

The Use of Non-Monetary Metrics to Assess Adaptation Actions: Cost-Effectiveness Analysis (CEA)

Key Messages

- The use of non-monetary metrics helps avoid the challenge of monetization of controversial values. In addition, indicators are simple and transparent and easy to communicate to a broader group of users or stakeholders.
- Cost-effectiveness criteria and metrics for adaptation are more likely to be useful where standards of acceptable risks or clearly defined targets exist, e.g. a certain flood protection level or the target of reducing heat-related deaths.
- Non-monetary metrics are especially used in health (e.g. number of prevented deaths through heat waves), water management (e.g. area of floodplain restored), extreme weather (e.g. number of people at risk by floods) and biodiversity (e.g. number of species conserved) policy areas.
- The analysis based on a single performance metric, thus omitting a full analysis of any wider economic costs and benefits and is limited suitable for cross-sectoral analyses.

Context

The use of standardized or common metrics in economic assessments can contribute to prioritization of adaptation activities, supporting an effective way of policy and decision making. There are several benefits in using such metrics. They can help evaluate, quantify and communicate the benefits of adaptation or climate-proofed policies and projects in economic terms which is particularly useful when trying to translate the importance of certain activities to actors coming from diverse sectors other than the environment. In this way, CEA can help the prioritisation and allocation of resources across a large range of options and activities.

Cost-effectiveness analysis compares the financial costs of alternative options for achieving similar objectives in order to identify options that deliver a predefined target for a lowest cost. It quantifies benefits in physical terms rather than in monetary terms. CEA is widely applied in decision-making in different sectors, e.g. climate mitigation, water management, but its use has yet to be mainstreamed in the economic analysis of adaptation options. In this factsheet we provide information on non-monetary metrics that can be used for adaptation policy and decision-making.

Methodological developments

Cost-effectiveness criteria and metrics are particularly useful when applied to health, water management, extreme weather and biodiversity policy areas. These areas have clearly defined targets and standards of risks, e.g. a certain protection level for river flooding or the reduction of heat-related deaths. CEA helps avoid the challenge of estimating controversial values such as the monetary value of reduced health and morbidity. In addition, indicators are simple and transparent and outcomes are easier to communicate than e.g. cost-benefit analysis results.

The “effectiveness” component of a CEA can be measured in different ways (see Table 1 for examples in different policy areas). It can refer to the effectiveness of measures in directly mitigating targeted pressures, or it can refer to the effectiveness in implementing measures. It can alternatively be assessed against the reduction of impacts resulting from improvement in status. It should be noted that one measure may not be sufficient to reach a particular target.

Non-monetary metrics used in conventional decision-making can broadly be used in adaptation decision-making. However, care is needed. The nature of climate change is that of change, and thus climate change can modify the type of pressures affecting targets, objectives, and scale which in

turn influences whether the effectiveness of adaptation activities. The impact of extreme events may also change the effectiveness of a particular measure or its costs, just as future socio-economic changes can also modify the costs of measures.

Non-monetary metrics are reported against estimated costs causing their use in cost-effectiveness analysis to ultimately suffer from limitations such as monetary-based methodologies (ex. cost-benefit analysis). For example, the cost component usually only takes into account the financial costs of abatement incurred by the investor (e.g. capital and maintenance costs) or the regulating authorities (e.g. cost of enforcement and monitoring), thereby ignoring wider economic costs incurred by society and targeted population (e.g. further cost of compliance, social and environmental costs). These issues were overcome with the using of social cost-benefit-analysis.

Limitations associated with the use of non-monetary metrics

More generally, other limitations are associated with the use of non-monetary metrics in cost-effectiveness analysis:

- CEA leads to a single non-monetary metric of effectiveness in relation to one and only one target which omits important risks and does not capture all costs and benefits (attributes) necessary for an option appraisal.
- Especially for regional and national adaptation strategies and action plans, the prioritization of adaptation measures is very often cross-sectoral due to the variety of climate impacts and interlinked challenges. Due to the focus of CEA on one non-monetary metric as effectiveness component, cross-sectoral analyses become more difficult.
- The criteria for measuring effectiveness must be easily monitored and quantified. Thus, metrics used may fall on more commonly monitored parameters. This may also lead to omitting important risks and dimensions for decision-making.
- The effectiveness of measures may only be visible after medium to long time periods whereas the costs occurred directly at the phase of implementation. In addition, costs and effectiveness may evolve as boundary conditions (e.g. due to climate change). The metric does not reflect this time-dependency.
- Similarly, non-monetary metrics in CEA do not easily reflect uncertainties in estimates. A range of methods can be used to cope with uncertainty in the calculation of cost-effectiveness ratios: use of intervals of costs and effectiveness estimates (instead of point estimates), sensitivity and scenario analysis, and more complex ones such as stochastic programming and Bayesian belief networks

Examples of non-monetary metrics used for CEA in adaptation projects and policies

The following table shows the results of a literature review on non-monetary metrics used for CEA in different adaptation projects and policies.

Table 1: Non-monetary metrics used for CEA in adaptation projects and policies

Policy area	Metrics used in CEA
Flooding (including inland and coastal from sea-level rise)	Level of reduction of flood risk or damages [%] Number of people living in the risk zone, multiplied by the probability of flooding per year [] Number of people at risk or affected by floods [] Reduction of maximum flood depth [cm] Extension of warning period [% or hours] Increase people's awareness [] Land loss [km ²]

Health	Disability Adjusted Life Years averted [DALY] Morbidity reduction range [%] Frequency of home visits by NGO outreach staff [%] Number of prevented deaths through heat waves [] Reduction in diarrheal disease incidence [total numbers (cases averted)/year] Loss of life per decade [total numbers (cases averted)/year]
Agriculture	Percentage change in storage additions and withdrawals [%] Nutrient and water efficiency [g/ha and m ³ /ha] Change of decreased soil erosion [t] Labour hours and working hours of machines [h/year] Carbon sequestration in soil [t humus/ha/yr] Livestock Adaptation (e.g. relevant for following options: Extension Services, Destocking, Choice of Breed, Game Switching, De-bushing) [t meat production/year] Crop Adaptation (e.g. relevant for following options: training for irrigation farmers, increase of land under irrigation and mechanisation of rainfed subsistence land) [t crop/year]
Water management	Area of floodplain restored [ha] Level of reduction of flood risk or damages [%] Assets exposed [%] Load reduction BOD, COD, N, P [kg load/ year]
Buildings and infrastructure	Effect on house price and the total value of property transactions [%] Green roof area [m ³] Green roof area per total roof area [%] Assets exposed [%] Subsidence damage to buildings [%, number of houses]
Biodiversity	Area of floodplain restored [ha] Area of habitat created/ maintained/ restored [ha] Area of urban green space provided/ maintained [ha] Area sustainably managed [ha] Ecosystems safeguarded [ha] Increase in protected areas [%] Number of species conserved [%] Effect on species population [%]
Energy	Change in energy demand and associated CO ₂ emissions [%] Energy output through hydropower: No and 50% reduction in effective glacier runoff [GWh] Change in energy demand [GWh] Energy demand for cooling [GWh] Effect on energy saving [GWh/year]

Main implications and recommendations

In adaptation, CEA is usually recommended over a CBA when economic benefits are difficult to estimate or difficult to compare across scales and sites. CEA is also useful when targets are set (e.g. regulatory standards) and authorities are interested to identify the least costly path to achieve that single target. Cost-effectiveness criteria and metrics are more likely to be useful in health, water management, extreme weather and biodiversity policy areas, based on standards of acceptable risks or clearly defined targets. As such, the use of non-monetary metrics helps avoid the challenge of estimating controversial values such as the monetary value of reduced health and morbidity. In addition, indicators are simple and transparent. Outcomes are thus easier to communicate than for example, CBA results.

Further Information

[Distributional objectives and non-monetary metrics: Use of non-monetary metrics in adaptation assessments \[pdf\]](#)

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