

# ***Methodology and experience with cost-benefit analysis for environmental policy***

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*Balancing the pro's and cons of a proposed action seems like a commonsense approach to decision making. A benefit cost analysis is a useful way of organizing this comparison of the favorable and unfavorable effects of proposed policies. The experience in other countries suggests that cost-benefit analysis and related regulatory impact analysis can improve the decision making process and generate better policy results. Experience however also indicates that careful program and institutional design are very important. Success seems to be supported by conditions such as political support at ministerial and parliamentary level, integration of economic analysis into the administrative and political decision processes, development of an adequate institutional structure, public participation and consultation, and adequate planning and careful program design.*

## **Cost-benefit analysis and decision-making**

The decision methods that can be used by regulators in to reach regulatory decisions can be simplified into five categories<sup>1</sup>:

- **Expert.** The decision is reached by a trusted expert, either a regulator or an outside expert, who uses professional judgment to decide what should be done.
- **Consensus.** The decision is reached by a group of stakeholders who reach a common position that balances their interests.
- **Political.** The decision is reached by political representatives based on partisan issues of importance to the political process.
- **Benchmarking.** The decision is based on reliance on an outside model, such as international regulation.
- **Empirical.** The decision is based on fact-finding and analysis that defines the parameters of action according to established criteria.

Every regulatory decision stems from a mix of these decision methods. The mix differs according to national culture, political traditions, administrative style, and issue at hand: small countries use bench-marking more than do large countries; crises in newspaper headlines tend to move decisions toward political methods and away from empirical methods, etc. In recent years however empirical information gains more importance. This trend can be observed in virtually all OECD member countries and is (among others) due to

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<sup>1</sup> OECD (1996). *Control and Management of Government Regulation*. Paris, OECD.

a growing concern for efficient policies as a result of political and cultural factors such as tightening government budgets, the social and economic climate, the emphasis on market forces and deregulation, the globalization of the economy etc<sup>2</sup>. Several countries have therefore taken steps to strengthen the role of empirical information in the decision making process. *Cost-benefit analysis* (CBA) is one technique that is being used frequently for this purpose.

### **Methodology of a cost-benefit analysis**

In any CBA, several stages must be conducted<sup>3</sup>. In this paragraph we describe chronologically the *essential steps* of a CBA. The stages must not be interpreted too strictly. It is common that whilst performing a CBA one discovers new information and alternatives and corrects previous errors. The steps are furthermore explained with traditional projects and policy measures in mind. The CBA methodology can however be applied to a range of policy questions, so the approach can differ. The steps also reflect the *content* of a written CBA, but should not be interpreted too strictly on this point either. Depending on the circumstances some other presentation can be useful.

#### *Step 1: definition of the problem*

The first step of an CBA deals with the precise formulation of the problem at hand: which measure/action must be evaluated? What is the objective of the analysis? What are the boundaries of the analysis (geographical, time horizon, treatment of indirect and secondary effects, ...)? Which alternatives exist and must be examined? One of the most important failures of a CBA is overlooking interesting alternatives. It can nevertheless be necessary to balance between a CBA including several alternatives on the one hand and a more thorough examination of the costs and benefits of a limited set of alternatives on the other hand. Already at this stage it is important to discuss the policy problem with affected parties. They are likely to be an important source for the identification of policy alternatives. The consultation must also help in building a consensus on the design of the CBA.

#### *Step 2: identification of the effects*

The next step after the definition of the action/measure is the identification of all impacts resulting from its implementation. For this purpose, a list of all effects and affected parties is drawn up. At this stage no quantification takes place yet. Important concepts here are additionality and avoiding double counting. Additionality refers to the net impacts of an action/measure. Only extra costs and benefits resulting from the implementation of the

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<sup>2</sup> OECD (1997a). *The OECD Report on Regulatory Reform*. Synthesis Report. Paris, OECD.

<sup>3</sup> For more information on CBA in general see e.g. GRAMLICH, E.M. (1990) *A guide to Benefit-Cost Analysis*. 2<sup>nd</sup> ed. Prentice Hall, Englewood Cliffs, New Jersey, and LAYARD, R. and S. GLAISTER (ed.) (1994). *Cost-Benefit Analysis*. Cambridge, Cambridge University Press, 2<sup>nd</sup> Ed. On CBA for environmental policy see e.g. HANLEY, N. and C. SPASH (1993). *Cost-Benefit Analysis and the Environment*. London, Edward Elgar, and KOPP, R.J., A.J. KRUPNICK, M. TOMAN. (1997). *Cost-Benefit Analysis and Regulatory Reform: An Assessment of the Science and the Art*. Washington D.C., Resources for the Future.

action/measure should be assessed. Double counting can occur i.a. as a consequence of transfer payments between parties concerned (e.g. taxes and subsidies).

*Step 3: selection of analytical method*

A "full" CBA shall in principle be preferred. In many cases it will however be hard to quantify benefits and to express them in monetary values. In some other cases a certain target that must be achieved is predetermined. In these circumstances a cost-effectiveness analysis (CEA) can be a useful way to find and design regulatory strategies that achieve a desired goal at the lowest possible cost. Another possibility to circumvent difficulties in monetary valuation is translating benefits into some measure of risk reduction (risk-benefit analysis or RBA). In any case it will be necessary to determine how non-quantitative factors are included in the analysis and how distributional consequences will be assessed<sup>4</sup>.

Another issue that has to be dealt with beside the selection of the assessment technique is the selection of the valuation method. For goods traded in markets a partial equilibrium model can be employed, starting from market prices. For non-marketed goods or not internalized external effects of market goods other valuation methods have to be applied (see infra).

*Step 4: assessment of costs*

The relevant cost concept in the context of CBA is total social costs. First, this implies that a CBA estimates the costs for society as a whole, and not just for one particular firm, sector or group of society. Second, a CBA employs *opportunity costs*. They reflect the value of goods and services that are no longer available for satisfying other needs. It implies that market prices have to be adapted to reflect true resource scarcity in the case of market distortions and imperfections (shadow prices). In the context of actions/measures in environmental policy four different cost categories can be distinguished<sup>5</sup>: the direct compliance costs of the polluters, the regulatory costs for government, the dead-weight welfare loss and adjustment costs for displaced resources. For most regulations requiring the use of pollution control technology, private real-resource costs will account for nearly all of the total cost to society, and little further effort to estimate costs is necessary. In some cases, however, other costs to society may be significant.

*Step 5: assessment of benefits*

The relevant starting point at the benefit side is also society as a whole. In the context of environmental policy the environmental benefits relate to the effects of an increase in environmental quality due to the policy actions and measures. These can be impacts on health, ecosystems, materials (e.g. buildings), economic activities (e.g. agriculture,

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<sup>4</sup> ARROW, K. e.a. (1996). *Benefit-Cost Analysis in Environmental, Health and Safety Regulations. A Statement of Principles*. Washington D.C., American Enterprise Institute/The Annapolis Center and Resources for the Future.

<sup>5</sup> EPA. (1991) US Environmental Protection Agency. *Guidelines for performing Regulatory Impact Analysis*. Washington DC, US EPA.

recreation, water supply, etc.) and aesthetic effects<sup>6</sup>. In some cases the assessment of benefits will be limited to a qualitative or quantitative enumeration of the different effects. In other cases one can decide to conduct a monetary valuation of the relevant effects, either directly, when market prices are available (e.g. the benefits of an improvement in environmental quality for commercial fishery), or, since the monetary value of environmental benefits is usually not reflected accurately in market prices, by techniques such as 'contingent valuation', 'hedonic pricing', 'travel cost', 'value of life' en 'wage risk' methods<sup>7</sup>. Monetary valuation is merely a device to facilitate comparisons between costs and benefits, but is not necessarily an indispensable part of a CBA. There are other techniques to group environmental benefits into one metric standard (e.g. risk reduction, function approach,...).

#### *Step 6: comparison of costs and benefits*

The main purpose of a CBA is to help compare the costs and benefits of actions/measures and its alternatives and to help select policies which are efficient. A CBA therefore should ideally assess all relevant costs and benefits, convert them through discounting into present value terms and present the net benefits (net present value) of each regulatory alternative. Care should be taken to assure that quantitative factors do not dominate important qualitative factors<sup>8</sup>. Calculated net benefits should therefore always be presented along with a description of the non-quantified and non-monetized effects. The results of a CEA are often part of a CBA. In addition to these basic outcomes of a CBA, one often integrates other information into the analysis. An example are the distributional consequences, either between population groups at a particular point in time or between different generations. These effects can be examined in a sensitivity analysis that assigns different weights to population groups or applies different discount rates (see infra). Other specific policy relevant points of interest can be assessed as well (e.g. impacts on small and medium sized enterprises).

#### *Step 7: sensitivity analysis*

A sensitivity analysis explores how sensitive the outcomes of the CBA are with respect to changes in the values of certain key parameters (assumptions and data). The main reason for performing a sensitivity analysis concerns uncertainty and unavoidable subjective elements in CBA. A sensitivity analysis is the basis for presenting upper and lower bound estimates in a CBA along with the expected value of costs and benefits (which are usually based on a probability calculation as well).

#### *Step 8: evaluation of the draft CBA*

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<sup>6</sup> EPA. (1991).

<sup>7</sup> On the valuation of environmental benefits, see e.g. OECD (1995). *The Economic Appraisal of Environmental Project and Policies: a Practical Guide*. Paris, OECD; FREEMAN, A.M (1993). *The measurement of environmental and resource values: theory and methods*. Washington DC, Resources for the Future; and SMITH, V.K. (1996). *Estimating Economic Values for Nature. Methods for Non-Market Valuation*. London, Edward Elgar.

<sup>8</sup> ARROW, K. e.a. (1996), o.c.

The next stage is the external evaluation of the CBA that has been conducted. This can be organized by discussions with the parties concerned and independent peer-reviews. A draft CBA should be made public and allow for comments. In order to guarantee transparency and accessibility of the CBA, it is recommended that each draft CBA includes a non-technical summary. This summary should not only discuss net cost or benefits of the alternatives examined (expected values along with upper and lower bound estimates and monetary information along with important non-quantified or monetized elements), but should also mention limitations, data gaps and uncertainties that have occurred during the analysis.

*Step 9: revision of the draft CBA*

At this stage the draft CBA is modified and complemented with the remarks that were made during the evaluation of the draft CBA. The revision can go from commenting on these remarks to reworking entire parts of the CBA.

*Step 10: final CBA*

The result from the preceding stages is a final CBA that can be entered into the normal democratic decision making process.

***Experience with CBA in environmental policy***

The experience with CBA in environmental policy can be summarized as follows<sup>9</sup>:

1. Economic analysis and CBA in particular is not an easy task, due to a lack of information, knowledge and skills in addition to limited time and resources available. A CBA will therefore hardly ever admit unambiguously clear conclusions on the net social cost or benefit of a policy measure. A more narrow methodology is therefore often used (e.g. CEA) or more pragmatic analytical approaches aimed at systematically assessing the negative and positive impacts of proposed and existing regulations are applied (Regulatory Impact Analysis or RIA)<sup>10</sup>. In other words, countries try to find a balance between the theoretical requirements of CBA on the one hand and practical judgements about feasibility and cost on the other.
2. Overall, experience with CBA in environmental policy can be qualified as positive. The best proof is perhaps the fact that every country that has begun a program of regulatory

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<sup>9</sup> This section is largely based on GAO (1984). US General Accounting Office. *Cost-Benefit Analysis can be useful in assessing environmental regulations, despite limitations*. Report to the Congress of the United States. Washington DC; EPA (1987). US Environmental Protection Agency. *EPA's use of benefit-cost analysis 1981-1986*. Washington DC, US EPA; OECD (1996); MORGENSTERN, R. (ed.) (1997) *Economic Analysis at EPA: Assessing Regulatory Impact*. Washington DC, Resources for the Future; KOPP, R.J., A.J. KRUPNICK, M. TOMAN. (1997); and OECD (1997b). *Environmental Regulatory Reform in OECD Countries*. Paris, OECD.

<sup>10</sup> See e.g. HOPKINS, T.D. (1997b). *Alternative Approaches to Regulatory Analysis: Description and Assessment*, In OECD (1997c). *Regulatory Impact Analysis. Best practices in OECD Countries*. Paris, OECD and VISCUSI, K.W. (1997). *Improving the Analytical Basis for Regulatory Decision Making*. In OECD (1997c).

impact analysis has expanded and deepened it<sup>11</sup>. Despite its limitations, CBA improves the decision making process. This is mainly due to the fact that policy makers obtain a better understanding of the costs of various alternatives to attain a certain environmental target.

3. Benefit-cost analysis will not automatically lead to less strict environmental regulations. Sometimes the opposite is the case. Many CBA have revealed regulatory alternatives that achieved the desired degree of environmental benefits at a lower cost compared to the initially proposed regulation, by selecting a different policy instrument or a different allocation of the pollution control efforts. Another striking point is that policy makers often seem to underestimate the social benefits of an environmental improvement. Several CBA have e.g. concluded that the positive health and welfare effects of a proposed environmental regulation were much higher than anticipated, thereby providing the basis for stricter environmental regulations.
4. In a way, the process of conducting a CBA is more important than the outcome of the analysis. Many failures stem directly from the mistaken view that CBA is a way of producing the right numbers. Experience makes clear that the most important contributor to the quality of decisions is not the precision of calculations, but the action of analyzing questioning, understanding real world impacts, exploring assumptions, and more general a better understanding of the policy problem and context. In essence, CBA attempts to widen and clarify the relevant factors for decision making. In the longer term, CBA contributes to a "cultural shift" and induces important learning effects, whereby regulators become more aware of the sometimes hidden costs of action, and more ready to adapt decisions to reduce costs.
5. Assessments of the effects of CBA on the outcomes of the decision making process show a very mixed picture. There are examples of good analyses that have had no effect on policymaking and examples of analyses of poor quality that indeed have had an impact. There are several explanations for this, such as value conflicts and power struggles, and procedural, political and legal issues. Experience indicates that on the one hand there is a risk that CBA is being abused to justify decisions already taken, and on the other hand there is a sense that the impact of well done CBA on decision making could improve. Many countries therefore pay more and more attention to careful program and institutional design of CBA to avert these problems.

### ***Institutional requirements for CBA***

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<sup>11</sup> JACOBS, S.H. (1997) An overview of regulatory impact analysis in OECD Countries. In OECD (1997c).

Experience in OECD countries suggests that careful program and institutional design are very important. Success seems to be supported by several preconditions<sup>12</sup>:

1. Political support at ministerial or parliamentary level is necessary. The use of CBA-RIA should be endorsed at the highest levels of government in order to organize and drive CBA-RIA efforts throughout the administration and to realize the other institutional requirements.
2. CBA-RIA should not be an ad hoc exercise, but must be part of a broader policy to improve regulatory quality. This is indispensable to make sure that CBA-RIA will effectively be integrated into the administrative and political decision processes. Two aspects seem to be important in this respect: (1) establishing explicit standards for regulatory quality and principles of regulatory decision-making (with the benefit/cost and least cost principles as one of the requirements for all regulatory decisions) and (2) laying down the system by which regulators respond to these quality standards is monitored. In several countries it is e.g. required to communicate the results of a CBA-RIA in the explanatory memorandum that accompanies proposed regulations.
3. The development of a good institutional structure and allocation of responsibilities is essential. Two models appear to be particularly ineffective: delegating full responsibility to regulators without adequate oversight sacrifices CBA-RIA to the narrower incentives and mission of the regulators, while, at the other extreme, placing responsibility for CBA-RIA in an independent body isolates the analysis from the decision making process, and renders it an academic and impotent exercise. Experiences in OECD countries therefore show no exceptions to the general rule that RIA will fail if it is left entirely to regulators, but will also fail if it is too centralized. Regulators must take primary responsibility under a system of support and oversight by an independent body. Such bodies exist in many countries and are mostly empowered to establish quality standards for analysis and develop a program to build expertise and skills among regulators, including the development of written government-wide guidance to ensure consistency, credibility and quality. These bodies often also play an important role in the co-ordination and quality control of CBA-RIA.
4. Public participation and consultation is important to open up the CBA-RIA process to interested groups and provide regulators with access to valuable information on regulatory impacts. Interest groups and the public should therefore be consulted widely

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<sup>12</sup> See i.a. DEIGHTON-SMITH, R. (1997), *Regulatory Impact Analysis: Best Practices in OECD Countries*, in OECD (1997c); BRU (1997). *Regulatory Compliance Cost Assessment: UK experience*. In OECD (1997c); JACOBS, S.H. (1997); MORALL, John, F. (1997). *An Assessment of the US Regulatory Impact Analysis Programme*. In OECD (1997c); APOGEE RESEARCH (1997). *Regulatory reform through regulatory impact analysis: the Canadian Experience*. In OECD (1997c); HOLMES S. en S. ARGY (1997). *Reviewing existing regulations: Australia's national legislative review*. In OECD (1997c); DE VRIES, Y. en J. TONK (1998). *Toetsing van milieuregelingen op bedrijfseffecten: de Nederlandse aanpak*. In *Energie&Milieu*, nr. 3/1998; etc.

and in a timely fashion. This is likely to mean a consultation process with a number of steps. Experience shows that CBA-RIA also enhances existing consultation and participation procedures. The openness and transparency of the decisions making process improves.

5. Achieving the full benefit of CBA-RIA requires new skills and major cultural change among regulators, politicians, and interest groups. Full integration of RIA into decision processes is a long-term task requiring sustained political and administrative support in order to develop acceptance and commitment. A long-term perspective is therefore essential when implementing a CBA-RIA program. This implies adequate planning and careful program development, including the selection of a methodology that is flexible and administratively feasible given capacities and resources, the development and implementation of data collection strategies, and the targeting of CBA-RIA efforts to those regulations where impacts are most significant and where the prospects are best for altering regulatory outcomes.

### ***Conclusions***

Cost-benefit analysis (CBA) is a useful tool to support good decision making. One of the main advantages is that a CBA assesses not only the negative or positive impacts of proposed and existing regulatory actions but both, and not for one particular target group but for society as a whole. In other words, a CBA is in its principles impartial and comprehensive: not pro or contra regulation, not pro or contra the environment or the economy, not pro or contra industry, agriculture or households. CBA is moreover not limited to one particular aspect such as the environmental impacts, the financial implications for the government budget or the compliance costs for business. A CBA is therefore a useful way of organizing a comparison of the favorable and unfavorable effects of proposed and existing policies. It implicitly broadens the mission of regulators from highly-focused problem-solving to balanced decisions that trade off problems against wider economic and distributional goals. These are important features when dealing with a sensitive and comprehensive topic such as environmental policy.

A major disadvantage of CBA is its practical implementation. Here several constraints must be considered, including data availability, analytical skills and tight budgets. In the context of environmental policy, a full CBA will hardly ever be feasible. Several countries have however taken the view that the principles of CBA should not be rejected simply because, quantitatively, CBA can be difficult in practice. The underlying principle of CBA is said to be more important than quantification. In other words, countries try to find a balance between the theoretical requirements of CBA on the one hand and the limited resources and practical policy needs on the other, leading to more pragmatic approaches (Regulatory Impact Analysis or RIA). This helps instil the CBA principle as a "habit of mind" within administration.



The conclusion from the experience with CBA in environmental policy is that CBA and related RIA can improve the decision making process and generate better policy results. A precondition is that the limitations and practical and conceptual difficulties of a formal CBA are recognized. CBA by itself is not a sufficient basis for decisions. Instead, CBA is best used as a guide to improve the quality of political and administrative decision-making, while also serving important political values of openness, public involvement and accountability, thereby adding an empirical dimension to consensus and political decision methods. It must be seen as a decision tool, not as a decision rule. Experience also indicates that careful program and institutional design are very important. Success seems to be supported by conditions such as political support at ministerial and parliamentary level, integration of economic analysis into the administrative and political decision processes, development of an adequate institutional structure, public participation and consultation, and adequate planning and careful program design.

### **References**

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