Chapter 4

I. The Role of Economic Evaluation

Economic evaluation can play three important roles in the environmental assessment (EA) of projects, namely: (i) use of economic information of environmental impacts to facilitate project selection, (ii) use of economic costs and benefits in the assessment of environmental mitigation measures suggested by the EA, and (iii) economic evaluation of the environmental impacts of projects.[12]

Principles of environmental economics can bring much-needed rigor and coherence to the identification, formulation, evaluation, and selection of development projects. Extended cost-benefit analysis (EBCA) can be used in the identification and pre-screening stages of the project cycle, and then the environmental components can be brought into the process of presenting various options and selecting among these options. This approach, explained in the *Economic Evaluation of Environmental Impacts: A Workbook*, will ensure that the selection of projects is done with environmental impacts clearly taken into consideration. Chapter 5 further describes how environmental economics aides analysts during project selection and processing.

The second role of environmental economics in EAs is focused on the evaluation of costs of environmental mitigation measures and management plans suggested by the EA. This may include a summary of the project costs, as well as how these cost estimates would change due to the activities proposed under the EA. This component can be considered a cost accounting of the environmental investment of a project. If information is available, these costs can be compared with the potential benefits from mitigation measures.

[12] *Environmental assessment in Asia is extensively discussed in Lohani, et. al, 1997.*

The third role—the economic evaluation of environmental impacts of a project—is intended to seek the economic values (both costs and benefits) of the expected environmental impacts associated with a project. Traditionally these impacts were neither mitigated, nor were they taken into account in project economic analysis. Such impacts should be identified by the EA, and sufficient quantitative and qualitative explanations should be given in the EA documents. Environmental economics can also be helpful in setting the objectives of cost effectiveness analysis.

To illustrate the role of environmental economics in EA, consider the case of an electricity generating power plant. Electricity can be generated using various sources of energy—coal, solar, wind, hydropower, or geothermal sources. If, in the pre-screening of proposed projects, it is possible to identify environmental costs and benefits among the options, and if these benefits and costs are used to select the project—or to modify it in some manner—then the first function of environmental economics in EA has been used. In this regard, a coal-fired power plant may have been identified. If the environmental components already have been recognized through the preliminary accounting of likely benefits and costs, and if the project is then modified by having the power plant install an electrostatic precipitator to reduce total suspended particulates (TSP) emissions, then that modification represents a mitigating measure. The costs of the precipitator should be included in the estimates of project costs. If the same power plant constructs a wall instead of fixing mufflers to reduce noise pollution, the cost of construction should also be included in project cost. These are standard mitigation measures whose costs should be reflected in standard economic analysis. If such an analysis is undertaken, then the second purpose of environmental economics would also have been accomplished.

Despite mitigation measures, there may still be a generation of pollutants. In such cases, or in cases where no mitigation is undertaken, conducting economic assessment without including the economic costs of TSP or noise pollution would be misleading and would give a false (a more favorable, underestimating the true costs) picture of the project. If analysts want to determine environmental costs and benefits, it may be possible to assess the likely damages from increased TSP pollution and this becomes relevant in balancing the costs of electrostatic precipitators against the likely benefits (or in this case avoided costs).

If damage estimates are not available, two options exist. One is to modify project costs to account for the necessary installation of electrostatic precipitators, and to assume that the benefits are at least as large as the costs—otherwise the project proponent would not be willing to mitigate the probable damage. If this route is followed, the project's economic feasibility is not "distorted" by the addition of benefit measures derived from some other means. The second option is to remove the mitigation expenditures from project costs (and benefits) but to retain the mitigation requirement as a condition for project approval. As above, decision-makers can consider the project on its more traditional economic criteria, but the adverse environmental impacts will be rectified before the project is operational. Regardless, the additional environmental costs that a project will generate are properly accounted in the evaluation of that project—either explicitly in its extended cost-benefit evaluation, or implicitly in the covenants for project approval.

The above-mentioned coal-fired thermal power plant may have other adverse environmental impacts that may or may not be capable of mitigation. For example, the generation of emission such as CO_2 is an inevitable result of coal-fired power plants. One may not be able to stop such emissions but there are actions that may reduce the damages caused by such emissions. For example, an afforestation program may have the potential to sequester part of the additional CO_2 produced by the new plant. Or, perhaps the new power plant will use state-of-the-art technology in power generation and therefore the kilowatt hour (kWh) of electricity per ton of coal burned will be far in excess of that from existing plants. In this case, the power authority may be able to close older less-efficient power plants. If this is possible, there will be environmental benefits from this project that are in addition to the benefits directly associated with project operations. If the associated reductions in pollution can be assigned a monetary value, then this will help the project analyst express the full economic benefits of the project in a more complete manner. Such an analysis covers the third purpose of economic evaluation of environmental impacts of projects.

In summary, if there is careful economic analysis in the EA the assessment of development projects can be enhanced, and can be made more comprehensive through the provision of other forms of information. If the EA exercise is used as an iterative planning tool, there will be opportunities at each step to reduce the negative environmental impacts, and to capture more of the positive environmental impacts of well-conceived projects. As methods improve, the more complete integration of economic analysis of environmental impacts into project and program evaluation can be very useful in enhancing the coherence of development programs, and in improving the quality of all development projects.

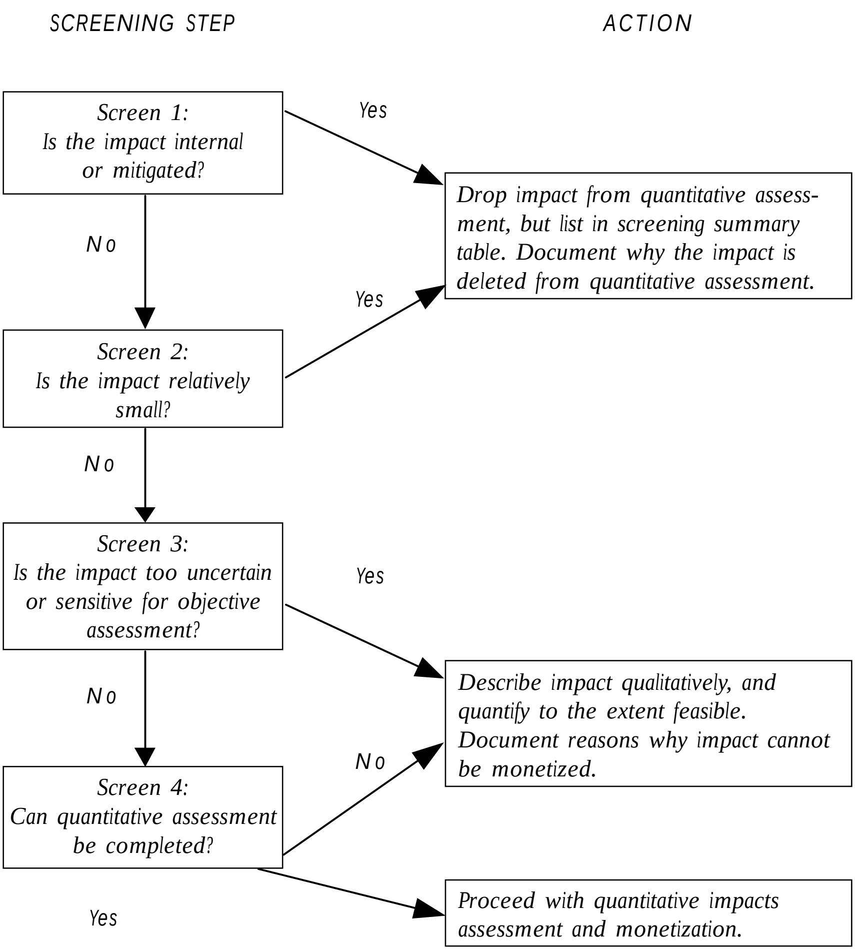
II. Steps in Economic Evaluation of Environmental Impacts

Economic evaluation of environmental impacts is important in project identification and preparation to ensure that development projects account for a nation's overall environmental quality. In addition, project components—or the way in which the basic project is formulated—can often enhance environmental quality. That is, project alternatives often vary in their economic and environmental impacts and the key to good project planning is to recognize these differences. Economic evaluation of such variations in the early stages of project identification and preparation provides important information to improve the quality of decision-making. The fuller economic evaluation of the environmental impacts of selected projects also allows for a more complete assessment of a project's social costs and benefits. A general procedure for economic evaluation of environmental impacts is presented in Figure 3.[13]

According to Screen 1 of Figure 3, if environmental impacts are internalized or mitigated, specific monetization of these environmental impacts is not required because the impacts are already part of project costs (or benefits). A good EA report should include a section on all such aspects

[13] *This figure is taken from ADB's Economic Analysis of Environmental Impacts: A Workbook (1996).*

Figure 3. The Impact Screening Process



Source: ADB, 1996.

of the project. Equally important is for EAs to present data on impacts and not just the quantity of emissions.

Screens 2 and 3 of Figure 3 reflect those instances in which a qualitative assessment and documentation is important. Screen 4 refers to the second purpose of economic evaluation of environmental impacts wherein an assessment of those environmental impacts that can be quantified is completed. At least six tasks need to be completed in the economic evaluation of environmental impacts of a project:

1. Determine the spatial and conceptual boundaries of the analysis (the accounting stance).

2. Identify the environmental impacts and their relationship to the project.

3. Quantify the environmental impacts and organize them according to importance—the impacts should be described qualitatively if they cannot be expressed in quantitative terms.

4. Choose a method for economic evaluation.

5. Perform economic evaluation (determine monetary values) of environmental impacts.

6. Set an appropriate time frame, make necessary conversions (e.g., economic values) and perform the extended cost-benefit analysis.

The boundary of the economic evaluation of environmental impacts analysis refers to the conceptual and physical limits of the analysis. It may consider on-site and off-site environmental impacts that are consequences of project activities. Another consideration is the type of goods and services that should be included in the analysis. The complexities of a project's environmental impacts may cause some difficulty in establishing the spatial and conceptual boundary of the economic analysis. The general rule is to start the analysis with directly observable and measurable impacts.

A successful EA report should provide the required information for economic evaluation of environmental impacts. The output of tasks 1, 2, and 3 is a list of all possible environmental impacts of the project. Thus, the EA should identify and completely document all impacts, and it should provide sufficient quantitative and qualitative descriptions. This list will then provide the basis for the economic evaluation (task 5).

Assessing environmental impacts in monetary terms is often the most difficult part of the whole exercise analysis. Monetization requires the use of valuation methods appropriate to the environmental impacts being investigated. Choosing the appropriate valuation methods itself is a difficult task requiring ingenuity and expert judgment from economists and environment specialists. Task 6 includes the incorporation of the economic values of environmental impacts which were generated, into the project level economic analysis.

Sound economic analysis of projects requires the identification of project costs and benefits by comparing the situation without the project and the situation with the project. The with- and without-project scenario is different to the before- and after-project scenario. Distinguishing before- and after-project, from with- and without-project is important in the economic evaluation of environmental impacts. This is because often, environment specialists tend to undertake the EAs of a project based on the before- and after-project scenarios. The before- and after-project scenarios do not allow an analyst to examine a project in view of the expected changes without the project.

It is incorrect to assume the without-project scenario as the status quo, unless it is the actual situation that would be warranted. Regardless of a proposed project intervention, there could be many changes taking place. These include ecological changes, changes induced by socioeconomic situations in the country or region, or certain changes that may take place due to transmigration in the project area. These changes are likely to take place regardless of the proposed project intervention. The analyst is supposed to use such expected changes as the baseline against how the proposed project is likely to change the trends and conditions of project-related activities. In that context the difference between with- and without-project scenarios must be taken into account. The difference between these two situations constitutes the environmental impacts of investments and other project activities such as construction and civil works, policy changes or capacity building activities. Technical experts involved in preparing EAs need to be advised properly to assure the quality of the information gathered under EA.

Another important concept in the identification of project cost and benefits is the distinction between nonincremental and incremental outputs and inputs. The distinction is important because of the difference in valuation. Nonincremental outputs are project outputs that substitute for existing production. For example, a new hydropower plant may in part substitute for existing production. Incremental outputs are project outputs that expand supply to meet new demand. An example of an incremental output is the growing demand for electricity due to the decline in generation and transmission costs or the increase in consumer's income. Incremental inputs are project demands that are met by an increase in total supply of the input while nonincremental inputs are project demands that are met by existing supplies, thus competing supplies away from existing producers.

The environmental impacts of these two parts must be analyzed carefully. Environmental impacts of a nonincremental nature can be taken as the difference between the existing pollution level, the likely without-project pollution, and with-project pollution levels. For example, suppose the present level of SO_2 is X, and it will change over time to X+Y. If these levels change in the with-project scenario to $X-X_1$ and $(X+Y)-X_1$, then the difference between these two levels must be taken as change in SO_2 level due to the nonincremental part of output. If the proposed project promotes new technology, cleaner fuel and industrial restructuring, the expected environmental impact (e.g., SO_2) due to the nonincremental part of the project can often lead to environmental improvement.

The incremental part of environmental impacts must also be assessed using with- and without-project scenarios. Environmental impacts due to the incremental part is often added to the ambient environment. Added emission would impose a cost to the project. However, for an environmental cleanup project, even this component can be a reduction of emissions. These issues need to be given due attention in proper economic evaluation of environmental impacts.

The methodology of valuing the costs and benefits of environmental changes is still evolving. In this regard, some general guidelines for conducting economic evaluation of environmental impacts of development projects should be observed in order to assure consistency, transparency, and credibility. Box 6 defines some concepts in project economic analysis. The Bank's *Guidelines for the Economic Analysis of Projects* (1997) suggest the following steps:

1. Start with the most obvious and easily valued environmental impacts. First, select project effects that have directly measurable production changes that can be valued in terms of market prices. An example might be the changes in fish or crop production due to diversion of water for a hydroelectric power project.

2. Always consider both the benefits and the costs of development projects. A clear distinction should be made between benefits (or costs avoided) and costs (or benefits foregone) as these will constitute the reference point from which changes are measured. For instance, the value of a stream-regulation structure should include as a cost—the capital costs, operating costs, and maintenance costs. The benefits may then be reckoned as the cost of flooding damages avoided by the project.

3. Economic analysis should be done so that it is clear that one is comparing the situation "with the project" versus the situation "without the project." Project alternatives should also be considered.

4. All assumptions (biophysical, social and economic) in the economic evaluation of environmental impacts should be clearly stated.

5. Prior to the integration of monetized environmental values, the values should be converted into economic values using appropriate conversion factors. Selection of conversion factors will vary according to the valuation technique, and the source and

Box 6. Concepts on the Valuation of Economic Costs and Benefits

Once the costs and benefits of a project are identified and quantified, they should be valued according to a common criteria. Costs and benefits should be valued in constant prices, or in terms of the prevalent price level at the time the project is appraised. In an economic analysis, market prices are adjusted to overcome various distortions. This is the general premise behind the following concepts:

Shadow price. *When market prices are adjusted to account for the effects of government intervention and market structure, the result is shadow prices. Shadow prices reflect the expected returns for capital (or other resource inputs) that might otherwise be invested in other productive areas. The shadow price reflects the real opportunity costs.*

For project outputs, the shadow price is based on the supply price, the demand price or a weighted average of the two. Where project output is nonincremental, or where it substitutes for alternative forms of supply, then the shadow price is based on the supply price of these alternative forms of supply—on the market price, less production taxes, plus any subsidies on the alternative supplies. This supply price in turn must be adjusted for the effects of government intervention and market structure on the inputs going into the alternative production. Where project output is incremental, where the project provides additional output compared to the without project case, then the shadow price is based on the demand price for that output—on the market price inclusive of any consumption tax and exclusive of any subsidy falling on the buyer. This demand price also must be adjusted for the average difference between economic and market prices.

Shadow wage rate factor (SWRF). *The economic price of different categories of labor can be expressed in relation to full wage*

type of information used. Some valuation methods can directly generate economic values.

III. The Case Studies

The case studies that follow illustrate the value of using many of the methods described in early chapters to undertake more complete analyses *of the same category of labor to form the SWRF. The SWRF for surplus rural labor is the ratio of the opportunity cost of rural labor plus the economic costs of migration to the project wage for surplus labor. Similarly, the SWRF for scarce labor is the ratio of its economic and financial price. In each case, the supply price of surplus labor and the demand price of scarce labor have to be adjusted for the general level of distortion in the economy.*

Shadow exchange rate factor (SERF). *The shadow exchange rate is the weighted average of imports and exports in domestic prices to the border price equivalent of the same good. The economic price of foreign currency—the shadow exchange rate—rather than the actual price of foreign currency—the official exchange rate—should be used in the economic evaluation of goods and services. The SERF is calculated as the ratio of the shadow exchange rate to the official exchange rate. It is applied to all outputs and inputs, including labor and land, that have been valued at border price equivalent values.*

Standard conversion factor (SCF). *The SCF is simply the inverse of the SERF. It represents the extent to which the border price equivalent values, in general, are lower than the domestic market price values. It is applied to all project items valued at their domestic market price to convert them to a border price equivalent value. Estimation of the SERF and SCF can be done from time to time on a country basis.*

Conversion factor (CF). *A CF is the ratio between the economic price value and the financial value for a project output or input. The ratio can be applied to the constant price financial values in project analysis to derive the corresponding economic values. CF can be calculated for: (i) specific project items, for example, the main outputs and inputs; (ii) groups of typical items, such as petrochemicals or grains; and (iii) the economy as a whole, as in the SERF or SCF.*

Source: ADB, 1997.

of proposed projects. Except for the case on wastewater treatment in Thailand, all cases are ADB-approved Projects. Each of the case studies will, in general, have the following information:

1. Project background showing the project in the context of the country's economy, policies, and environmental management strategy (These are extracted from ADB documents);

2. project details showing the dimensions of the project and other essential details;

3. analytical methods describing the various procedures for valuing environmental impacts of the project;

4. results and discussion showing the environmental impacts and the values obtained from the economic analysis; and

5. notable aspects highlighting several essential aspects of the project and its economic evaluation of environmental impacts.