost of climate change is only expected to grow at around 0.1% of GDP a year, varying greatly from year to year. It is not, therefore, possible to monitor adaptation benefits directly in the short- or medium term. Instead, it is necessary to monitor the outputs and outcomes from adaptation investments and then describe and estimate the benefits of action.

In most cases, the indicators of outputs and outcomes that are useful for estimating adaptation impact are the normal indicators of the outputs of the investment. The indicators should reflect the key variables that determine the results of cost benefit analysis. Typical examples are presented in Table, but there may be more detailed output indicators that are more easily monitored and are specific to each investment.

Mitigation. For mitigation, monitoring is usually more straightforward. The reduction in GHG emissions is the single indicator of impact and it should normally be easy to estimate this directly from output indicators such as energy savings, renewable energy generation, and changes in land use.

TABLE 6. TYPICAL INDICATORS FOR MONITORING OUTPUTS LEADING TO IMPACT

Sector	National Level Indicator
Forestry, Peatland, Marine Resources, Coastal	• Change in deforestation rate (ha/year) • Degraded peatland rehabilitated (ha/year) • Coral area protected (km^2) • Vulnerable coastal areas protected from storm surge (ha)
Agriculture COMMA	• Drought resistant crop varieties planted (ha) • Area with water harvesting protection (ha) • Farm area benefiting from weather insurance (ha), percentage of female farmers with access to insurance • Irrigation area (ha), percentage of area equipped for irrigation managed by women • Biofuel production (t)
Energy and Industry	• Energy saving (kWh) • Renewable energy generated (kWh), and households using renewable energy technology (disaggregated sex of head of household) • Carbon intensity of electricity generation (tCO2e/kWh) • Expenditure on fossil fuel subsidies ($)
Transport and Urban Planning	• Households with water supplies vulnerable to flood, disaggregated by sex of head of household • Number of rail/metro/bus passengers, disaggregated by sex)/socio-economic group • Waste going to landfill (t) • Use of climate proofing standards (value of investments) • Urban area vulnerable to 10-year flood (ha)
Education and Health Programmes	• Education spending on CC programs as % of all education • Health spending on CC related programs as % of all health
Disaster Reduction and Management	• Communities with disaster management plans • Lead times before warning for flood/tidal surge

Aggregating National Impact many of the indicators used for monitoring the effectiveness of expenditure can be aggregated at a national level to give an indication of national progress towards adaptation and mitigation objectives. When indicators of projects in execution are aggregated, it should then be possible to make an assessment of how they will affect adaptation impact i.e. reduced or avoided harm, losses and damages, and mitgation impact (i.e. reduced GHG emissions) and this can then be compared with total expected lossesand damages to give an indication of the Adaptation Gap (or the extent to which these losses are not addressed by current or planned climate change expenditure).

This approach has been pioneered in the use of Climate Change Financing Frameworks (CCFFs), which have now been done in a number of countries in Southeast and South Asia. The conclusions from this work suggest that the Adaptation Gap is typically between 80% and 90%.

Process and Institutional Readiness. In addition to the actions that directly affect adaptation and mitigation, some projects provide 'soft support' to build institutional capability to respond to climate change. These may be considered indirect projects that are essential for the effectiveness of direct projects but do not generate benefits without the direct projects.

It is not possible to isolate the benefits from these indirect projects on their own, but their role in facilitating direct benefits can be taken into account when considering the full range of projects, including overheads, projects that deliver services, and investments that provide direct benefits. For example, a country may consider that it is necessary to devote, say, 40% of resources to indirect projects and 60% to direct projects in the first few years of a climate change strategy, but, once the institutions are in place, the indirect projects may require only 20%.

There are a number of international initiatives that provide guidance on monitoring institutional readiness to climate change (Brooks and Fisher 2014). In essence, these involve a checklist of institutional capacity that needs to be in place covering the following issues:

- Awareness and knowledge
- Planning and financing systems
- Information services and knowledge systems
- Processes for consultation, participation and coordination, enabling inclusive and gender responsive stakeholder engagement mechanisms and inter-institutional arrangements across relevant levels of government and sectors, including with women-led groups, indigenous peoples' organizations, minority communities, etc.

3.7 GENERAL GUIDANCE FOR EXECUTING ANALYSIS

3.7.1 Assemble a Team of Relevant Experts

Before conducting this analysis, it is important to assemble the right resources. At the very least, an expert in CBA and a climate science expert. These two resources together can provide traction on the three core challenges of successfully executing a CBA – namely, creating a model for cost benefit analysis, acquiring the relevant climate parameters, and linking the two.

A full quantitative analysis is a non-trivial undertaking and will require getting the appropriate technical resources. This includes adequately incorporating gender and social inclusivity dimensions with the help of relevant experts, including the creation of a cost-benefit matrix that provides equal consideration of socio-economic impacts with other variables (see GESI checklist in Annex 3). This attempt should treat the unquantifiable non- financial costs and benefits equally with the quantifiable, financial costs and benefits.

3.7.2 Obtain High Quality Climate Change Projections

Getting high quality climate change projections is critical to cost benefit analysis with climate change. It is important to consider as many global circulation models (GCM) and downscaled models as possible. There needs to be a consideration of past historical changes (do trends fit with expected future changes) and an assessment of how reliable the projections are.

Questions need to be asked whether the scenarios capture the full range of variability or whether they may underestimate extremes. Where there are limited models and scenarios, e.g., for impact modelling, the results should be placed in context by considering the climate futures simulated by other models and how these might impact the results of the cost benefit analysis.

3.7.3 Rationalize Choice of Climate Scenarios

Once you have found the relevant climate projections, it is important to rationalize the choice of those scenarios. Whatever scenarios you pick, you must have some rationale for. Perhaps a best case and worst-case climate change scenario to bound your net benefit estimates. Whatever the selection, please carefully justify the selection so decisionmakers are aware of the logic for scenario selection.

3.7.4 Focus on Marginal Costs and Benefits

There should be clarity on what the goal of the analysis is, i.e., calculate net benefits from an adaptation project. The goal of conducting a cost benefit analysis that integrates climate change is to quantify the marginal net benefits from adaptation. That means that the business-as-usual pathway (that accounts for climate change) is compared to an adaptation pathway (that also accounts for climate change). This difference in net benefits is what is required of the analysis and what will guide decisionmakers on whether to proceed or not.

3.7.5 Carefully Define the Project and its Timeline

Vital to the success of this analysis is clearly defining project objects – actions undertaken, and hardware deployed. For these actions and deployments, it is vitally important to define timing, i.e., to know exactly when and for how long a specific action will be undertaken and hardware will be deployed. Without defining these dimensions of an adaptation project, it will be impossible to construct an analytic model that can generate net benefit estimates.

4. INSTITUTIONAL, OPERATIONAL AND GENERAL GUIDANCE

4.1 ALIGNING/ INTEGRATING CLIMATE POLICIES AND STRATEGIES WITH BUDGET-SETTING PROCESSES

Integrating climate change adaptation or mitigation priorities informed by CCBAs is likely to require some modifications in the budget processes followed in the country. There could be requirement to revise budget circulars that are circulated to line ministries/ departments to include guidance to the budget desk officials of the relevant Ministries/ Divisions to be able to provide information related to climate change and GESI priorities and actions in their budget formats.

The budget formats may themselves require some changes in its structure to accommodate climate and GESI dimension in the budget setting process in line with the national priorities set by the government in its NDC commitments, SDG commitments or National Action Plan on Climate Change. The lead for the process needs to be taken by Ministry of Finance or Ministries of Planning who will provide the strategic direction for the process.

BOX 10. EXAMPLE OF ALIGNING/INTEGRATING CLIMATE POLICIES WITH BUDGET-SETTING PROCESS IN BANGLADESH

Bangladesh Example:

Through a Climate Public Expenditure and Institutional Review (CPEIR) in 2012, Bangladesh identified thirty-seven Ministries and Divisions of the Government together with hundreds of government agencies as relevant to public climate finance. In the Climate Change Fiscal Framework of 2014 (updated in 2020) it was, therefore, recommended that the existing structure of Ministry Budget Framework should be changed to accommodate climate dimension in the budget setting process of all of these Ministries and agencies.

This necessitated some modifications in the format of Budget Circular. These changes for alignment have been brought about in line with the six thematic areas identified in the Bangladesh Climate Change Strategy and Action Plan (BCCSAP) 2009. To complete the exercise of alignment, the climate issues were mapped with new Budget & Accounting Classification Manual (BACS) and the Integrated Budget and Accounting System (iBAS++) by working out appropriate methodologies. Strategic directions of the Ministry of Finance and Planning Commission and engagement of Ministries/Divisions have been instrumental in taking this agenda forward.

4.2 INSTITUTIONAL ARRANGEMENTS

Certain institutional arrangements and responsibilities will be necessary for operationalizing CCBA guidelines during the budgeting cycles. This institutional arrangement is likely to vary for each country. However, the general structure of the institutional arrangement may be as follows:

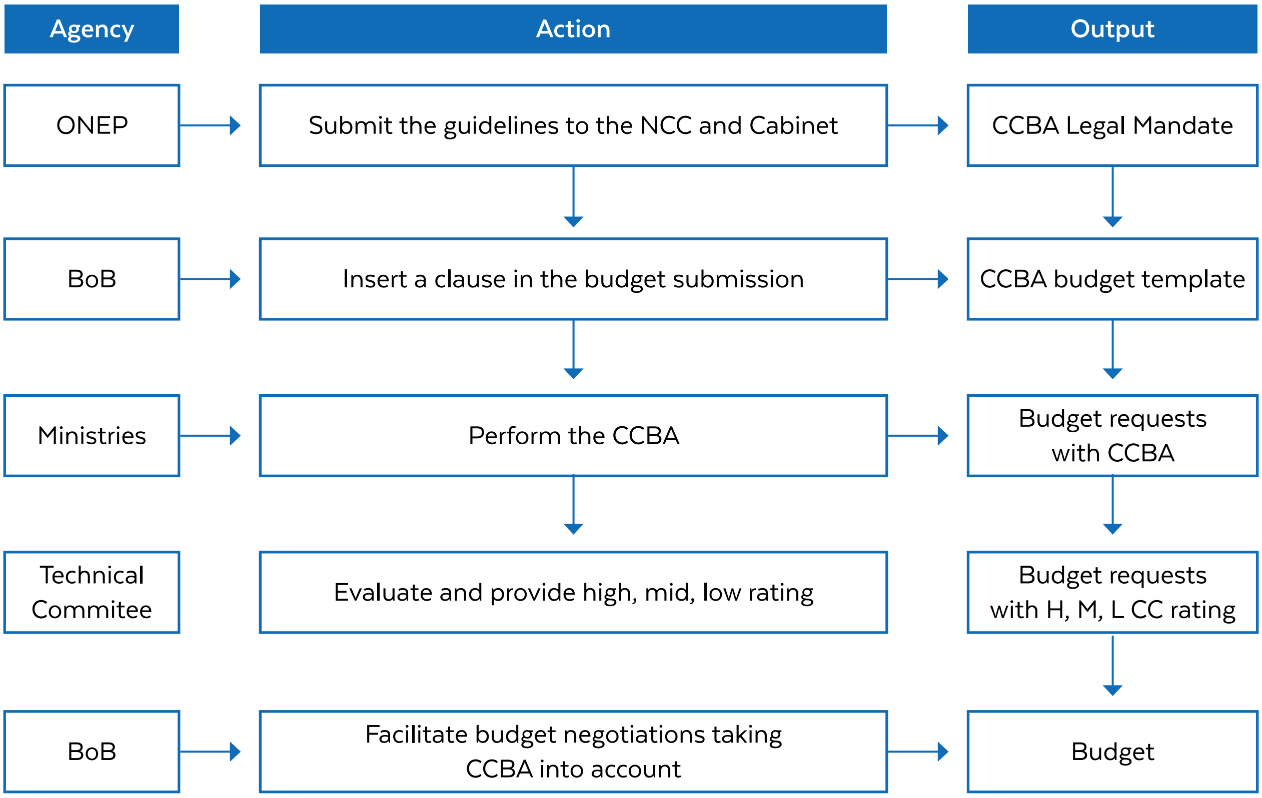
Climate Change Nodal Ministry/ Department – Takes the lead in operationalizing the guidelines and coordinates with relevant ministries, specifically the Ministry of Finance or Ministry of Planning, depending on the Government structure in the country for concrete policy and legal mandates.

Ministry of Planning/ Ministry of Finance – Provides guidance to line ministries/ departments and to sub-national entities to include climate and GESI considerations in the budget process. As mentioned above, this could require some modification of existing templates and guidelines. The MoF/ MoP may also be required to form a technical sub-committee with participation from the CC Nodal Department/ Ministry as well as external experts to assess evaluate the quality of the analysis undertaken by line ministries. It must be ensured that gender specialists and social inclusion experts from Social/ Women's Affairs ministries are part of the exercise.

The committee also summarizes the conclusions of the analysis and provides recommendation to the MoF/ MoP on the climate relevance of the budget proposals. The MoF/ MoP considers the submitted budget requests (with the evaluation undertaken by the technical committee) along with other existing budget approval criteria and decides when the analysis should influence the budget negotiations.

Line ministries/ departments – Perform, as required by the mandates, the cost benefit analysis with climate change, and submit their budget requests to Ministry of Planning/ Ministry of Finance to be evaluated by the cost benefit analysis Technical Committee established under the MoF/ MoP.

FIGURE 17. EXAMPLE OF INSTITUTIONAL ARRANGEMENT AND RESPONSIBILITIES IN THAILAND



BOX 11. TYPICAL TEMPLATE FOR COLLECTING CLIMATE RELEVANCE DATA INCORPORATING GESI

Typical Template for Collecting Climate Relevance Data incorporating GESI, sex-disaggregated data, use of participatory vulnerability assessments/stakeholder consultations

Nature of and Severity of CC Risks: ....
[e.g. flood (high); sea-level rise (low); drought (low)]

How CC Risks Impact the Population/Environment: ....
[e.g. livelihood threatened ; increased health burden; species extinction]

How the Proposed Expenditure Reduces CC Impact: ....
[e.g. crop productivity protected from drought; villages protected from floods]

Techniques/Evidence Used to Assess Net Benefits: ....
[e.g. CBA based on statistics; CBA based on expert opinion; participatory analysis]

Sensitivity of Net Benefits to Key Assumptions: ....
[e.g. change in flood return frequency (high sensitivity); dependence of households on dry season rainfed cultivation (mid) ; value of GHG emissions (high)]

4.3 OPERATIONALIZATION

Table 7 summarises how the cost benefit analysis with climate change is operationalized under existing project planning and budgeting and is used for monitoring and tracking climate change related investments for the Climate Change Master Plan and other climate change related plans (e.g., National Development Plan).

Planning. The project screening helps identify which investments require cost benefit analysis and the steps provided for conducting it help assess the relative importance of climate change benefits compared with other sustainable development benefits.

Budgeting. The cost benefit analysis with climate change clause in the budget submission template requires line ministries to prepare budget requests with the analysis to be submitted to MoF/MoP and subsequently reviewed by the Technical Committee. The technical evaluation provides confidence in the assessment of climate change relevant projects for budget negotiation and M&E purposes.

Monitoring and Tracking. The budget requests tagged with climate change relevance facilitate the M&E of projects and the tracking of investments for the Climate Change Master Plan.

TABLE 7. OPERATION OF THE CCBA GUIDELINES UNDER EXISTING PLANNING AND BUDGETING

	Process					
	Planning	Budgeting			Monitoring	Tracking
		Submission		Approval		
Responsible Agency	Line Ministries		Technical Committee	MoF/MoP	MoF+ Line Ministries	CC Nodal Agency
Action	Screen projects for CCBA Conduct CCBA with GESI	Integrate CCBA into budget request	Evaluation with rating	Consider the evaluation with other approval criteria	Monitor and evaluate CC relevant projects	Track CC activities for CC Master Plan and NDP
Output	CC relevance identified	Budget request with CCBA submitted	Budget request rated with high, mid, low CC relevance	Budget with CC relevance approved and tagged	CC relevant projects monitored and evaluated	CC relevant projects tracked for related plan

4.4 SUMMARY AND CONCLUDING REMARKS

Climate change is a critical development issue to which all countries in the world give much importance. It affects natural ecosystems and the built environment, as well as all segments of the population, and in turn, economic sectors that are reliant on these systems.

Several countries have designed operational specifications related to climate change in national development plans and ministerial strategies. However, implementation still experiences problems on many issues, and in part is still inefficient and ineffective.

In particular, the following three main challenges are present currently:

- Lack of a clear operational framework at the level of projects and plans, and unclear budget requests related to climate change;
- Lack of systematic appraisal of the costs and benefits of climate change projects with adequate consideration of distributional effect, gender and social inclusion; and,
- Lack of an adequate monitoring and evaluation frameworks for projects and plans related to climate change.

These Guidelines were produced with an aim to address these challenges by providing a framework for analyzing climate change projects with an easily understood systematic project appraisal process that policymakers and planning agencies can use. It provides a selection of appropriate technical tools and related iterative steps for undertaking a climate change cost benefit analysis, depending on the type and nature of the project, type of activities, quantitative or qualitative data, and level of community involvement.

With any cost-benefit analysis, the analytical results are intended to start a discussion — they will not provide an exclusive answer on what the most effective portfolio of adaptation or mitigation measures would be for a particular context. A broader set of selection criteria and approaches — covering both evaluation and implementation — may be needed, which may include measures' potential for impact, their ease of implementation and their synergies.

The case studies in **Annex 1 and 2** provide real-life examples of the tools applied in Thailand and Zanzibar, highlighting their wide range of applicability, while **Annex 3** provides a **Gender Equality and Social Inclusion (GESI) Mainstreaming Checklist for Screening Climate Finance Proposals** - which is a useful tool for ensuring that these considerations are taken into account throughout the entire life cycle of any project or intervention.

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ANNEX 1 – CASE STUDIES AND EXAMPLES OF CCBA

EXAMPLE CCBA USING QUANTITATIVE CBA- FLOOD PROOFING IN THAILAND

The 2011 floods in Thailand caused more than 800 deaths, and loss and damage of about THB 1430billion, affecting especially the manufacturing sector, but also urban infrastructure and agriculture. In response, the Royal Thai Government (RTG) prepared a range of projects to reduce future flooding in the Chao Phraya River Basin. This included the creation of diversion canals (or upgrading capacity of existing ones), improvements in information flow to flood-affected parties, and putting into place proactive control measures, such as deliberate flooding of some agricultural land (which acts as a countermeasure to unexpected large volumes of water in the channels and overflow that leads to devastating natural flooding events).

An initial economic analysis was undertaken in 2011 that did not take climate change into account. It considered three different options. Of these, the most comprehensive one was priced at THB 508 billion, including all construction, land, and resettlement costs. This option was designed tp protect against all floods up to the level experienced that was experienced in 2011. On the basis of past records, the 2011 flood has a return period of 43 years (i.e., a probability of occurring in any one year of 2.3%).

The 2011 economic analysis estimated the reduction in loss and damage to property would have a Net Present Value (NPV) of THB 529 billion, using a discount rate of 12% over 38 years. This was based on an assumed average annual benefit of THB 41.5 billion in 2012 (i.e., the THB 1.43 trillion 2011 costs multiplied by the 2.3% probability of recurrence, plus an additional 25% of average annual costs for smaller floods) and that this benefit would grow at 5% a year, in line with economic growth, reflecting the increase in asset value at risk to flooding without the project. Therefore, the Benefit Cost Ratio was 1.1, which means that benefits were slightly higher than costs. However, this is well below the levels of 1.5 to 2.0 that is normally required to obtain approval for funding.

The 2011 analysis has been revisited to consider the implications of climate change and to take into account a wider range of benefits. Key features that were added are as follows:

- According to the latest climate models, the return period of a 2011 flood will change dramatically in the future and will reduce to 7 years by 2050 (i.e., a probability of 14.3%). This has a dramatic impact on the benefits, since they are directly proportional to the probability of a flood occurring. However, the increased risk takes place gradually, in equal annual increments up to 2050. The net effect is to increase the NPV of benefits from THB 529 billion to THB 1557 billion, taking the BCR to over 3, which is very strongly positive.
- Analysis was also undertaken to assess the relative importance of wider benefits not taken into account in the initial analysis. These included the value of a wide range of social issues associated with the flooding and was based on surveys using contingent valuation techniques. The issues covered included: health issues, lost days of work, stress, and other similar social measurements that would feed into economic impacts. These surveys suggested that the value placed on the disruption and loss caused by the flood averaged THB 100,000 per person for the 2 million people most seriously affected, and THB 10,000 for the 20 million people on the margins. Therefore, the extra costs were THB 400 billion, thus increasing the potential costs of the flood by about 28%. As the benefits from the project are directly related to the avoidance of flood costs, the BCR will therefore be increased by 28%, increasing it from slightly over 3.0 to nearly 4.
- The benefits of avoiding loss of life were also considered, using international conventions for valuation of Disability Adjusted Life Years (DALY). WHO recommend that each DALY is valued at about 3.5 times the annual GDP per capita, which is about THB 125,000. Assuming that the average age of those who lost their lives in 2011

was 30 years and that the life expectancy in Thailand is 74 years, the economic value of the loss of life was THB 15 billion, i.e. 800 x (74-30) x 125,000 x 3.5, or about 1% of the loss of property.

- The new analysis also has the benefit of observing the recent response of the private sector to the 2011 floods, which has included substantial investment in localised flood protection around high value manufacturing locations. This provides alternative options to reduce the costs of flooding. No formal survey work was undertaken. However, the opinions of local officials in the areas worst affected suggested that at least 10 industrial estates have built protection and that these sites contain between 5% and 10% of the total manufacturing asset value. Therefore, this reduces the benefits from the flood protection by 5% to 10%.
- A sensitivity analysis is done to consider the implications of reducing the discount rate from 12% to 5%. This is in line with best international practice and is well above the rate of interest that government is paying on domestic borrowing. It is, however, well below the real interest rate of commercial borrowing. Changing the discount rate also has a dramatic impact on the NPV of benefits, increasing them to over THB 6000 billion and raising the BCR to over 9, which is well beyond the levels normally available for public investment.

The above analysis shows that taking climate change into account makes a dramatic difference to the economic case for the project to invest in flood protection.

EXAMPLE CCBA USING CBA WITH EXPERT OPINION – BIOGAS SCHEME IN THAILAND

The government is proposing to subsidise a pilot scheme to encourage rubber plantations to invest in biogas generation. The analysis relies strongly on the experience of the experts involved in biogas generation and the manager of the rubber plantation. The climate change benefits are those associated with the reduction in greenhouse gas (GHG) emissions.

The physical and financial parameters involve some detailed estimates of (i) the volumes of wastewater and pollutants; (ii) the efficiency of the process in extracting carbon from the wastewater and converting it into biogas and methane; (iii) the heat content of the biogas generated and the savings in firewood that can therefore be made; and, (iv) the value of replacing harmfully polluting wastewater with beneficially fertilising wastewater.

The equipment costs THB 8.65m and has annual operating costs of THB 0.41m. The opportunity cost of the land (i.e., the income that could be made from using it for alternative purposes) is estimated to be THB 0.16m per year. The Net Present Value (NPV) of these costs over 35 years using a 5% discount rate is THB 15.4m.

The benefits come from four sources: (1) savings in firewood, (2) the fertilising value of the wastewater, (3) the reduction in water pollution, and (4) the reduced GHG emissions. The savings in firewood are estimated to be THB 1.09m per year.

The fertilising benefits are based on the nutrient content of the wastewater, valued at the price of nutrients in conventional chemical fertiliser, which suggests the fertiliser value is very small at less than THB 0.01m per year. The value of avoiding pollution is determined from studies in other locations of the impact of water pollution on health and livelihoods, including fishing. This suggests that the benefits of avoiding pollution are relatively small at THB 0.02m per year. Excluding the value of GHG emission reductions, the NPV of benefits is thus THB 13.91m, giving a Benefit Cost Ratio of 0.90, which is insufficient to justify the investment and would argue against a public subsidy.

The rubber processing plant produces about 15,000t of rubber per year and 184,000m3 of wastewater. Without biogas generation, about 50% of the carbon in the wastewater decomposes into methane and about 73,000m3 of methane is emitted into the atmosphere, equivalent to about 1160 tCO2e. With biogas generation, all methane generated is burnt and released as carbon dioxide, which contributes only about 65 tCO2e. The saving in GHG emissions from wastewater arising from biogas generation is therefore 1095 tCO2e, which has a value of THB m, assuming a carbon price of about 5 $/tCO2e, which increases the BCR from 0.90 to 1.23, which is an improvement but still not strongly attractive.

In addition, there are potential savings from GHG emissions associated with not having to burn firewood. If the firewood comes from sustainable sources (i.e., it comes from forests where only mature timber is extracted to avoid decomposition and the stock of timber is maintained) and there is a plentiful supply of this firewood, then the firewood is carbon neutral and there are no gains in emissions from not using firewood.

However, if the firewood is not from sustainable sources, or if there is a limited supply of sustainable timber and others are forced to use fossil fuels (e.g., kerosene) or electricity generated from fossil fuel, then there is reduction in GHG emission from the savings in firewood. In the latter case, there are savings of about 2600 tCO2e per year. If carbon is valued at 30 $/tCO2e, this has an NPV of about THB 11m. This lifts the BCR to 1.94 which is strongly attractive.

Therefore, the analysis suggests that in areas where sustainable firewood is in short supply, there is a strong justification for subsidising the installation of biogas treatment, when GHG emission are valued at carbon market values slightly above existing market values. If the carbon emissions are valued at the higher levels seen in earlier carbon markets, then the BCR increases from 1.94 to over 4, and becomes very strongly attractive. If carbon is valued at the social cost of carbon (e.g., 50 to 100 $/tCO2e), then the argument for investing in biogas is irresistible.

EXAMPLE CCBA USING PARTICIPATORY APPROACHES - CONSERVATION AGRICULTURE IN THAILAND

The following example is a hypothetical project described to illustrate the techniques. First, let's consider that traditional farming practices in a region rely on ploughing land and growing a rotation of staple crops, combined with legumes and pasture. These techniques provide a living that is close to subsistence for most small farmers during normal years. However, in dry years, yields drop significantly, and households are unable to survive from their farms and must resort to various coping strategies to diversify incomes.

There have been a number of small NGO projects that demonstrate that a low tillage approach to farming can result in rapid improvements in soil moisture capacity, which gives farmers marked improvements in yields during dry years. Farmers practice a wide range of mixed activities, including crops, livestock and agro-forestry. Low tillage approaches must, therefore, be well-adapted to the local circumstances. The government is subsidising a network of farmers' field schools that will allow the pilot projects to disseminate their experience and then build a system that allows farmers to share their experience.

The government does not have strong evidence about the benefits. Nevertheless, in our hypothetical example the project designers call a meeting of leading farmers and of those people who have been closely involved in the NGO projects. This meeting discusses the range of potential benefits from low tillage farming, which include a) higher soil moisture and hence more resilient yields in dry years; b) reduced soil erosion, especially in wet years; c) lower requirements for herbicides, after three years of more heavy herbicide use; and, d) lower probability of the most serious pest attacks. It also identifies a number of costs, including, notably, some high labour costs during the first few years, while the new system is becoming established.

The group scores the relative importance of the various benefits, assuming current climate conditions. It then considers the available evidence on climate change, including recent trends and the evidence from climate modelling, all of which point to an increased probability of a moderate drought from 25% to 35% by 2050. The meeting then discusses the relative change in the various benefits as a result of this expected climate change.

The farmers then discuss the potential interest in the new techniques and it is thought that about 1000 farmers could be using some form of fairly comprehensive low tillage cultivation by 2025. The proposed government budget for the project is THB 200m. In order to estimate the additional benefits associated with climate change, the group estimates the income of a typical small farm, using current practices and current climate conditions. It then uses the existing consultation to assess the change in that income and this allows a BCR to be estimated for the new techniques, with current climate conditions. The consultation also provides the qualitative participatory evidence to show the likely impact of climate change on these benefits.

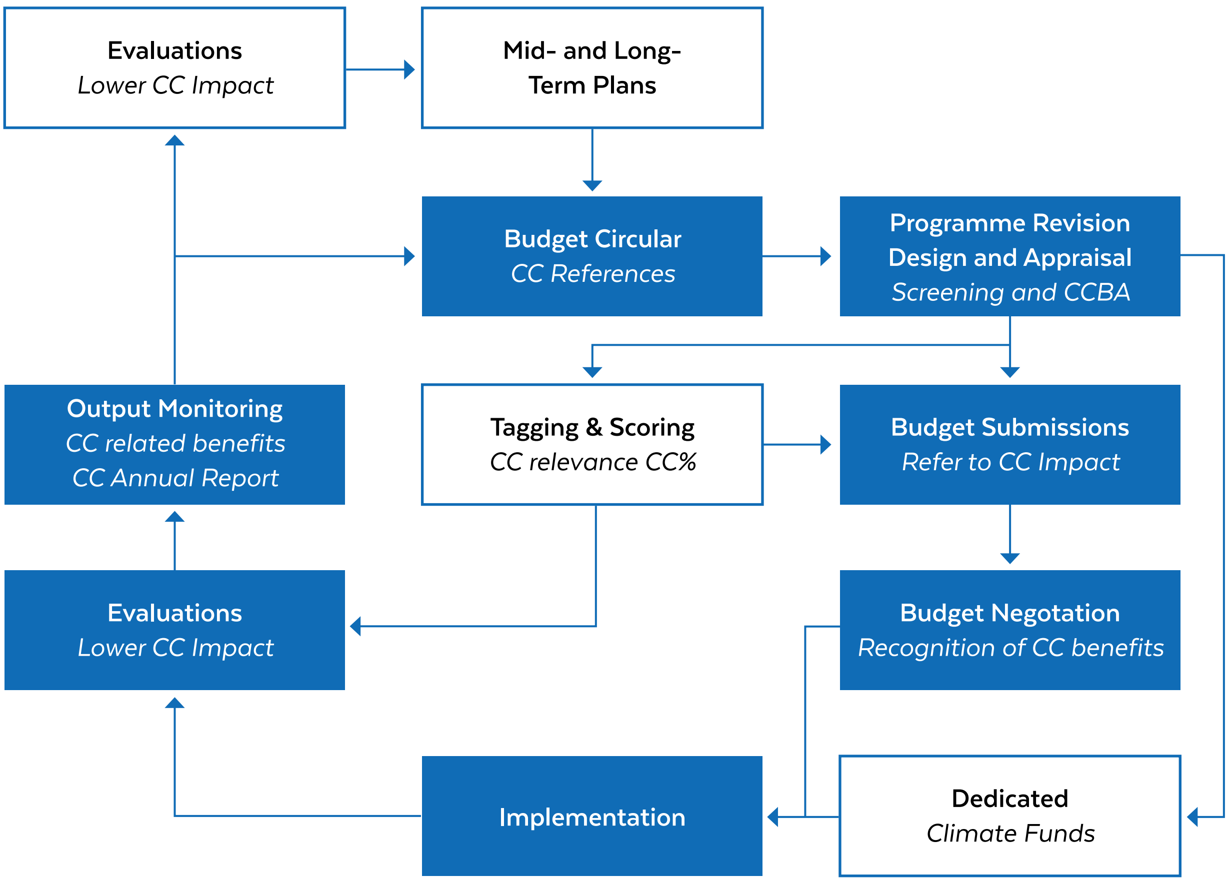
EXAMPLE OF A CLIMATE RELATED APPRAISAL USING EXPERT OPINION AND OBA

The Ministry of Agriculture has been pursuing a programme to promote climate change across all its activities and wishes to evaluate the results of this programme. Part of this programme has involved requesting all departments to comment on the relevance of climate change to their proposed projects, in their budget submission forms. For this reason, the forms include a box which asks whether climate change is a primary objective, a secondary objective, a minor consideration or irrelevant. The Ministry then has to covert the evidence in this box to estimated CC% that is roughly consistent with other more rigorous evidence on CC%, based on the benefits approach.

ANNEX 2 – THAILAND CASE STUDY ON CCBA APPROVALS

The UNDP and partner-led Climate Public Expenditure and Institutional Review (CPEIR)s worked on undertaking a review of Policies, Institutions, and Expenditures in over eight countries. Thailand developed detailed guidelines for budget submissions, and a detailed case of Thailand's experience is shared as an example for the purpose of understanding how the CCBA-related guidelines were developed and tested in-country, how they related to other guidelines, and the extent to which they were synergistic. The diagram below depicts the activity flow for Thailand's CCBA process within their budget and planning process.

FIGURE 18. ACTIVITY FLOW FOR THAILAND'S CCBA PROCESS WITHIN THEIR BUDGET AND PLANNING PROCESS



Note: Cli,ate change influence on activities in grey

INTERACTION OF CCBA WITH OTHER GUIDELINES – THE CASE OF THAILAND

CCBA supplements existing guidance on how to appraise public investments, as summarised in the *Thai BoB 'Practical Guide to the Budget'.* The Thai annual BoB budget guide requires budget submissions to describe, among others:

a. the links to national and ministerial strategies and targets;
b. the results of the expenditure and the impact on beneficiaries;
c. the readiness and efficiency of the agencies delivering the expenditure;
d. the challenges faced and conditions for addressing these challenges; and,
e. the resources required.

The NESDB Project Appraisal Guidelines 2012. These Guidelines set criteria for appraising an investment project, including:

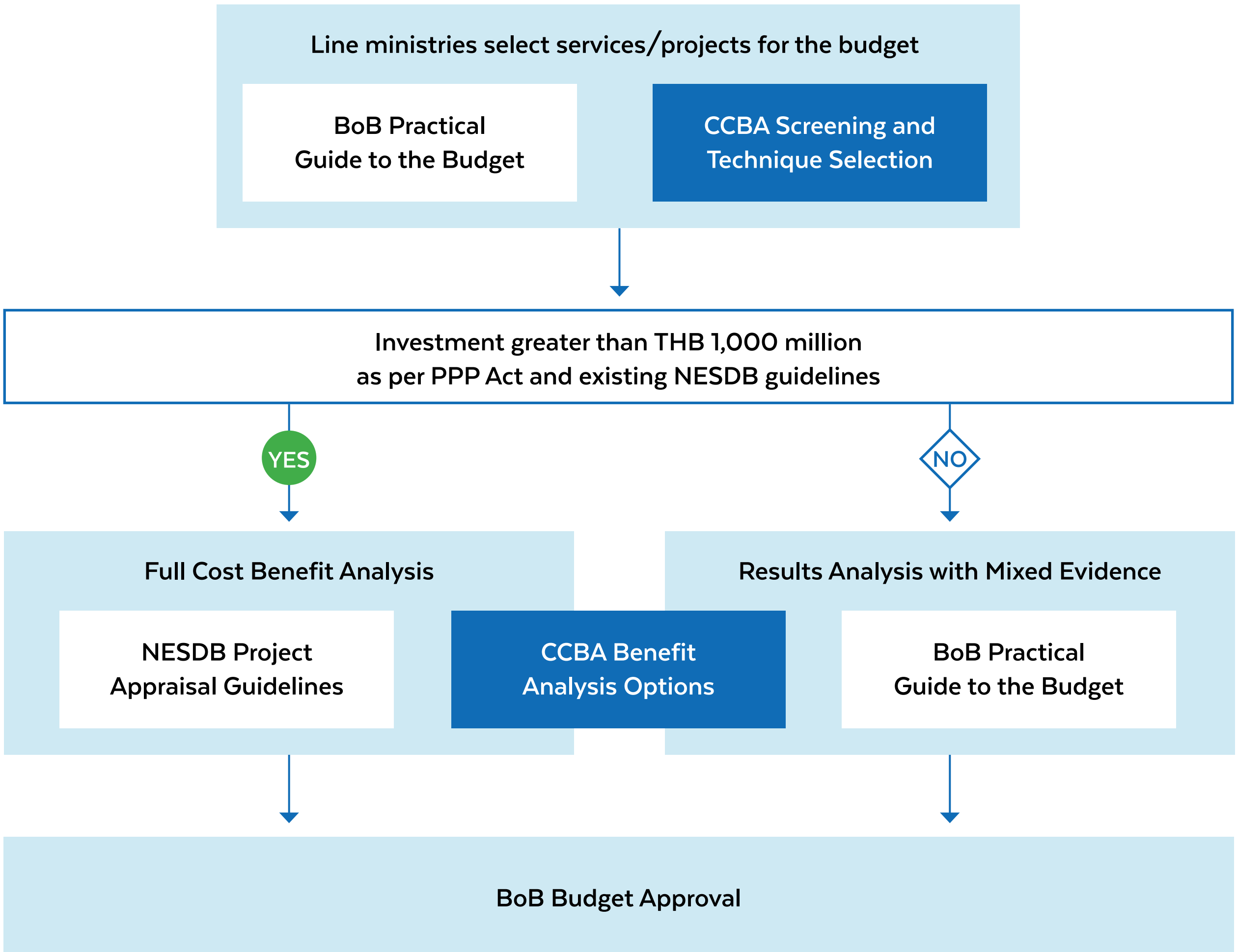
a. the project's consistency with the national development plan;
b. the needs for a project;
c. the project's appropriateness in terms of physical, financial, economic dimension;
d. the project's impacts to environment; and,
e. the appropriateness of project management and risk management.

TABLE 8. COMPLEMENTARITY OF CCBA GUIDELINES AND THAI BOB AND NESDB GUIDELINES

Thai BoB GUIDELINES	CCBA COMPLEMENTARITY
Links to national and ministerial strategies	Consistency with CC Master Plan and the contribution to protecting growth and equity in the NDP
Implementation	CCBA identifies possible risks to implementation
Strategic goal	CCBA requires clear definition of CC related benefits
Contribution to ministry targets	CCBA requires CC benefits to be estimated
Results and impact on beneficiaries	CC benefits relate to impact on beneficiaries
Readiness and efficiency of agencies	CCBA incorporates cost effectiveness, either on its own or as part of cost benefit analysis
Challenges and measures to respond	CCBA highlights challenges associated with CC
Resources required	CCBA requires specification of costs
NESDB GUIDELINES	**CCBA COMPLEMENTARITY**
Consistency with NDP	Consistency with CC Master Plan and the contribution to protecting growth and equity in the NDP
Needs of the project	CCBA requires estimates of any additional needs arising because of CC
Appropriateness (i.e., physical, financial, social and economic dimensions)	CCBA requires evidence-based assessment of the implications of CC for these dimensions, including on economic performance
Environmental impact	CCBA requires assessment of how CC alters the impact on environment
Appropriateness of project management and risk management	CCBA requires project management to take explicit measures to deal with CC risks

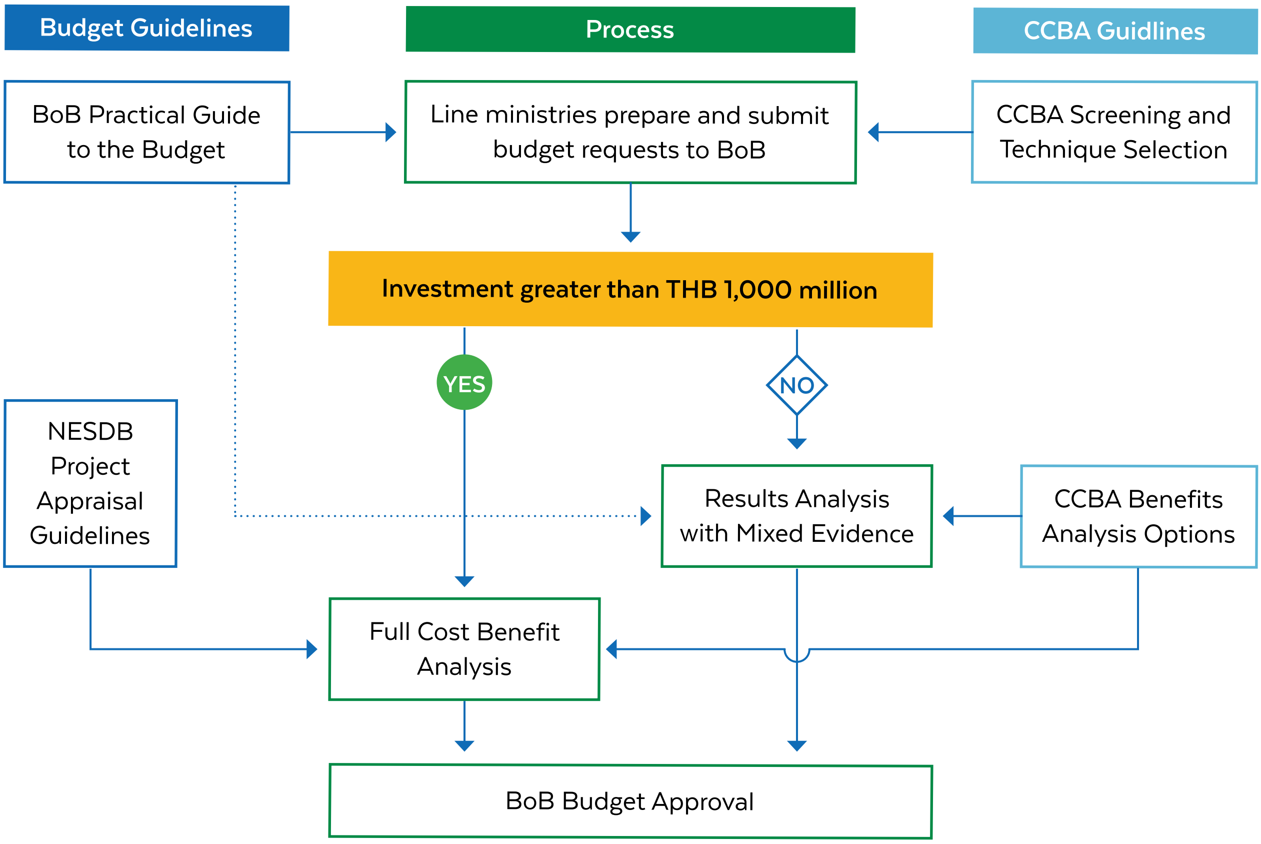
In the case of Thailand, the rules regarding the appraisal of large public-private-partnership (PPP) projects of more than THB 1,000 million are defined by the B.C.2556 PPP Act which specifies that, for public-private-partnership (PPP) projects, NESDB provides recommendations on appraisal, but project appraisal is done by the State Enterprise Policy Office, who is also responsible for submitting the project to Cabinet. For a project of more than THB 1,000 million that is not a PPP project, Cabinet approval is also required.

FIGURE 19. RULES REGARDING THE APPRAISAL OF PPP PROJECTS IN THAILAND



The Secretariat of the Cabinet decides whether the project should be sent to NESDB for full appraisal and recommendations or whether to submit directly to Cabinet. **Error! Reference source not found.** shows the budget submission and approval process and how the CCBA supplement other guidelines.

FIGURE 20. INTERACTION BETWEEN CCBA AND OTHER GUIDELINES



EXAMPLE USING CCBA FOR CALCULATING DISTRIBUTIONAL BENEFITS (GENDER): SEAWEED FARMING IN ZANZIBAR

This case study developed by the ECONADAPT[31] project evaluates different options for adapting seaweed farming, which is a main export product of the local economy in the Zanzibar islands, to the impact of a changing climate,.

The distribution of benefits across the population is a particular concern amongst officials in Zanzibar. Seaweed farming has been celebrated as an important industry for women in Zanzibar, as women in rural coastal villages have no other revenue-generating activity to rely upon for additional resources, while on the contrary, men have opportunities to find employment in construction, harvesting, and other labour-intensive sectors around the island.

The practice of floating line farms have the risk of reducing the benefits that women gain from the sector, as the seaweed is grown in deeper waters than are currently used. In the communities currently involved in seaweed farming, women are rarely taught how to swim, so such a practice as floating farms poses a threat to life.

Consequently, to preserve gender benefits when switching from off-bottom farming to floating line farming methods, precautions must be undertaken so that women are enabled to participate without needing to enter deep waters. As an example of this, the use of family-sized boats in floating-line seaweed farms can preserve female participation by allowing women to remain on boats to tie seedlings and assemble floating line frames while male farmers install anchors and carry out in-water maintenance.

With complete compliance, the family boat model would reduce female participation to a maximum of 50% of the farmer workforce.

31 Please refer to: https://econadapt.eu/sites/default/files/docs/Deliverable%209-3%20approved%20for%20publishing.pdf

Family-sized boats are included in the cost-benefit analyses carried out in this appraisal but must be implemented with proper education and awareness-raising measures if they are to preserve gender benefits from seaweed farming.

The case study investigated different ways in which seaweed farmers could respond to the threat of rising sea surface temperatures and assessed the costs and benefits of the different options. The investigated options included a variety of deep-water floating raft farm methods to replace the current off-bottom shallow water method. In this way, seaweed crops are moved to deeper waters where temperatures are lower and more stable, and sediment is less present at the level of the seaweed plants.

On top of this, a programme to gather information on temperature changes around the islands was investigated as an additional measure. The information from this programme would then be used to inform long-term strategic decisions. In appraising the floating raft farm options, 35-year cost benefit analyses were calculated under a number of discount rates, including official European and international rates, as well as higher commercial lending rates.

The study found positive returns, both in the form of financial returns and in terms of the social welfare generated from all adaptation options included in the analysis. Distributional effects of seaweed farming as well as discount rates applied in analysis both have important implications for interpreting the findings of this analysis.

Distributional impacts of any intervention are of high interest to policymakers as seaweed farming represents a unique source of income for women in coastal villages. With no alternative, adverse impacts on women farmers should be avoided wherever possible.

Though the share of female farmers drops in the adaptation options, non-market values of distribution-weighted income to females increases in all of the adaptation options over the baseline scenario, due to higher total incomes. Based on the above analysis, it was decided that over the long-term, the seaweed farming growth strategy could target equal growth across genders in order to preserve maximum distributional welfare benefits from the sector.

ANNEX 3 – GESI MAINSTREAMING CHECKLIST[32]

Checklist	Yes/ No	If No, what additional measures are required?	By Whom (Responsibility)	By When (Timeline)
PROJECT INCEPTION (CONCEPT NOTE)				
1. Did development of the concept note involve consultation with representatives of all stakeholder groups (i.e., women, men, youth, people with disabilities) and/or their organizations (i.e., women/youth groups, disability associations)?				
2. Does the project concept note include gender, equity and social inclusion issues and explain how the project will benefit marginalized or vulnerable groups?				
3. Does the concept note adhere to human rights and GESI principles?				
PROJECT DESIGN				
4. Does the design demonstrate real understanding of impacts of climate change and disasters on different vulnerable groups gained through participatory consultations with women, men, youth and people with disabilities in target areas?				
5. Does the design adequately consider the impacts of the project on people's current roles, responsibilities and workloads?				
6. Will the project contribute to empowering women and other vulnerable groups?				

32 Adapted from USAID (2021) "Gender Equity and Social Inclusion Mainstreaming Checklist for Screening Climate Finance Proposals" (Source: https://www.climatelinks.org/sites/default/files/asset/document/2021-06/2021_USAID-Climate-Ready_GESI-Mainstreaming-Checklist-for-CF-Proposals.pdf)

Checklist	Yes/ No	If No, what additional measures are required?	By Whom (Responsibility)	By When (Timeline)
7. Does the design identify strategies to promote and support women and other vulnerable groups in leadership and decision-making positions?				
8. Does the design identify gender targets and strategies to ensure equitable participation in project activities?				
9. Have potential negative consequences for disadvantaged groups been carefully assessed including damage to family, community or organizational relations?				
10. Does the design identify GESI-related risks and mitigation strategies?				
11. Will the project contribute to increasing the capacity of women, youth, and disability organizations to respond to the impacts of climate change and disasters?				
12. Does the design identify how the project will collaborate with organizations representing women, youth, people with disabilities, workers associations, etc.?				
13. Does the design include a GESI budget and sufficient financial resources to achieve GESI outcomes?				
14. Does the design include a strategy and resources to build GESI capacity among project staff and stakeholders?				
15. Does the design include GESI indicators and GESI sensitive data collection methods for all proposed activities?				
16. Does the design align with international & national GESI-related standards and targets (i.e., Sustainable Development Goals; Convention on the Elimination of All Forms of Discrimination Against Women; National climate change gender, youth and disability policies)?				

Checklist	Yes/ No	If No, what additional measures are required?	By Whom (Responsibility)	By When (Timeline)
PROJECT IMPLEMENTATION				
17. Are women, men, youth and people with disabilities actively and equitably engaged in project planning, implementation and review processes?				
18. Are project staff trained in GESI- sensitive analysis and approaches and do they have the necessary skills to be effective in this area?				
19. Is GESI technical assistance utilized and/or available to project staff and stakeholders as required?				
20. Does the project consistently produce documented evidence of free, prior and informed consent from stakeholders?				
21. Does the staff composition model gender balance at all levels?				
22. Does the project governance body model GESI principles through equitable representation of women and men and key beneficiary groups?				
PROJECT MONITORING AND EVALUATION (M&E)				
23. Does the project M&E Framework include specific GESI indicators and targets?				
24. Does the project consistently gather and analyze sex/age/disability disaggregated data and use this information to improve practice?				
25. Does the project provide regular reports on GESI achievements, constraints and lessons?				

UNDP