Environment and project appraisal

Chapter 7

Introduction

Environmental appraisal of a project is a process for identifying and evaluating the potential benefits as well as adverse impacts of a project on the surrounding environment. It provides a clear, well-structured and rational analysis of the consequences of proposed actions, and assists in selecting the most environment-friendly option.

Project types

- Projects may be divided broadly into two types, viz., production-oriented and service-oriented.
- **Production-oriented** category includes chemical plants, metal industry, refineries and cement plants. These projects are involved in transforming natural resources to saleable goods and have direct impact on the environmental and ecological balance.
- **Service-oriented** projects involve rendering various services, such as education, health, law, defense and land reforms. These categories of projects do not have an immediate impact on the environment.
- Service-oriented projects may create far-reaching outcome in the future on values, lifestyles and social links leading to promoting consumerism in the society and consequently indirectly encouraging manufacturing (production-oriented) projects. Thus, **there is a link between the two types of projects.**

Environment and environmental issues

World Bank’s broad definition of **environment as ‘The natural and social conditions surrounding all mankind, including future generations’ is pertinent in this context** (World Bank, 1992, quoted by Peter Abelson).

Main environmental issues:

The aspects concerning impact of a project on the environment which should be considered prior to discussion of the main issues may be broadly identified as follows:

- The existing environmental and socioeconomic conditions of the site;
- Effects of the proposed project on these conditions;
- Examination of the impact of the proposed project vis-à-vis the existing environmental regulations. Any impact that exceeds the regulations should be eliminated to avoid environmental hazard.

Environmental resources as public goods

classified as a pure public good as it possesses all three characteristics of a public good

- **non-rivalry in consumption,** implying zero opportunity cost of consumption in the sense that one person's consumption does not affect the availability of the good for others;
- **non-excludability by producers,** implying that the suppliers cannot exclude any consumers or other producers who want access to the good; and
- **non-excludability by consumers,** implying that the consumer cannot choose whether or not to access or consume the good.

Environmental resources as public goods

A **public environmental good** is the air we breathe.

Unregulated competitive market forces to result in the over-exploitation of natural resource stocks, such as fish stocks. An example of a **semi-public environmental good** is the common.

Externalities and environment

Externalities arise where there is no market connection between those taking an action, which has consequences for material welfare, and those affected by that action.

Negative externality example: the runoff of nutrients and chemicals from irrigated farmlands into a river resulting in downstream pollution damage. The costs are borne by others, such as the fishers or tourists whose benefits are determined by the quality of the water downstream and perhaps at the adjacent coast where there might be a coral reef. In other words the costs are external to the person who causes them and she has no direct financial incentive to avoid making them.

Positive externality example: if the nutrients in agricultural run-off stimulate the growth of fish stocks, the fishers may benefit from larger catches but the farmers who provided the extra nutrients do not.

Total economic value

Environmental resources contribute value not only to those who use the resource, but also to non-users, who may value the conservation of the resource. The value to non-users could arise for reasons of altruism – the value to one individual from knowing that the asset can be used and enjoyed by others – or for reasons of self-interest – the value to an individual from knowing that the asset will continue to be accessible in the future.

For instance, you may be unsure whether you will ever be able to visit Australia's Great Barrier Reef, yet you might feel a significant loss of value if it and the ecosystem it supports were destroyed.

Total Economic Value (TEV) is the term used by economists for describing the range of use and non-use values of a resource, where:

TEV = Direct use value + Indirect use value + Quasi-option value + Existence value + Bequest value

Total economic value

Direct Uses include the most obvious and important market-based uses such as fisheries (a consumptive use that can include subsistence, artisanal inshore fishing, recreational fishing, and large-scale commercial fishing) and tourism (mainly a non-consumptive use, although it usually includes commercially organised recreational fishing trips). Other consumptive uses can include coral mining for building materials, as well as shell and coral collecting.

Indirect uses include regulatory functions such as storm surge protection, fish nursery and food chain regulation, and, where mangroves form part of the reef's ecosystem, wastewater treatment.

Option value is the value we attach to keeping alive the possibility of one day being able to benefit from the resource. Since it is the value attached to potential use, its current "non-use" value is attributable to its potential use value in the future, e.g., possible future discoveries and bio-technological advances to be gained from ecosystems, which will be lost if we allow irreversible damage to occur.

Where the individual's satisfaction arises purely from the knowledge that the environmental resource will continue to exist it is labeled **existence value**. Where the individual's satisfaction is attributable to the continued existence of the resource for the future possible benefit of others, either known or unknown to them, it is **bequest value. Example: biodiversity (people do not use or consume them, e.g., panda, whale, rainforest)**

Contingent valuation

A hypothetical situation for the use of an environmental resource is described and the interviewees are asked, contingent on the existence of the situation described to them, how much they would be willing to pay for the use and/or non-use services of the resource, such as recreation or existence.

The most commonly used stated preference method is the Contingent Valuation Method (CVM). CVM uses surveys to ask people directly how much they would be willing to pay for a change in the quality or quantity of an environmental resource.

The resulting sample mean (or median) WTP is then multiplied by the relevant population to estimate total WTP. CVM is, in principle, a relatively simple method, although state-of-the-art applications have become quite complex.

One of the main advantages of CVM, like other stated preference methods, is that it is capable of estimating both use and non-use values and it can be applied to almost any situation.

Contingent valuation

CVM is susceptible to a number of response biases. These include:

- **hypothetical market bias:** where responses are affected by the fact that it is a hypothetical and not a real market choice, and individuals may overstate their true preferences for an environmental good, or, where they simply want to please the interviewer – "yeah-saying";
- **strategic bias:** where respondents believe that their survey response bids could be used to determine actual charges or expenditures they may understate or overstate their true WTP;
- **design bias:** the way in which the information is presented to the respondents can influence the individuals' responses, especially concerning the specification of the payment vehicle, raising the question of how far preferences can be considered exogenous to the elicitation process; and,
- **part-whole bias:** individuals have been found to offer the same WTP for one component of an environmental asset, say, recreational fishing in one river, as they would for fishing in the entire river system.

Contingent valuation

Options	No. of hh	Sample WTP/hh ($)	Total WTP ($)	Project cost ($)	Net benefit ($)	Net benefit/$cost
Option 1: improve river quality to a level suitable for recreational boating	200	12.5	2500	2000	500	0.25
Option 2: improve river quality to a level suitable for recreational fishing	200	17.5	3500	3250	250	0.08
Option 3: improve river quality to a level suitable for swimming	200	25	5000	4250	750	0.18

If you rank the options in terms of: (a) **maximum aggregate net benefit, you will rank as option 3 > option 1 > option 2** and in terms of (b) **maximum net benefit per $ invested, you will rank as option 1 > option 3 > option 2**. Option 2 always comes in last.

Hedonic pricing

We can use the behaviour of consumers as revealed in other related markets to infer their preferences for the good in question. **The underlying proposition is that an individual's utility for a good or service is derived from the attributes of the good or service in question, and that it is possible to distinguish the value of each attribute.**

For example, if the quality of an environmental resource, such as air or water, is considered an important attribute entering our choice of house, **variations in air or water quality should directly affect relative house prices.** For instance, the value to the resident of property frontage on a waterway could be affected by the quality of the water. If we compare house prices in polluted vs. non-polluted situations, with controls for price differences attributable to other factors, we should be able to measure the dollar value of differences (and changes) in water quality. **When all other effects have been accounted for, any difference in property price is attributed to the differential water quality. This is called the Hedonic Pricing Method (HPM).**

Hedonic pricing

In which area, will house prices be higher?

Hedonic pricing

To apply the HPM in this instance, data on house prices are gathered to estimate a model that explains variations in house price in terms of a whole set of attributes, one of which is the environmental attribute in question.

For example, observed house price can be modeled as a function of house and site characteristics, neighbourhood characteristics, and water quality characteristics. This is the hedonic price function which can be expressed as:

$$P_h = P(S_i, N_j, Q_k)$$

where, P_h = house price
S_i = site characteristics
N_j = neighbourhood characteristics
Q_k = environmental quality characteristics
and, $i = 1\ldots m$; $j = 1\ldots n$; and $k = 1\ldots 1$

Firstly, calculate an implicit “price” or value for the environmental attribute in terms of its marginal influence on house prices.
Secondly, estimate a demand curve for the environmental attribute, using the environmental price and quantity information obtained from the first stage and allowing for socio-economic differences among the sampled house buyers so as to isolate the effect of water quality from other factors, such as income, which affect house prices.

Hedonic pricing

The main advantages of the HPM are:

- It is conceptually intuitive.
- **It is based on actual revealed preferences.**

The main disadvantages of the HPM are:

- It requires a relatively high degree of statistical knowledge and skill to use.
- It generally relies on the assumption that the price of the house is given by the sum of the values of its individual attributes, implying a linear relationship among attributes.
- It assumes that there is a continuous range of product choices containing all possible combinations of attributes available to each house buyer.