

Annex I: Cost-benefit analysis versus cost-effectiveness analysis

Cost-benefit analysis

Cost-benefit analysis involves translating all benefits and costs into monetary terms, including non-marketed environmental, social and other impacts.¹ The benefits from an action are compared with the costs (including the opportunity costs) within a common analytical framework. The direct benefits are usually measured physically in widely differing units—for instance, quantities of water generated by desalination plants. Other benefits are intangible and difficult to estimate in physical or monetary terms—for example, reduction in mortality rates due to improved water provision. The same concepts apply to the cost of water options (direct costs, indirect costs, or both). Comparison is enabled through the use of a common monetary term. Benefits and costs of each option should thus be converted into monetary values in a given time period and compared with the common scenario that would prevail if no action was taken. The net benefit of each alternative option is given by the difference between the costs and benefits. The most economically efficient option is that with the highest present value of net benefits (net present value). Economic efficiency requires selecting the option with maximum net present value, assuming that various options involve equal investments. Options are economically viable only where the net present value that they generate is positive or the present value of total benefits equals or exceeds the present values of total cost. ($B/C \geq 1$)

The key elements for cost-benefit analysis in the water sector include:

- Identifying possible alternatives for intervention, including maintaining the status quo (business-as-usual or no action).
- Determining the scope of the analysis, which involves identifying key stakeholders and the costs and benefits associated with each identified individual and group, compared with the status quo.²
- Systematically assessing the benefits and costs of various alternatives, based on a common unit of measurement (money).
- Identifying all benefits and costs associated with each alternative, including societal benefits and costs. This means incorporating both private and external costs and benefits, such as treatment costs borne by members of the community in case of sickness caused by drinking contaminated water.
- Measuring external benefits and costs, including environmental benefits and costs, using methods appropriate for them and the degree of uncertainty in available data. In this context, many methods are available to measure or estimate the monetary values of benefits and costs, but not all of them will lead to meaningful results.³
- Dealing with the benefits and costs associated with the activity over its life span, meaning future values of benefits and costs are included in present values.
- Applying fixed criteria or objectives to reach a decision and the most common standard criteria used in the cost-benefit analysis are the net present value and benefit-cost ratio.

Cost-effectiveness analysis

Cost-effectiveness analysis (also known as least-cost analysis) is used to identify the most cost-effective option for achieving a set of predefined objectives. The most cost-effective option is identified as that with the lowest present value to meet the same level of objective. “Cost-effectiveness analysis is a tool that can help to ensure efficient use of investment resources in sectors where benefits are difficult to value, or when the information required is difficult to determine or, in any other cases, when any attempt to make a precise monetary measurement of benefits that would be tricky or open to considerable dispute. It is a tool for the selection of alternative projects with the same objectives quantified in physical terms. It can identify the alternative that, for a given output level, minimizes the actual value of costs, or, alternatively, for a given cost, it maximizes the output level.”⁴

Applying cost-effectiveness analysis involves the following steps:⁵

- Drafting alternatives that can achieve a set of objectives and determine the degree of compatibility between the alternatives, including the option of maintaining the status quo (business-as-usual or no action).
- Determining the scope of the analysis, which involves identifying key stakeholders and their associated costs.
- Estimating the costs of each alternative, not only in financial costs (capital, operation or maintenance costs) but also in economic costs from a social perspective, regardless of whether they are incurred by the government, donors or beneficiaries.
- Excluding alternatives that can neither meet the intended objectives nor attain them at a higher cost than other alternatives.
- Integrating the assessment of successive alternatives and incremental costs, if any, to determine the overall cost of the alternatives that can achieve the ultimate goal in phases.

The disadvantage of cost-effectiveness analysis is that it does not identify the benefits of actions or society’s willingness to pay for improving the environment by implementing water and sanitation projects, which are important considerations in many decisions.⁶

The following underlines some of the limitations and drawbacks of cost-effectiveness analysis:

- Cost-effectiveness analysis points to the least-cost combination of measures to achieve an objective. Regarding water deficits, for example, uncertainties on costs and water yields are serious limits to the relevance of the results. These uncertainties can significantly bias the ranking of the measures.
- Cost-effectiveness analysis can be applied easily to quantitative and qualitative water issues, but applying it to ecological issues is more challenging. The effectiveness of actions is more difficult to assess when habitats and biodiversity are considered.
- Many options and measures are hard to quantify physically. Either they have to be omitted from the analysis or their effects have to be estimated very roughly. This will lead to bias in the result.
- Other biases in the formulation of actions or measures can result from the omission of time lags, synergy effects and transport coefficients from the calculations. Although these aspects can be taken into account in quantitative cost-effective analyses, they are often omitted for a practical convenience.
- Ranking biases can occur if the multiple effects of measures are neglected and a selection is made accounting for only a series of multiple objectives for a body of water.
- It is used to make comparisons between alternatives that have the same scope. It cannot be used for projects with different objectives or for a project with multiple objectives.⁷

Endnotes

¹ Turner and others 2004.

² Mitchell and others 2007.

³ Chong, Kazaglis, and Giurco 2008.

⁴ EC 2009.

⁵ Gerasidi and others 2003.

⁶ Turner and others 2004.

⁷ Aulong and others 2008.