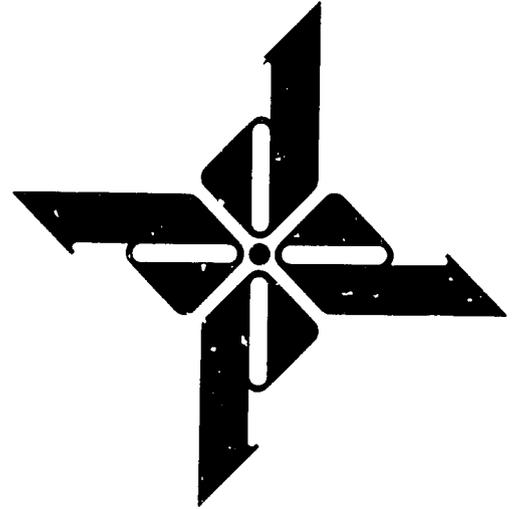


PN- AAK -362

ISN 13547

TAPE COMPLEMENT



**COST-BENEFIT
ANALYSIS AND
PROJECT DESIGN**

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This material has been produced cooperatively by the
Training Studies and Development Division,
United States Agency for International Development and
PASITAM, the Program of Advanced Studies in Institution Building
and Technical Assistance Methodology of
MUCIA, the Midwest Universities Consortium for International Activities

 PASITAM: Indiana University, 400 E. Seventh Street, Bloomington, Indiana 47405 U.S.A.

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**Printed in the United States of America
1980**

Cost-Benefit Analysis and Project Design

Choosing among alternatives—perhaps the most characteristic human act—is the essence of project design. Simple or obvious choices generally yield to that blend of experience and intuition called common sense. But complex problems of choice (or formal requirements for analysis) establish the need for a systematic search for the best alternative, sometimes involving structured analytical tools. Cost-benefit analysis is one of these tools. It is a method, an approach, or a set of procedures for appraising the financial or economic efficiency of a proposal.

The word “analysis” literally means to separate a complex aggregate into its simple components. The videotape program presents the process of cost-benefit analysis in terms of its five basic elements, or stages. (These “stages” are not a rigid sequence of steps; rather, they are somewhat arbitrary divisions made to better understand the process in its different dimensions.)

The five stages of cost-benefit analysis are introduced through a case example based on a rural access roads project in Kenya. Then the principles and logic behind the process are covered. A matrix (on pp. 2-3) arrays the five steps—how they are presented in the videotape and where and how they are covered in other parts of this module.

The Five Dimensions of Cost-Benefit Analysis

1. Set aims and boundaries

This first step is obvious and seems simple. Often it isn't. Clearly, costs and benefits cannot be identified unless the project's aims (and something of the broader values that inform them) are known. Similarly, setting

boundaries—temporal, spacial, and social—is essential to any quantitative analysis. The problem is that projects seldom do only one thing. They tend to have effects at odds with objectives and outside any stipulated boundaries. When these *externalities* are significant, any cost-benefit analysis that ignores them has limited validity. But deciding how far—and how—to account for externalities calls more for judgment than for quantitative tools.

A related issue is the central distinction between *financial* and *economic* cost-benefit analysis. Financial analysis usually refers to a limited system—a farm, a company, a single public agency—and the aims it recognizes are all expressed in money terms. Economic analysis tests for efficiency in terms of a broader system and often incorporates criteria that cannot be covered by money prices. This distinction is a theme that runs through this module.

2. Find and explore alternatives

This refers to the technical, engineering, and financial investigation that determines what the options are and what each implies, in terms of the resources required and the effects that can realistically be expected. This stage establishes the basis for what follows—translating this technical information into an organized economic judgment.

Implementing a project means using resources. The men, equipment, material, and management required will not be available for some other use. The goal is to make sure that this “other use”—the *opportunity cost* of the project—is less valuable than the project itself. The *idea* of opportunity cost is powerful and broad in scope, but the *specific* opportunity cost of a given

Dimensions of Cost-Benefit Analysis	1. Set aims and boundaries	2. Find and explore alternatives
Summary	<p>Setting aims and boundaries establishes the terms of analysis. The <i>aims</i> of a project determine how costs and benefits are defined and distinguished. The <i>boundaries</i> determine what costs and benefits are considered in the analysis.</p>	<p>Finding and exploring alternatives means gathering and organizing the technical information that is the raw material for financial and economic analysis. There are two aspects at issue here: (1) <i>alternative ways</i> to reach a given objective, and (2) <i>alternative uses</i> of resources a project would require.</p>
In the Kenyan Rural Roads Project Example	<p>The <i>aim</i> was to build a specified number and grade of roads in order to provide rural Kenyans with better access to markets and social services, and thus to encourage rural development.</p> <p>The boundaries set for the project were six districts in two Kenyan provinces.</p>	<p>At the stage considered here, the alternative ways of building the roads were narrowed to a capital-intensive approach using imported equipment and a more labor-intensive version involving many local workers.</p>
Special Terms and Concepts	<p><i>Financial analysis</i> refers to a limited system, and its aims can be expressed and measured in terms of money.</p> <p><i>Economic analysis</i> tests in terms of a view of efficiency that goes beyond financial profit. It weighs costs and benefits as they affect a broader system. Public projects are usually evaluated in financial <i>and</i> economic terms.</p> <p><i>Externalities</i> are project effects that are outside the boundaries specified for the project.</p>	<p>The <i>opportunity cost</i> of a choice is the value of the next best use of the resources that will be tied up by that choice.</p>
Relevant Selections in Reader	<p>Sassone and Schaffer, "Performing a Cost-Benefit Analysis," page 11.</p> <p>Little and Mirrlees, "Project Appraisal and Planning for Developing Countries," page 43.</p> <p>Marglin, "The Essentials of the UNIDO Approach to Benefit-Cost Analysis," page 56.</p> <p>Poy and van der Tak, "A New Approach to the Economic Analysis of Projects," page 64.</p>	<p>Delp, "Cost-Effectiveness Analysis," page 33.</p> <p>Little and Mirrlees, "Project Appraisal and Planning for Developing Countries," page 43.</p> <p>Donahue, "Cost-Benefit Analysis and Project Design," page 1.</p>
In the Workbook Case Exercise	<p>Aims and boundaries are provided with background data for the case, both for financial and for economic analysis.</p>	<p>The technical features of the main alternatives are provided in background data.</p>

3. Value inputs and outputs	4. Summarize	5. Test
<p>Valuing inputs and outputs is the key step in judging the financial or economic soundness of a proposal. In <i>financial analysis</i> values are set by market prices. In <i>economic analysis</i> inputs and outputs may be valued in three ways: by market prices, by shadow prices, or indirectly.</p>	<p>Summarizing the results of quantitative analysis gives simple measures of a project's estimated worth in order to facilitate comparing alternatives and presenting results. Three summary measures are presented in this module.</p>	<p>Testing assumptions involves sensitivity analysis. This means changing the numbers that represent predicted inputs, outputs, discount rates, and so on, and then re-running the quantitative analysis to check the changes in the overall results. This highlights the relative importance of different factors.</p>
<p>Market prices were used for many inputs. Shadow prices were used for foreign exchange and unskilled labor. The roads were valued indirectly on the basis of the worth of the extra agricultural production they would encourage.</p>	<p>All three summary measures used showed the labor-intensive alternative to be superior to the capital-intensive option, under the terms set up for the analysis.</p>	<p>The rural roads project would be economically sound even with a 20% cost overrun and 20% lower benefits than predicted.</p>
<p><i>Market prices</i> are actual monetary costs and receipts determined by free exchange. <i>Shadow prices</i> are estimates of economic value used when market prices are distorted or otherwise unusable as measures of value. <i>Discounting</i> is a technique for neutralizing the time factor in valuing inputs and outputs. The <i>discount rate</i> is the annual percentage at which the perceived value expected in future years declines.</p>	<p>The <i>benefit-cost ratio</i> is discounted benefits divided by discounted costs. The <i>net present worth</i> is discounted benefits minus discounted costs. The <i>internal rate of return</i> measures the percentage yield of resources invested in a project. It is the discount rate that pushes the net present worth down to zero.</p>	<p><i>Sensitivity analysis</i> is a technique for plugging different values into quantitative analysis to see how varying key predictions and assumptions affect the overall results.</p>
<p>Little and Mirrlees, "Project Appraisal and Planning for Developing Countries," page 43. Marglin, "The Essentials of the UNIDO Approach to Benefit-Cost Analysis," page 56. McKean, "The Use of Shadow Prices," page 79. Ray and van der Tak, "A New Approach to the Economic Analysis of Projects," page 64.</p>	<p>Donahue, "Cost-Benefit Analysis and Project Design," page 1.</p>	<p>Sassone and Schaffer, "Performing a Cost-Benefit Analysis," page 11.</p>
<p>In the economic analysis section (Part II), the user takes background information, worksheets, and material covered in this module to develop and apply a system of shadow pricing in the case example.</p>	<p>In Part I, the user learns how to compute three summary measures. In Part II, each measure is used several times in the case example.</p>	<p>Since sensitivity analysis is simple in concept and time-consuming in practice, it is not covered in the workbook.</p>

choice can be hard to identify. Sometimes the lost opportunities are far removed from the project in time and distance. But any choice that uses resources has economic consequences somewhere. The real problem is not the *idea* of opportunity cost—which is just a label for a commonsense idea—but identifying and measuring the lost opportunities. Theoretically, the prices of the necessary resources should do this. Sometimes they don't. This point leads to the next dimension of analysis.

3. Value inputs and outputs

A project transforms resources into results. It makes sense if what comes out is worth more than what goes in. This fundamental question concerns *relative value*. How can it be answered? For *financial* analysis there is, in principle, no serious problem. When only financial criteria are involved, market prices are adequate measures of value. But *economic* analysis aims for a broader view of efficiency, and valuing inputs and outputs is the main issue. For any item there are three possibilities for setting values: using market prices (as in financial analysis), using *shadow prices*, or finding values indirectly.

When market prices reflect economic value, there is no problem: Use them. Yet, market prices may not work. Exchange rate regulations may make foreign exchange artificially cheap, inserting an import bias into project design. Minimum wage regulations may overstate the real value of unskilled labor and show its cost as higher than it really is in terms of production given up. Or, more generally, taxes and subsidies may affect the relative prices of goods in ways that convey little information—or misinformation—about their scarcity or productivity.

When price distortions are serious, economic analysis may call for estimating and using shadow prices. Shadow prices are estimates of real economic values and are meant to represent the prices that would exist in a perfect market. The problem is finding the right shadow prices (the book of readings covers shadow pricing in detail). Shadow prices are always hypothetical and usually reflect considerations of facts *and* values. The use of shadow prices is the most controversial area of economic analysis.

Some inputs and outputs have no prices at all, not even distorted ones. The output in the case study—a system of rural roads—is an example of an item that never enters the market. When there is no price to start from, setting values requires both economic logic and

educated guesswork. This topic has its own controversies and is covered in the reader. (Sometimes the figures that result from indirect valuation are also called shadow prices. Here a distinction is made: Shadow prices *correct* existing market prices; indirect valuation stands in for non-existent prices.)

Along with each input and output, one more thing must be valued—*time*. Costs and benefits occurring in the future are usually considered less valuable than costs and benefits right now (the reasons why are discussed in the reader). This concern can enter the decisionmaking calculations through the technique of *discounting*. The purpose of discounting is to express costs and benefits in different years in terms of their equivalent *present worths*.

4. Summarize

Cost-benefit analysis—financial or economic—includes several ways to compress the quantitative information gathered and processed into single measures. The three most important are covered in this module.

The *benefit-cost ratio* is simply total discounted benefits divided by total discounted costs. It is an estimate of “units” of output per unit of inputs.

The *internal rate of return* measures the profitability of a project, or the “yield” realized on the resources invested.

The *net present worth* is total discounted benefits *minus* total discounted costs. It indicates whether the project makes sense internally (whether the benefits exceed the costs) and also shows the absolute size of the project's net benefits.

The calculation, meaning, and uses of these measures are discussed in detail in the workbook.

5. Test

Cost-benefit analysis is always based on assumptions about the future. Prediction is usually a precarious activity, and everyone aims to minimize the risks involved. *Sensitivity analysis* is one strategy for managing uncertainty in cost-benefit analysis. This refers to a process of running through the quantitative analysis several times, while changing the numbers representing predictions to cover different points on the range of possibilities. Sensitivity analysis helps to identify the critical factors governing the project's economic viability. It lets project designers ask a series of “what if” questions on paper ahead of time, which is often wiser than waiting to see what happens in the project. Sensitivity analysis is a topic in itself; it is mentioned in this

module since it adds greatly to the power, flexibility, and realism of quantitative cost-benefit analysis.

Problems and Limitations

In principle, cost-benefit analysis makes sense. It tests the economic soundness of proposals and, with an eye to opportunity costs, aims at avoiding waste. But cost-benefit analysis has some built-in limitations:

There is the problem of *quantification*. Putting reliable, consistent, and realistic numbers on the whole range of costs and benefits of any project borders on the impossible.

Any cost-benefit analysis is *incomplete*. The actual decision to implement or not usually turns on environmental concerns, political priorities, and social considerations as well as economic soundness. Some approaches to cost-benefit analysis try to fit these other criteria into the cost-benefit framework and to compare them directly with economic concerns. These comprehensive methodologies can get complicated, and their worth is an open issue.

A third—and very basic—limitation is that cost-benefit analysis does not create information; it only processes it. And the information that goes into an analysis is always imperfect. Project designers never know all the possible alternatives, and they seldom have time to study in detail the options they do know. So cost-benefit analysis is always incomplete—some information is not considered—as well as imperfect—what *is* considered is always less than certain.

A final issue to consider is that cost-benefit analysis is not cost-free. It uses inputs—skilled manpower and time spent gathering data and presenting results. The outputs it produces are information for making choices. The “net worth” of the analysis depends on the opportunity cost of the resources required and on the quality, pertinence, and effects of the information produced. At some point, cost-benefit analysis is not worth doing.

This videotape presentation is an introduction to cost-benefit analysis. Other components of this module give a more detailed picture:

The *reader* contains ten selected readings and two essays that spell out the basic aims and approaches of cost-benefit analysis. It covers the idea of shadow prices and introduces three systematic approaches for setting them. It explains the key problems that have been mentioned here.

The *workbook* introduces and explains the quantitative procedures involved in cost-benefit analysis. It shows how each procedure works and presents a case example that offers a chance to develop some expertise in discounting, computing summary measures, and so on.

This material is meant to give a solid and usable introduction to the basics of cost-benefit analysis—knowledge that can be important for people involved in making choices about projects or in judging other people’s proposals and cost-benefit claims. Cost-benefit analysis is only a tool, and a limited one, but it is the best available means for applying economic logic to project design and thus for responding to the reality of resource scarcity.