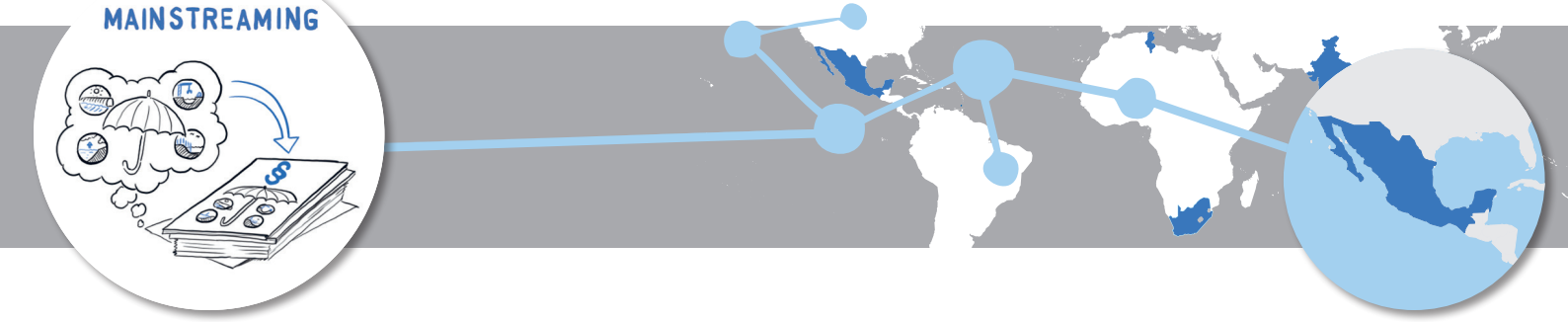

Method Brief

Cost-benefit analysis for prioritising climate change adaptation measures: an example for Mexico

Approach

Cost-benefit analysis (CBA) is a tool for comparing the costs and benefits of a project or measure in monetary terms and so help improve the allocation of public resources. This is relevant for decision-making, since budget constraints do not allow all institutions or individuals to implement all actions proposed. In the past few years CBA has been increasingly discussed as a tool for evaluating adaptation projects and measures.

Scope and entry points

In its recent climate change law as well as its National Climate Change Strategy, the Mexican Government expressed the need to mitigate and adapt to climate change. As adaptation is identified as a priority at the national and subnational levels, there is a need to develop tools to assist in decision-making processes. As the lead organisation in the sector, the Mexican Ministry of the Environment and Natural Resources (SEMARNAT) is working together with the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) in developing and piloting a methodology for prioritising climate change adaptation measures using multi-criteria analyses (MCAs) and CBAs within three pilot sectors: irrigated agriculture, water, and forests within natural protected areas. The MCA is used for a pre-selection of adaptation measures. Measures that are deemed suitable based on the MCA are scrutinised in more detail in the CBA (see this method brief on the MCA methodology used in Mexico).

How it works

CBA compares the costs and benefits of an adaptation measure or project expressed in monetary terms. This comparison can demonstrate the cost-effectiveness of an adaptation investment for decision-makers.

When conducting a CBA, one must first agree on the **adaptation objective** and establish whether it can be quantified in monetary terms (e. g. reduced rehabilitation costs in case of flooding). Defining an adaptation objective helps determine what exactly is being evaluated and the information needed to obtain the results. This adaptation objective cannot be determined decoupled from its context; it should be defined based on the relevant climate change impacts identified as well as the vulnerability in the region under study, which form the basis of the design of an adaptation measure.

Figure 1: Steps in assessing adaptation using a cost-benefit analysis (Adapted from the publication of the United Nations Framework Convention on Climate Change, Assessing the Costs and Benefits of Adaptation Options)

giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

On behalf of

Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

of the Federal Republic of Germany

TYPES OF COSTS AND BENEFITS

DIRECT: directly generated by project operation, for example:

- goods and services produced by the project,
- investment and operation costs.

INDIRECT: affect the project indirectly, for example:

- environmental costs of a factory discharging wastewater in a river,
- time saved by a given population through the project that can be used for other activities.

INTANGIBLES: are very hard or costly to measure, value or quantify, for example:

- a project that affects the cultural values of the population.

After defining the objective, it is essential to **define the baseline** scenario that will help to evaluate the costs and benefits of adaptation without taking action compared to the costs and benefits of implementing an adaptation project or action. Both costs and benefits should be assessed as being either **direct** or **indirect**. Benefits should also include avoided damages and co-benefits of the actions to be evaluated. One of the most important challenges of CBAs is obtaining a quantifiable measure of **intangible** costs and benefits. These can be evaluated and quantified through non-market-based approaches (e. g. contingent valuation, etc.).

Aggregating costs and benefits allows computing the net present value (NPV), which is the difference between costs and benefits considering the present value of money, to be determined. The final NPV gives decision-makers an indicator as to which project(s) can be more effective for each dollar invested. The higher the NPV is, the more effective the project is, while a negative NPV represents an ineffective project, and, based on this economic valuation, one which should not be implemented. For more details on the CBA methodology see also Economic approaches for assessing climate change adaptation options under uncertainty.

In the described application of the CBA in Mexico, the benefits and costs were listed and systematised while simultaneously selecting a baseline scenario (i. e. the costs and benefits of not adapting to climate change). The data was validated with the experts at the respective ministries. All of the assumptions on e. g. discount rate, time horizon, investments, taxes, etc. are also stated in a final document so as to make the analysis clear and transparent.

All data was collected in an Excel-tool showing the NPV and other results clearly arranged for the decision makers. The tool allows carrying out a sensitivity analysis by changing the parameters (interest rate, estimated costs, estimated benefits, etc.). Finally, the final worksheet will contain an application to perform a Monte Carlo analysis to assess risk and estimate intervals for different scenarios.

Stakeholders and institutional set-up

For Mexico, the adaptation objectives and measures to be analysed were selected together with the respective governmental counterparts (e. g. SEMARNAT and its independent bodies, the National Forestry Commission (CONAFOR) and the National Commission for Natural Protected Areas (CONANP), as well as the Secretariat of Agriculture, Livestock, Rural Development, Fisheries and Food (SAGARPA)) for each sector under study. These institutions also validated the data underlying the CBA.

Input

Conducting a CBA is a complex process and requires several types of resources. First of all, considerable time is needed to gather the data for analysing the costs and benefits. In the case of unreliable data on the costs or benefits of an adaptation measure, extra time is spent on analysing additional sources or even computing the missing values.

If an institution is not familiar with using CBA, it might be necessary to hire an external expert to do the initial analysis. The budget for conducting a CBA will vary according to the number of measures for which the CBA has been developed.

In addition, several workshops have to be held. For instance to agree on the assumptions and the choice of adaptation measures to be analysed, among other things. Methodology trainings need to be developed and conducted together with the relevant institutions in order to institutionalise the CBA. Such a process can take several months. In the case of Mexico, it took four months to complete the methodology and apply it on the three pilot sectors.

Output

The final product is an Excel sheet, which serves as the main tool in carrying out the CBA for the selected measures in the three pilot sectors. It can be adapted for additional measures in the future and in other sectors. The tool is accompanied by a how-to manual, including tips for interpreting the results.

Capacity required and ease of use

In general, those conducting a CBA need to have knowledge or training in economics or finance since they need to understand the logic behind the analysis and the data and information requested. They also need to be capable of interpreting the following components of the results: NPV, internal rate of return (IRR), cost-benefit index and cost-effectiveness index. Some familiarity with Monte Carlo analysis is needed to interpret the results of that analysis, which is also included in the Excel tool used for the CBA. Even though the Excel tool looks simple and a manual was developed on how to use it, the person conducting the analysis needs to have intermediate knowledge of Excel.

Conclusions for future application

Outcome, added value and cost-benefit ratio are to be assessed at a later stage.

Potential for replication

The challenges identified in performing a CBA for climate change adaptation are:

- **Uncertainty of future impacts:** the potential impacts of climate hazards are uncertain, and the benefits of adaptation actions are therefore also uncertain. Additionally, the limited information that exists on climate change and appropriate adaptation actions hinders the ability to correctly account for the costs and benefits.
- **Taking account of benefits:** Although it can be assumed that the benefits of climate change adaptation actions are tangible and measurable, not all of them are obvious and their true benefits might be difficult to quantify in monetary terms.
- **Temporal effects:** While a project has a specific time frame for its implementation, the effects (which can be measured in costs and benefits in the future) are not always evident and easy to assess, especially at the beginning of a project that is yet to be implemented.
- **Expert knowledge and/or support:** Although the Excel tool that was developed for this CBA is straightforward and accessible, it is recommended that those who apply the analysis are familiar with CBA.

References

GIZ (2007). Economic Approaches to Climate Change Adaptation and their Role in Project Prioritisation and Appraisal. Eschborn, GIZ.

Contact for further information

Camilo de la Garza, Advisor, Mexican-German Climate Change Alliance, camilo.dlgarza@giz.de

Gloria Cuevas, Ministry of the Environment and Natural Resources (SEMARNAT), gloria.cuevas@semarnat.gob.mx

José Alberto Lara, consultant in developing the methodology, jose.lara@uia.mx

Edited by:
Deutsche Gesellschaft für
Internationale Zusammenarbeit (GIZ) GmbH

Registered offices
Bonn and Eschborn, Germany

Inventory of Methods for Adaptation
to Climate Change – IMACC
Dag-Hammarskjöld-Weg 1–5
65760 Eschborn, Germany
T +49 6196 79 - 0
F +49 6196 79 - 1115
E info@giz.de
I www.giz.de

Contact
Michael Hoppe
T +49 6196 79 - 2597
E michael.hoppe@giz.de
I www.giz.de/climate
www.adaptationcommunity.net

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