OFFICE OF THE COUNCIL OF MINISTERS

COST BENEFIT ANALYSIS GUIDE

ECONOMIC, SOCIAL AND CULTURAL COUNCIL

REGULATORY EXECUTIVE TEAM

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Contents

FOREWORD

The Royal Government under the leadership of Samdech Akkak Moha Sena Padei Techo Hun Sen, Prime Minister of the Kingdom of Cambodia has always regarded private sector as the engine for economic growth that is clearly indicated in the rectangular strategy and in the national strategic development plan. To achieve this goal, the Royal Government has made and continues to make policies, laws and regulations to support the development of the private sector.

Regulatory Impact Assessment (RIA) is recognized as an efficient tool in making regulations more effective. However the most difficulty in RIA process is the cost-benefit analysis (CBA). It is not easy to quantifying or monetizing them. This guide book would present a comprehensive approach of CBA that would certainly have facilitated line ministry staff in the preparation of RIA statement on proposed regulation.

I would like to take this opportunity to to express my respectful thanks to Samdech Techo, Prime Minister of the Kingdom of Cambodia, for firmly supporting the RIA implementation in Cambodia and issuing, on 26th December 2016, the Royal Government Decision on the establishment of Working Group on RIA in all line ministries and institutions and Regulatory Executive Team within the Economic, Social and Cultural Council (ECOSOCC), responsible for training, advocating, promoting, updating and publishing the RIA methodology.

I would like also to express my thankful thought to Samdech Vibol Pagna, defunct Deputy Prime Minister and Minister in charge of the office of the Council of Minister for his strong

support and indispensable guidance in establishing RIA programme.

I would also like to acknowledge and appreciate the efforts of ECOSOCC RIA Team lead by H.E. Yim Nolson, Vice Chairman of ECOSOCC and manage by H.E. Pech Sokha, Deputy Secretary General of ECOSOCC for publishing this CBA Guide book and the valuable assistance of Asia Development Bank to ECOSOCC in carrying out the task of RIA programme. I would present them my sincere thanks.

My regards also go to Mr. Chris Toyne, Senior Advisor at the Office of Best Practice Regulation of the Department of the Prime Minister and Cabinet of the Australian Government of his contribution to the edition of this guide book and the CBA training to the members of RIA working groups on 13-16 September 2016, that I would warmly thank him.

H.E. YIM NOLLA
Senior Minister in Charge of Special Missions
Chairman of Economic, Social and Cultural Council

Introduction

Road Map of RIA Programme in Cambodia

The RIA programme in Cambodia aims to enhance competition and regulatory efficiency through institutionalizing principles of regulatory good practices within the government. The RIA system will require Ministries to follow the principles of regulatory good practices and assess the merits of all proposed regulations that impact on business, compliance costs and competition.

The programme started in 2011 as a pilot project financed by a grant from Asian Development Bank (ADB) which is managed by the RIA office being established within ECOSOCC at the Office of the Council of Ministers and mandated to provide advocacy information, RIA training to line ministries on principles of regulatory good practices, support line Ministries in the implementation of RIA and oversee the rollout of the programme.

At the early stage of the pilot project, 4 implementing line ministries (Ministry of Commerce, Ministry of Environment, Ministry of Industry, Mines and Energy and Ministry of Tourism) participated in the programme to practice RIA in their regulation making process. Line ministry RIA staff (4 officers of each ministry) and ECOSOCC RIA office staff (13 officers) did get assistance and coaching on RIA from a team of international and local consultants hired by ADB for developing the programme and the training until March 2013. Since then, RIA office of ECOSOCC was completely in charge of the RIA programme development including training and coaching.

Due to the successful implementation of the project, reported in the mid-term review by ADB on June 2013, the Council of Ministers and ADB agreed that ECOSOCC added 3 more line ministries, namely Ministry of Agriculture, Forestry and Fisheries, Ministry of Labor and Vocational Training and Ministry of Education, Youth and Sports into the programme on January 2014. Thus the grant was extended until the new TA started in early 2016.

During the pilot project stage, many RIA awareness seminars have been organized by ECOSOCC and ADB among all line ministries, institutions, General Secretariat of National Assembly (with participation from officials of General Secretariat of Senate), universities and private sector with more than 4500 participants who all strongly supported RIA process in Cambodia.

For 2016-17 with the support of the new TA from ADB, ECOSOCC continues the RIA programme by adding 6 new line ministries in 2016 namely Ministry of Public Works and Transport, Ministry of Health, Ministry of Industry and Handicraft, Ministry of Economy and Finance, Ministry of Posts and Telecommunications, and Ministry of Land Management, Urbanization and Construction and 6 more new line ministries in 2017.

Seeing the benefit of RIA process, the Royal Government of Cambodia has decided to issue an executive order (Royal Government Decision No. 132), on 26th December 2016, to all line ministries and institutions to create a working group on RIA for preparing their regulation proposals after getting a formal training from ECOSOCC.

Following the Royal Government Decision No.132, ECOSOCC has officially established the Regulatory Executive Team (RET) on 7th

January 2017, replacing RIA office, to continue the implementation of RIA programme.

More information on RIA programme in Cambodia can be obtained at ECOSOCC website (ecosocc.gov.kh). You can also contact RET or the Secretariat General of ECOSOCC to arrange an introductory presentation if you would like a tailored overview of RIA suited to your organisation.

About this guide

This guide provides only an introduction to cost-benefit analysis (CBA) for regulatory proposals. You can also refer to a comprehensive guide to CBA, such as the Australian Government's Handbook of cost–benefit analysis (Commonwealth of Australia 2006) or a textbook like Boardman et. al. (2010), for more detail and guidance.

Most CBA guides concentrate on infrastructure projects, for which the costs and benefits are relatively easy to measure. Here, the focus is on CBA applied to regulatory proposals, where the impacts are often uncertain and therefore more difficult to quantify.

Topics covered in this guidance note include an introduction to the steps in preparing a CBA, how to deal with costs and benefits that are difficult to measure, taking equity effects into consideration, determining the social discount rate, and some common CBA mistakes.

More information and assistance on preparing CBAs can be obtained by contacting the Office of Regulatory Impact Assessment or from the references provided at the end of this guide.

Cost-Benefit Analysis in Regulatory Impact Analysis

In regulatory impact analysis, CBA is a method of evaluation that attempts to estimate and compare the total benefits and costs of a particular policy proposal.

In principle, CBA measures the efficiency or resource allocation effects of a regulatory change. It calculates the dollar value of the gains and losses for all people affected. If the sum is positive, the benefits exceed the costs and the regulatory proposal would increase efficiency.

CBA is useful because it:

- provides decision makers with information – quantitative and qualitative – about the likely effects of a regulation
- encourages decision makers to take account of all the positive and negative effects of the proposed regulation, and discourages them from making decisions based only on the impacts on a single group within the community
- assesses the impact of regulatory proposals in a standard manner, which helps consistent decision making
- captures the linkages between the proposal and other sectors of the economy (for example, increased safety may reduce health care costs), helping decision-makers maximise net benefits to society
- helps identify cost-effective solutions to problems by identifying and measuring all costs.

Even when it is difficult to fully estimate some costs or benefits, CBA makes it clear what assumptions and judgements have been made. Attempting to quantify costs and benefits also encourages analysts to examine the impacts more closely.

What is Cost–Benefit Analysis?

Regulations impose costs on government, business and individuals. Effective regulation will also provide benefits when the government's objectives are achieved.

Impact analysis provides decisions makers with information to weigh and balance these many positive and negative impacts. If decision makers choose to regulate without conducting impact analysis, they may not achieve the objectives or ignore less costly options. The role of the impact analysis is to help decision makers avoid making these errors.

Using a tool such as cost benefit analysis, allows RIA to demonstrate which options achieve benefits greater than costs and, for a given value of benefits, which option achieves them at least cost.

Definitive analysis of this type is rarely produced in the most sophisticated RIA system. Requiring this high standard for Cambodia would be counterproductive as it would make the task of preparing a PAS or RIS difficult, leading to fewer PASs and RISs being completed. However, knowledge of the CBA tool can help guide the sorts of questions which should be asked in a RIA, even if the full CBA approach is not used.

The steps in a Cost-Benefit Analysis

Conducting a CBA requires you to follow a logical sequence of nine steps (Table 1).

Table 1: Steps in preparing a full cost–benefit analysis

1	Specify the set of options.
2	Decide whose costs and benefits count.
3	Identify the impacts and select measurement indicators.
4	Predict the impacts over the life of the proposed regulation.
5	Monetise (attach dollar values to) impacts.
6	Discount future costs and benefits to obtain present values.
7	Compute the net present value of each option.
8	Perform sensitivity analysis.
9	Reach a conclusion.

Source: Adapted from Boardman et al. (2010).

Step 1: Specify the set of options

Identify a range of genuine, viable, alternative policy options to be analysed. A 'do nothing' or 'business as usual' option will usually provide the base case against which the costs and benefits of each alternative are determined. In some cases, doing nothing may be the best option available. Only costs and benefits that would not have occurred in the base case should be included in the CBA.

Step 2: Decide whose costs and benefits count

For most regulatory proposals, measuring the national costs and benefits is appropriate, rather than measuring any international impacts. As far as is practical, you should count the costs and benefits to all people residing in Cambodia.

Step 3: Identify the impacts and select measurement indicators

Identify the full range of impacts of each of the options. It is important to identify the incremental costs and benefits for each option, relative to the base case (which will normally be 'what would happen if the current arrangements were to continue?').

Where relevant, the base case should be forward-looking, recognising that the world in which the regulation will be implemented may differ from the current situation (key variables may change in the future, meaning that current or historical situation may not be the most relevant). That is, the base case should not simply assume that nothing will change over time — changes that can be reasonably expected should be recognised when identifying impacts of each option.

All the effects of a proposal that are considered desirable by those affected are benefits; all undesirable effects are costs. CBA requires you to identify explicitly the ways in which the proposal makes individuals better or worse off.

The choice of indicators to measure the impacts depends on data availability and ease of monetisation. For example, a

regulatory proposal may reduce risks of a hazard. Its positive impact could be measured in terms of a reduced number of accidents. The benefit from accidents avoided could be valued in dollars (see Step 5).

Step 4: Predict the impacts over the life of the proposed regulation

The impacts should be quantified for each time period over the life of the proposed regulation. The total period needs to be long enough to capture all the potential costs and benefits. Because of the uncertainty involved in forecasting costs and benefits over long periods, exercise caution when adopting an evaluation period longer than, say, 20 years (although some environmental regulation may require the use of a longer time horizon).

Predicting future impacts is difficult. There will always be some uncertainty about the outcome of a proposed regulation. Assessing uncertainty should be a standard component of the evaluation of any major proposal. This means that you assess expected values and variability of costs and benefits, as well as taking downside risks into account.

A CBA should present the best estimates of expected costs and benefits, along with a description of the major uncertainties and how they were taken into account. You need to set out how costs and benefits are likely to vary. For example, would large price changes (such as a rise in energy prices or real wages) significantly change the net benefits from the regulatory proposal? In general, your CBA should not just assume that the net benefits for one year will be repeated every year.

Although it is difficult to predict what the effects of a proposed regulation might be in 10 or 20 years, decisions require some assumptions to be made. A CBA should make those assumptions transparent. When you clearly consider and justify the assumptions underlying the forecasts, it improves implementation planning and identifies where more effort should be made to improve the analysis. It is a first step towards dealing with the uncertainties that the regulatory proposal may create.

Step 5: Monetise (place dollar values on) impacts

Estimating the net dollar value of the gains and losses of a regulation for all people affected is at the heart of CBA. Measurement of costs and benefits in this way is sometimes referred to as monetising costs and benefits.

The amount an individual would pay to obtain (or avoid) a is one measure of the value of that change to them. The value could be positive or negative depending on whether the change makes them better or worse off. Adding up these values across all affected people gives the community's total willingness to pay for the change. If the sum is positive, the change increases efficiency. The costs and benefits to all people are added without regard to the individuals to whom they accrue: a $1 gain to one person cancels a $1 loss to another.

This 'a dollar is a dollar' assumption enables resource allocation to be separated from equity effects—or efficiency from equity effects. That does not mean that distributional considerations are unimportant or should be neglected. It means that they should be brought into account as a separate

part of the overall analysis of the proposal in question—which may be more important than the resource allocation assessment, but should be distinct from it. Dealing with equity issues is discussed in more detail below in the 'Accounting for equity' section.

Dollar values can be estimated from observed behaviour. You can measure the value people place on something by observing how much they actually pay for certain goods or services, and the quantities of those goods and services that are consumed. Market behaviour reveals people's valuations (or is at least a guide to them). For example, if a consumer pays $3.50 for a cup of coffee, the value they place on the coffee is at least $3.50 (it will likely be higher).

However, monetisation, or more general quantification, can be difficult because impacts are sometimes uncertain, some are difficult to value in dollar terms, and some are both uncertain and difficult to value. Environmental goods or safety provisions are good examples of goods that are difficult to place dollar values on, as they are usually not traded in markets. Various methods for estimating the value of non-market goods and accounting for uncertainty in CBAs are outlined below in the 'Dealing with costs and benefits that are difficult to value' section.

The fact that some impacts may be very difficult to quantify in dollar terms does not invalidate the CBA approach. In such cases, a detailed qualitative analysis will often be most appropriate in place of dollar values. Your qualitative analysis should be supported by as much evidence and data as possible

to increase the transparency of the report and to assist the decision maker in choosing between alternative options.

Step 6: Discount future costs and benefits to obtain present values

Why discount?

The need to discount future impacts can be viewed from two main perspectives, both of which focus on the opportunity cost of the cash flows implied by the regulation. The first perspective is the general observation that individuals prefer a dollar today to a dollar in the future. This is most obvious in the fact that banks need to pay interest on deposits to entice individuals to save rather than spend. This general preference for current consumption is known as the 'rate of time preference' and relates to all economic benefits (and costs), not just those that are financial in nature.

Since individuals are not indifferent between cash flows from different periods, those flows cannot be directly compared. For monetised flows to be directly comparable in a CBA, those costs or benefits incurred in the future need to be discounted back to current dollar terms. This reflects society's preferences, which place greater weight on consumption occurring closer to the present.

The second perspective is that flows of costs and benefits resulting from a regulation also have an opportunity cost for investment. When regulations impose costs on individuals or businesses, those costs will need to be funded in some way. This funding imposes costs on the affected party, either

through the interest paid for borrowing the money, or the returns forgone when the funds are not used for other purposes.

The regulation will therefore only be beneficial when it provides a return greater than the cost to society of deferring consumption, or of the return that could have been earned on the best alternative use of the funds. By applying a discount rate to future cash flows, the required rate of return is taken into account in the net present value calculation.

Either approach demonstrates that the need to discount future cash flows can be viewed in terms of the opportunity cost of the cash flows, whether this is the cost of delaying consumption or the alternative investment opportunities forgone. Since most of the costs and benefits of regulatory proposals are spread out over time, and their value depends on when they are received, discounting is very important in CBA.

The rate that converts future values into present values is known as the discount rate. If the discount rate were constant at r per cent per year, a benefit of B_t dollars received in t years is worth $B_t /(1+r)^t$ now. Box 1 provides an example of how to calculate net present values. The references listed at the end of this guide provide more guidance.

Accounting for inflation

Inflation is another reason that a dollar in the future is worth less than a dollar now. A general rise in the price level means that a dollar in the future buys fewer goods. Analysts conducting a CBA have the choice of whether to include future cash flows in terms of their actual monetary value at the future date (the 'nominal' value) or in terms of their current dollar value (the 'real' value). However, since all cash flows need to

be converted to current dollar terms to be comparable in a CBA, it is usually simplest to adopt the latter approach.

Box 1: Calculating net present values

To determine the net present value (NPV) of an option, the costs and benefits need to be quantified for the expected duration of the proposal.

The net present value is calculated as:

$$NPV = (B_t - C_t)/(1+r)^t$$

where B_t = the benefit at time t

C_t = the cost at time t

r = the discount rate

t = the year

T = number of years over which the future costs or benefits are expected to occur (the current year being year 0).

Consider an option that will require industry to install new equipment to limit air pollution. The equipment costs $5 million to install and will operate for the following four years. Ongoing (annual maintenance) costs to business are $1 million a year (in constant prices). The benefits are estimated at $3 million a year (in constant prices). The discount rates are 3 per cent, 7 per cent and 10 per cent.

	Costs (C_t)	Benefits (B_t)	Net benefit (B_t-C_t)	Net Present value 3%	7%	10%
Year 0	5	0	-5	-5.00	-5.00	-5.00
Year 1	1	3	2	1.94	1.87	1.82
Year 2	1	3	2	1.89	1.75	1.65
Year 3	1	3	2	1.83	1.63	1.50
Year 4	1	3	2	1.78	1.53	1.37
Net present value of proposal				**2.43**	**1.77**	**1.34**

CBA measures the value people place on various outcomes, preferably using their willingness to pay as revealed by their market behaviour. Consequently, the preferred approach is to base the discount rate on market-based interest rates, which indicate the value to the current population of future net benefits. Market interest rates determine the opportunity cost of any capital used by the Government's regulatory proposal—that is, what it would have produced in its alternative use.

There is uncertainty about the appropriate discount rate to use for regulatory proposals. It is uncertain what the alternative uses for capital used by a proposal would have been, and what the capital would have produced in those uses.

The discount rate for regulatory interventions

The CBA should identify a 'central' real discount rate. As with any uncertain variable, sensitivity analysis should be conducted (see below for more information on sensitivity testing), so in addition to the central discount rate, the net present values should also be calculated with real higher and lower discount rates. If the sign of the net present value changes, the sensitivity analysis reveals that the choice of discount rate is important. This information should be highlighted in the summary of the CBA, as it is an important caveat for the analysis.

Many of the references at the end of this guide provide a more detailed discussion of the issues surrounding the choice of discount rate, and present specific discount rates that can be used in CBA.

Step 7: Compute the net present value of each option

The net present value (NPV) of an option equals the present value of benefits minus the present value of costs:

$$NPV = PV(B) – PV(C)$$

If the NPV is positive, the proposal improves efficiency. If the NPV is negative, the proposal is inefficient. If all costs and benefits cannot be valued in dollars, you should outline why the non-monetised costs and benefits are large or small relative to the monetised impacts.

Step 8: Perform sensitivity analysis

There may be great uncertainty about predicted impacts and their appropriate monetary valuation. Sensitivity analysis provides information about how changes in different variables will affect the overall costs and benefits of the proposed regulation. It shows how sensitive predicted net benefits are to different values of uncertain variables and to changes in assumptions. It tests whether the uncertainty over the value of certain variables matters, and identifies critical assumptions.

If sensitivity analysis is to be useful to decision makers, it needs to be done systematically and presented clearly. Common approaches to sensitivity analysis include the following:

- Worst/best case analysis: The base case assigns the most likely values to the variables to produce an estimate of net benefits that is thought to be most representative. The worst, or pessimistic, scenario assigns the least favourable of the plausible range of values to the variables. The best, or optimistic, scenario assigns the

most favourable of the plausible range of values to the variables. If the pessimistic scenario gives an NPV below zero, you will need to investigate the critical elements driving the value of the regulatory proposal, using the following two techniques.

Partial sensitivity analysis examines how net benefits change as one variable varies over a plausible range (holding other variables constant). It should be used for the most important or uncertain variables, such as estimates of compliance costs, forecasts of benefits and the discount rate. It may be important to vary the values assigned to 'intangibles', especially when the assumed values are controversial. Partial sensitivity analysis makes it clear to decision makers how the CBA results are affected by uncertainty about the level or value of a variable. If you find that varying a parameter has large effects on the net benefits from the proposed regulation, uncertainty about its value becomes important.

Monte Carlo sensitivity analysis creates a distribution of net benefits by drawing key assumptions or parameter values from a probability distribution (See Boardman et al. 2010, pp. 181–184) for more details). While this is a more statistically robust approach to sensitivity analysis, care needs to be taken in adopting reasonable and justified assumptions about the probability distributions that have been assumed.

If the sign (positive or negative) of the net benefits does not change after considering the range of scenarios, there can be confidence in the efficiency effects of the proposal.

Step 9: Reach a conclusion

You should summarise the results of the CBA. The option with the highest net benefit should be your recommended option. Given that NPVs are predicted (average) values, the sensitivity analysis might suggest that the alternative with the largest NPV is not necessarily the best alternative under all circumstances. For example, you might be more confident in recommending the option with a lower expected value of net benefits, but with a smaller chance of imposing a significant net cost on the community (lower 'downside risks').

Your conclusion should include the time profiles of costs, benefits and net benefits, their NPVs, the discount rate used, information on the sensitivity of estimated impacts to alternative assumptions, a list of assumptions made, and how costs and benefits were estimated.

Dealing with costs and benefits that are difficult to value

When a proposal uses and produces goods sold in markets, estimating costs and benefits is in most cases more straightforward and is covered in a number of existing CBA guides.

However, it is often difficult to identify and measure the effects of a proposed regulation, especially when there are impacts on goods not traded in markets, such as pollution levels or access to scenic views.

Costs and benefits can be difficult to value in dollars because the size of the impact may be unknown or uncertain, or because they are difficult to express in money terms even if their impact is known. Examples include environmental, social and cultural considerations, regional impacts, health and safety, publicity, and national defence.

It is important that you identify and describe all costs and benefits. You should then quantify them as much as possible. When valuations are uncertain, sensitivity analysis should be used to test how varying the value assigned affects the overall result of the analysis.

If the impacts cannot be valued, they should still be quantified in non-monetary terms. For example, a regulation to reduce pollution could quantify the expected reduction in emissions. The quantification should aim to identify matters such as the assumptions applied to determine the effects, the impact on the community (such as how many people are affected and how) and the likelihood of the full impact being realised. Where

impacts cannot be valued, the reasons why should be set out clearly.

The process of trying to describe and measure costs and benefits is valuable in itself. By examining what determines the costs and benefits and how they are likely to vary, you should consider different approaches and determine the best way to achieve the intangible objectives. Is the policy the best way of producing them, or could a better outcome be produced by some alternative? Even qualitative descriptions of the pros and cons associated with a contemplated action can be helpful.

A wide range of tools have been developed to help you to estimate the value of costs and benefits when direct market information is not available, including revealed preference techniques and stated preference techniques. See Boardman et al. (2010) or Commonwealth of Australia (2006) for more information.

Revealed preference techniques

Revealed preference techniques estimate value from observed behaviour and market interactions. When individuals make purchases in markets, the price they pay reveals information about the value placed on that good. While this concept is useful for measuring the value of most markets, regulatory interventions typically deal with goods that are not directly traded in markets, or for which the market does not give a reliable signal as a result of one or more market failures. In these cases, estimating values to be included in a CBA will require that you consider non-market valuation techniques.

These techniques often require the use of market proxies to provide information on the value of a non-market good. When

similar goods to the one being regulated are traded, their price will suggest the value placed on the good in question. For example, information about the benefit of providing free public transport can be gleaned from travel patterns in cities where citizens pay for this service.

Regulations that aim to reduce the probability of a negative event occurring can be valued by analysing individuals' willingness to pay to avoid the event. For example, health and safety regulations often need to estimate the value of a statistical life. This value is often estimated by analysing expenditure on smoke alarms, car airbags and other devices that individuals buy to reduce the probability of death.

In some cases, the 'price' paid for a good might not be a physical exchange of money but instead reflect the effort and expense that individuals have incurred to consume the good. This expense can be used to estimate the value of a good when no explicit market is present. For example, the values of visits to galleries or museums can be estimated by analysing the travel costs of visitors and the opportunity cost of their time.

Stated preference techniques

In some situations, it may not be possible to use revealed preference techniques. These cases usually occur when a good is not actively consumed or enjoyed by individuals, but its mere existence is still valued. In such cases it is still possible to get information on the willingness of individuals to pay for a good by simply asking them to state their preferences. Stated preference techniques rely on surveys to obtain information on how people value costs and benefits. These surveys are called 'contingent valuation' surveys.

A survey may be the only way to collect information on non-use values where an individual places value on a resource or activity, even though they may not directly use it or participate in it. For example, people might be willing to preserve a wilderness area because they place value on knowing that some natural habitat exists for rare animal species.

Boardman et al. (2010, pp. 369–402) set out how to conduct contingent valuation surveys and outline some problems with the technique.

Choice modelling is another survey method that may be useful when the benefits from a proposal have many attributes and the options provide different combinations of those attributes. It is examined OECD (2006; pp. 125–143).

To be a useful addition to a CBA, a stated preference study should aim to find willingness-to-pay estimates from well-informed individuals. For example, if a choice modelling study is trying to establish the community's willingness to pay for a regulation to reduce a particular environmental risk, it is important that participants in the study base their responses on accurate information about the nature of the environmental risks, rather than on their uninformed perceptions of the risks. This shows the importance of identifying, describing and, where possible, quantifying the likely impacts of a proposal.

As a general rule, estimates of individuals' valuations of goods and services derived from observing their behaviour in markets tend to be more credible than those from survey questionnaires (Boardman et al. 2010). Observing purchasing decisions *directly* reveals preferences.

Survey respondents may have little incentive to take the question seriously, to invest in obtaining the information necessary to answer it accurately, or to be truthful. They bear little cost for inaccurate or ill-considered answers and may have an incentive to exaggerate.

Determining impact valuations from secondary sources

The methods discussed above provide a set of tools for the practical valuation of impacts, but may be difficult to implement. When you do not have the resources or expertise to conduct an original study, you may wish to 'plug in' values from previous studies. This process, called 'benefit transfer', has been used to estimate values such as the value of a statistical life or life-year, the value of travel time savings and the cost of noise and air pollution.

While information from secondary sources can provide a quick, low-cost approach for obtaining desired monetary values, you should treat it cautiously and not use it without a clear justification. Judgement is required to determine whether results from a previous study are appropriate to use in a particular CBA. Estimates derived from secondary sources may need to be adjusted, depending on the specifics of the particular application.

The accuracy and quality of the original study should be carefully examined. When studies with technical weaknesses are used, you should discuss any biases or uncertainties that may arise as a result. Clearly, if a study has major weaknesses, it should not be used. Also, information from secondary sources is most robust when several sources can be used to corroborate the assumptions or estimates made.

Dealing with costs and benefits that cannot be valued in dollar terms

Some costs and benefits resist the assignment of dollar values. A CBA should nevertheless include all relevant information that can affect a decision in such cases. It should make explicit allowance for costs and benefits that cannot be valued. You should report cost and benefit estimates within three categories:

- monetised
- quantified, but not monetised
- qualitative, but not quantified or monetised.

The challenge is to consider non-monetised impacts adequately. For example, if a proposal is advocated despite monetised benefits falling significantly short of monetised costs, the RIS should explain clearly why non-monetised benefits would tip the balance and the nature of the inherent uncertainties in the size of the benefits.

CBA can encourage decision makers to reveal the limits they place on non-monetised benefits. For example, the monetised costs of a proposed regulation may exceed monetised benefits by $16 million, which equates to a net cost of $1 per Cambodian resident over the life of the proposal. Is the non-monetised benefit valuable enough to outweigh the net monetised costs? It may be considered reasonable to assume that the residents value the proposal's non-monetised benefits at more than $1 each. But if the cost were, say, $100 per head, it may not be plausible to assume such a high willingness to pay for the non-monetised benefits, depending on the benefits in question.

If quantification is not possible, your analysis should at least describe such intangibles in a qualitative manner and assess the strengths and limitations of the relevant arguments for taking those impacts into account. Where possible, include relevant data to support the qualitative analysis. For example, information on the number of people affected by the regulation or the value added of the affected industry may be useful to the final decision maker.

Cost-effectiveness analysis

Cost-effectiveness analysis is a widely used alternative to CBA in circumstances where the most important impact cannot be monetised. It compares alternatives on the basis of the ratio of their costs and a single quantified, but not monetised, effectiveness measure, such as lives saved. It may be reasonable to use cost-effectiveness analysis if the effectiveness measure captures most of the policy's benefits.

Cost-utility analysis is a form of cost-effectiveness analysis that employs a more complex effectiveness measure, reflecting both quantity and quality. It is generally used in the area of health care. For example, the benefit measure may be quality-adjusted life-years (QALYs), which combines the number of additional years of life and the quality of life during those years (usually measured on a scale in which a value of one is assigned to perfect health and zero to death). In cost-utility analysis, the incremental costs of a number of options are compared to the health changes measured in QALYs that they produce. A similar cost-effectiveness measure that is also used is disability-adjusted life-years (DALYs).

Accounting for equity

A CBA adds up costs and benefits across individuals without regard to the equity of the distribution of those costs and benefits. A CBA implicitly counts a dollar gain to one person as cancelling a dollar loss to another. It assumes that a dollar is worth the same to everyone. In other words, CBA is directed at whether the proposal delivers a net gain in dollar value to society as a whole, rather than who receives the benefits or who pays the costs.

The 'dollar is a dollar' assumption separates a policy's efficiency or resource allocation effects from its equity or distributional effects. This separation is useful, as there is no consensus about the weight to be attached to equity effects. Ultimately, it is up to decision makers to decide the trade-off between equity and efficiency. A CBA can only help to inform this decision.

The way costs and benefits are distributed among various groups, and over time, can also be important to decision makers. While CBA cannot resolve equity issues, it can draw attention to them by quantifying the impacts of proposed actions on different groups. If the information is available, a CBA can identify potential winners and losers and the size of their gains and losses. It is then up to decision makers to decide whether distributional impacts or equity issues are important and need addressing.

A CBA clarifies the trade-offs when comparing alternative proposals, such as how much income may need to be sacrificed to achieve other objectives. For example, the decision maker may decide to reject an option with the largest NPV if it has

significant adverse equity impacts. The reasons should be made explicit.

Accounting for future generations

An issue arises when regulatory impacts cross generational lines (for example, when costs are borne by today's generation but benefits are shared with or received by future generations). Some argue that a lower discount rate should be used for intergenerational discounting. However, there is no consensus about how to value impacts on future generations.

Rather than use an arbitrarily lower discount rate, it is suggested that the effects on future generations be considered explicitly. One way this could be done is to supplement CBA with a discussion of how future generations could be affected by the proposed regulation.

Common cost–benefit analysis mistakes

Some common mistakes that arise, particularly in analysing regulatory proposals, include the following.

Downplaying or ignoring non-financial social costs and benefits

Regulatory proposals differ greatly in the ease and accuracy with which the likely costs and benefits can be quantified. Although CBA places emphasis on valuing costs and benefits in monetary terms, it is important that the RIS process is not biased in favour of those proposals with impacts that are relatively easy to value. You should take care to ensure that monetised impacts do not overshadow other important factors in decision making.

Double counting benefits

If the costs and benefits of a regulatory change have been estimated from the impact in one market, do not count them a second time as a result of consequent changes in other markets. For example, if a change to transport regulation results in savings in travel time to a particular group of homeowners, it would be inappropriate to add the resulting increase in their house prices (which is merely the capitalised equivalent of the benefits counted earlier) to the travel time benefits from the regulatory change.

More generally, impacts will often manifest in two ways: the real impact (for example, time savings or increased productivity), and the nominal impacts when the real impacts are reflected in markets. Either can be used to place dollar

figures on the impacts, but care should be taken that the analysis does not include both.

'Before/after' rather than 'with/without'

The costs and benefits of a proposed regulation properly relate to changes compared to what would have happened in the absence of the regulation. That is, it is necessary to compare the world without the change to the world with the change. It is inappropriate to merely calculate incremental costs and benefits compared with the status quo, unless no further changes would have eventuated in the absence of the proposal.

This problem is especially prevalent when assessing the impact of regulations that are part of a suite of policies with the same aim (for example, there are several policies aimed at reducing electricity use in buildings, and several regulations aimed at reducing the take-up of cigarette smoking). In these cases, it is important to analyse the incremental impact of the regulation being considered, recognising that, even if no action is taken, the Government's other actions may work towards the desired outcomes. That is, the 'without regulation' base case option should include the impacts of these complementary interventions. Also, you should consider whether the community would change its current behaviour in the absence of any government action.

Using the riskless rate of interest to discount net benefits that contain market risk

A riskless rate of interest should only be used to discount net benefits that are uncorrelated with market returns. The use of low 'social discount rates' is common in the CBA literature and often justified through one of the following arguments:

- The government can borrow at the bond rate, usually much lower than the market rate of interest, and therefore the rate of return required by the government is lower than that required in the private sector.
- The government has a diversified portfolio of 'investments' and therefore faces no market risk.
- Society should not discount the welfare of future generations.

However, these arguments are typically not pertinent for regulatory interventions. While it is true that the government can raise funds at the lower bond rate, it is the opportunity cost of those funds (the alternative uses to which the funds could have been put) that is important, rather than the funding costs, in considering the social impact. Further, the Government is generally no better placed to diversify its asset holdings than are individuals and, unlike individual investors, it does not usually invest funds with diversification in mind. Finally, you should not account for the welfare of future generations by adjusting the discount rate; this requires the relative value of different generations' welfare to be quantified, and there is no accepted way of doing this. Rather, you should consider the impact of a proposal on future generations explicitly.

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Appendix – Example CBA

There has been a recent spate of drowning deaths and near drowning of young children in Australia. The Health Ministry notes that there are no incidents in pools surrounded by fences, and the government of Australia is considering making it compulsory from 2017 to install a fence around newly built swimming pools. To ensure compliance with the new law, the government will send out inspectors each year to check whether pools built from 2017 have fences installed.

The government has asked you to work out, using cost benefit analysis, whether this policy would be a good idea. What would you recommend to the government?

Here is the information you will need for the analysis:

Number of pools

- In 2016 there were 500,000 pools, and 20 per cent already had fencing. The number of pools grows by 3% per year.

Costs

- It costs $2,500 to install a new fence, and an average of $25 per year to maintain a fence.
- It costs the government $40 to inspect each pool, and 25% of pools built from 2017 are inspected each year.

Number of drowning deaths and near drowning

- In 2016 there were 20 drowning deaths and 50 near drowning in pools without fences. There were no incidents in fenced pools.

Cost of drowning

- The value of a life is estimated to be $3 million
- The acute health costs associated with near-drownings are $5000 per incident, and the long term health costs are $500,000 per incident.
- The ongoing quality of life for a child who has nearly drowned is 0.8 of a QALY.

Discount rate

- The discount rate is 7 per net.

Period of analysis

- 10 years.

Table A.1: Assumptions and data

		Number of pools	500,000	
		Growth per year	3%	
		Number of pools with fencing (base)	20%	
Costs	A	installation cost of fence	$2,500	per pool
	B	maintenance cost of fence	$25	per pool per year
	C	inspection cost of fence	$40	per pool
	D	rate of inspection	25%	per year
Benefits		Drowning deaths	20	in un-fenced pools
	E	*- drowning rate*	*0.0000500*	*per un-fenced pool*
		near drowning	50	in un-fenced pools
	F	*- near drowning rate*	*0.0001250*	*per un-fenced pool*
	G	value of life	$3,000,000	
	H	acute care cost	$5,000	per incident
	I	Ongoing health cost	$500,000	per incident
	J	QALY	0.8	
	K	*- lost health*	*0.2*	
		Discount rate	7%	

Table A.2: Calculation of Net Present Value (NPV)

				Year									
			2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
	Base Case (no regulation)												
	Number of pools		500,000	515,000	530,450	546,364	562,754	579,637	597,026	614,937	633,385	652,387	671,958
L	- number of pools with fences		100,000	103,000	106,090	109,273	112,551	115,927	119,405	122,987	126,677	130,477	134,392
M	- number of pools without fences		400,000	412,000	424,360	437,091	450,204	463,710	477,621	491,950	506,708	521,909	537,567
	- pools built since 2017			15,000	30,450	46,364	62,754	79,637	97,026	114,937	133,385	152,387	171,958
N	Number of drownings	(L*E)	20	20.60	21.22	21.85	22.51	23.19	23.88	24.60	25.34	26.10	26.88
O	Number of near drownings	(L*F)	50	51.50	53.05	54.64	56.28	57.96	59.70	61.49	63.34	65.24	67.20
	Policy case (with regulation)												
P	- number of pools with fences		100,000	115,000	130,450	146,364	162,754	179,637	197,026	214,937	233,385	252,387	271,958
Q	- number of pools without fences		400,000	400,000	400,000	400,000	400,000	400,000	400,000	400,000	400,000	400,000	400,000
R	*Additional pools with with fences (built this year)*	(change in S)		12,000	12,360	12,731	13,113	13,506	13,911	14,329	14,758	15,201	15,657
S	*Additional pools with fences (since 2017)*	(P-L)		12,000	24,360	37,091	50,204	63,710	77,621	91,950	106,708	121,909	137,567
T	Number of drownings (Q*E)	(R*E)	20	20	20	20	20	20	20	20	20	20	20
U	Number of near drownings (Q*F)	(R*F)	50	50	50	50	50	50	50	50	50	50	50
V	*Reduction in drownings*	(T-N)		- 0.60	- 1.22	- 1.85	- 2.51	- 3.19	- 3.88	- 4.60	- 5.34	- 6.10	- 6.88
W	*Reduction on near drownings*	(U-O)		- 1.50	- 3.05	- 4.64	- 6.28	- 7.96	- 9.70	- 11.49	- 13.34	- 15.24	- 17.20
	Values												
	Additional installation costs	(R*A)		-$30,000,000	-$30,900,000	-$31,827,000	-$32,781,810	-$33,765,264	-$34,778,222	-$35,821,569	-$36,896,216	-$38,003,102	-$39,143,196
	Additional maintenance costs	(S*B)		-$300,000	-$609,000	-$927,270	-$1,255,088	-$1,592,741	-$1,940,523	-$2,298,739	-$2,667,701	-$3,047,732	-$3,439,164
	Government inspection costs	(C*D*S)		-$150,000	-$304,500	-$463,635	-$627,544	-$796,370	-$970,261	-$1,149,369	-$1,333,850	-$1,523,866	-$1,719,582
	Willingness to pay for reduced drowning	(V*G)		$1,800,000	$3,654,000	$5,563,620	$7,530,529	$9,556,444	$11,643,138	$13,792,432	$16,006,205	$18,286,391	$20,634,983
	Willingness to pay for reduced injury	(W*G*K)		$900,000	$1,827,000	$2,781,810	$3,765,264	$4,778,222	$5,821,569	$6,896,216	$8,003,102	$9,143,196	$10,317,491
	Avoided short and long term health costs	(W*H)+(W*I)		$757,500	$1,537,725	$2,341,357	$3,169,097	$4,021,670	$4,899,820	$5,804,315	$6,735,945	$7,695,523	$8,683,889
	Net impact			-$26,992,500	-$24,794,775	-$22,531,118	-$20,199,552	-$17,798,038	-$15,324,480	-$12,776,714	-$10,152,515	-$7,449,591	-$4,665,578
	Undiscounted total		-$162,684,861										
	Net Present Value (NPV)		-$123,876,080										

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