

A CRITIQUE OF COST-EFFECTIVENESS

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Cost and effectiveness are the most important considerations in almost every public decision and in most private ones as well. Nevertheless, for the decisionmaker to base his decision on an analysis of these considerations alone, even though supplemented by his best judgment, can be risky. Cost-effectiveness analysis has major deficiencies as well as virtues; a critique asks that I bring these to your attention and suggest improvements.

One needs to be clear, however, as to what he is critiquing. I must not direct my comments toward public analysis in general and avoid discussing, for instance, the problems in selecting a discount rate or in deciding what factors to leave out or to include, for the difficulties with such questions are common to all analysis that seeks to give a decisionmaker some clue as to what action should be taken and are not found just in cost-effectiveness alone.

What do we mean or should we mean by cost-effectiveness analysis? One way to find out is by an empirical approach. To this end I set out to examine the abstracts of recently published papers indexed under cost-effectiveness. This didn't work out very well -- my sample was too small. The heyday of the cost-effectiveness study was sometime around 1962-1967. Since 1968, *Operations Research* has indexed only one paper under that heading. *International Abstracts* did a little better with about one per year for the last few years. Considering the widespread and frequent use of cost-effectiveness calculations, why so few? My conjecture is that today with emphasis given to considerations other than cost and effectiveness, the role of the cost-effectiveness study has changed.

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Let me define that role and a definition of cost-effectiveness will follow.

The cost-effectiveness study belongs to the class of activities that are carried on to generate and present information relevant to a particular issue in order to help a policymaker or decisionmaker. The aim is to improve the basis on which they exercise their judgment in the hope this will lead to a better outcome. These activities go by various names -- operations research, systems analysis, cost-benefit analysis, policy analysis, and so forth. The distinctions between them are fairly arbitrary -- at least the distinctions I make are. These distinctions are largely historical in nature, arising from their origin. They have a great deal in common; they all depend on economic theory and draw from the same stockpile of tools -- linear programming, computer simulation, operational gaming, and so on. With respect to inclusiveness, they form a hierarchy\* with operations research, narrowly defined, at the lower end. Broadly defined, as it is by this Society, operations research includes the entire class of activities and would thus be at the upper end.

Originally, or traditionally, operations research sought no more than to do something better, to use scientific methods to get the most out of the available resources. System analysis grew out of operations research; it sought, and still seeks, to do all that operations research did, but, in addition, it sought to see that the right thing was being done and not only better but more cheaply. Policy analysis, as I define it, came next. It seeks to do all that systems analysis sought, but to see that it is done with equity. Hence the hierarchy. Systems analysis may be considered to encompass operations research (in its original historical concept), adding economic considerations and inquiry into goals and their interaction with means. Next, policy analysis, still broader, encompasses systems analysis, adding a concern for the distributional effects or impacts of a policy or decision and putting considerable emphasis on problems of acceptance and implementation.

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\* This scheme was suggested to me by Frank Trinkl.

In the above scheme, cost-effectiveness belongs with systems analysis; it involves economic considerations but is not concerned with distributional impacts. It may be regarded as a tool or procedure or as an incomplete form of systems analysis in which the alternatives or possible choices are compared in terms of just two of their possible characteristics -- the cost of the resources required to implement the chosen alternative and its effectiveness, the extent to which that alternative will attain the desired objective. Effectiveness is measured on a scale that is either directly related to the objective or a good proxy for it.

Cost-effectiveness is the most commonly used analytic procedure for the comparison of alternatives and with good reason. It makes the comparison in terms of two factors of crucial interest to every decisionmaker -- how much he will have to spend and how far it will go in getting him what he wants. It is almost powerful enough to stand alone, provided we can find a single scale on which the effectiveness in attaining the objective of all alternatives can be satisfactorily measured and provided "other" considerations are not too significant. However, since costs are in one dimension and effectiveness in another, a value judgment is required to decide on the scale of the effort.

In 1966, when the Department of Defense was under attack for its widespread use of cost-effectiveness, the House Armed Services Committee remarked\*, in the words that Oscar Wilde used to define a cynic, that the DoD dedication to cost-effectiveness "raises the specter of a decisionmaker who ... knows the price of everything and the value of nothing."

Let me take that statement as my text. It calls attention to the defects I find in cost-effectiveness -- that price is equated to cost; that effectiveness is equated to value; and that cost and effectiveness together are assumed to be all one needs to know to choose among alternatives.

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\* House Report 1536, May 16, 1966.

First, effectiveness doesn't necessarily measure value, even in the simplest of cases.

Consider a single unambiguous goal, say to improve garbage collection. To compare alternative systems we need a scale on which to measure their effectiveness in achieving that goal. But there is no obvious scale to measure better garbage collection and we have to use a proxy -- a measure such as the percentage of blocks without health hazards or the reduction in the number of fires involving uncollected solid waste, rodent bites, or valid citizen complaints. All these unfortunately treat just an aspect, not the full value of garbage collection. In practice, people have done even worse, using efficiency measures -- number of tons collected per man-hour -- or a workload measures -- tons of waste collected -- that indicate nothing about the quality of the work.

If the objectives are multiple or if (what amounts to the same thing in practice) the alternatives aim for the same ultimate objective by seeking to attain intermediate targets that are radically different, it may be impossible to find a single scale on which to measure effectiveness. Thus cost-effectiveness is not of much help in telling us how to allocate our resources among such diverse alternatives as law enforcement, education, or defense.

Now cost; in cost-effectiveness, it is taken to be price.

Cost, more properly, is the loss or penalty incurred by selecting an alternative -- the "opportunities forgone" as the economists say -- the price is merely what we have to pay to implement it. Cost-effectiveness is an attempt to determine whether a program or activity is worthwhile by pricing the inputs -- what must be paid in money, resources, time and manpower to implement and maintain an alternative. But there are other penalties or losses that may accompany the alternative -- it may, for instance interfere with something else we want or bring undesirable consequences to other people. These costs are not accounted for in cost-effectiveness.

Costs are thus associated with both inputs and outputs. In the decision to choose a freeway route there are not only input costs to consider -- planning, right-of-way, material, labor, equipment rental,

and so on but other costs that follow as a consequence. Some of these latter may be borne by the users -- when completed the new freeway will attract traffic, possibly so much so that the motorists who use it may impose costs on themselves -- in delays and in additional fuel. Others must be borne by the state that built the road -- merchants in the neighborhood may be no longer visited and property values and tax receipts may go down. And finally there are costs that may be borne neither by the users nor by the public entity -- the costs suffered by people whose access is cut off by the limited access road and by those who suffer from fumes and noise.

Now, finally, consider the combination. Even if we can compute the cost and effectiveness of each alternative for the full range, we are still faced with the problem of how to choose, unless we have additional information. We need some way to set the scale of the effort -- either a cost we must not exceed or an effectiveness level we must achieve. The ratio of cost to effectiveness is not a satisfactory guide even when we are totally uninterested in the scale of effort.

One other defect. The people who must pay the costs of a decision and those who stand to gain may not be the same and may differ from alternative to alternative. Cost-effectiveness does not provide a way to take these distributional impacts into account. They may or may not be important to the success of the decision or merely as a matter of equity but the decisionmaker would like more than his intuition to guide him here.

To sum up, cost-effectiveness calculations leave a great many considerations that may be important to the decision to be handled outside of the analysis proper, often by the uninformed judgment of the decisionmakers.

Some people feel that the way to take this load off the decisionmakers and avoid all the difficulties with the scale of effort, multiple objectives, spillovers, distributional impacts and other elements that cost-effectiveness doesn't handle, is to turn cost-effectiveness analysis into cost-benefit analysis.

Cost-benefit analysis is a structure that can weave together all the elements in a decision. It associates with each possible choice

all the inputs and outputs, all the positive effects and all the costs, including the spillovers, condensing everything going into a proposed undertaking and all its results into a single number. Even the distributional impacts can be handled by weighting the cost and benefits going to different groups differently.

It does this, however, by a great deal of arbitrary quantification, often by means and arguments that are at least questionable. More importantly, particularly where values are concerned (which is almost everywhere) its results are based on judgments by the wrong people -- that of the analysts, not that of the responsible decisionmakers.

There are other objections\* to a cost-benefit approach but I'll mention only one. Under its criterion the role of government would be to provide only those services that would be profitable if all the benefits could be cashed in at their value to society. But the traditional role of government has not been that -- it has been to provide society with goods and services it wanted but which no one found profitable enough to supply.

If cost-effectiveness leaves out too much and cost-benefit analysis does little more than result in changing clear statements into suspicious indices, is there a better approach? The most informative way for me to find out whether something I would like to have is worth its cost to me, is to present me with a full and honest description of what I would be getting (including all the negative aspects and spillovers) and what I would have to give up to get it. A practical way of presenting all these things to a decisionmaker has been given the name "system impact assessment" by Bruce Goeller.\*\* It's essence is not one but many calculations of a cost-effectiveness type in which the cost is not necessarily expressed in dollars. The idea is to display the consequences that ensue from the decision to select one of the alternatives -- the costs, benefits, spillovers, risks, segments of society

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\* See E. J. Mishan, *Cost-Benefit Analysis: An Introduction*, New York, Praeger Publishers, 1971 and its review by Doris M. Iklé, *Policy Sciences*, V, No. 1, March 1974, p. 122.

\*\* Goeller, B. F., "System Impact Assessment: A More Comprehensive Approach to Public Policy Decisions," R-1446-RC, The Rand Corporation, Santa Monica, California, to appear.

affected, and so forth -- in terms of the natural units commonly used to characterize them. Thus in a transportation comparison we might have as costs tons of pollutants released, acres of land taken for a right-of-way, and, by income class, households displaced as well as investment and subsidy required and taxes lost in dollars. Some impacts may, on occasion, be described in natural language. The ideal display presents the entire spectrum of consequences both good and bad, with an indication of who gets the benefits and who pays the costs. The task of ranking is then up to the decisionmakers. This is, of course, not a new idea and many of you do just this when you practice what you today call cost-effectiveness.

Now to summarize.

It is important that a decision take into account all the relevant information whether or not this information lends itself to inclusion in formal analysis. All forms of analysis have their virtues and drawbacks. None can take into consideration or present all the information. A single cost-effectiveness calculation leaves out a great deal but it does emphasize the aspects that are usually the most important and of greatest interest to the decisionmaker. It gives excellent results provided the alternatives are reasonably similar and seek the ultimate goal through the same target so that their effectiveness in attaining that target can be measured on the same scale. Cost-benefit analysis can take into account many more aspects of a decision but it does so at the expense of emphasis and through a great deal of heroic quantification that is extremely arbitrary and, where values are concerned, is based on the judgment of the wrong people. Multiple cost-effectiveness calculations, including some that do not translate all costs into monetary units obviously go farther in taking things into account than the traditional single comparison that we often think of when we say cost-effectiveness analysis. It has the additional advantage that it not only forces the judgment on the right people but calls their attention to which judgments are needed. The only drawback I see is that it can force so many judgments that those who must make them may perceive the effort as no analysis at all.