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# BENEFIT-COST ANALYSIS AND WATER-POLLUTION CONTROL IN THE UNITED STATES: A NOTE\*

## A HISTORICAL SURVEY

Benefit-cost analysis and the embodiment of its results in a benefit-cost ratio had their origins in United States Federal Government practice, having been used by the Army Corps of Engineers for over fifty years in connection with river and harbor improvements. They constituted an administrative device which owed nothing in its origins to economic theory, and until the early nineteen-thirties were applied only to tangible costs and benefits. However, when the Great Depression led to attempts to revive the national economy by massive public works, the evaluation techniques currently in use appeared to be unduly restrictive. In 1934 the Water Resources Committee of Secretary Ickes' National Resources Board recommended the extension of benefit-cost analysis to intangible factors, and in particular to take into account the benefits of employing "creatively" labor that might otherwise be idle and maintained at public expense. In 1936 the Flood Control Act empowered the Federal Government to participate in flood control schemes "if the benefits to whomsoever they may accrue are in excess of the estimated costs, and if the lives and social security of people are otherwise adversely affected." Thenceforth the practice of making benefit-cost analysis, and with it an increasing attention to intangibles, more particularly on the side of benefits, spread over the whole field of water development.

No attempt was made before World War II to secure consistency in the practices of various agencies, and when large-scale economic projects, calling for high federal expenditures, were resumed after the war, the methods of analysis employed were found to be widely divergent. Moreover, with large-scale unemployment apparently a thing of the past, the attitude of Congressional and public opinion became increasingly critical of inconsistencies all of which seemed calculated to increase the burden on the federal taxpayer. From about 1950 onward, professional economists began to take a sustained interest in benefit-cost

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questions, and a substantial literature developed. Controversy centered mainly on indirect or secondary benefits and the extent to which intangibles might be admitted.

In 1946 the Federal Inter-Agency River Basin Committee appointed a sub-Committee on Benefits and Costs for the purpose of formulating mutually acceptable principles and procedures. This Committee still exists under another name. In May 1950 it produced an interim report—commonly known as the “Green Book”—which was welcomed by economists as a step forward in the rational treatment of benefit-cost problems. But this did not end controversy between agencies or criticism from outside commentators, and it seems fair to describe the work of the Committee as having reached an impasse. This is principally, perhaps, because no agency is willing to give up practices which ensure it “satisfactory” benefit-cost ratios—i.e., in excess of unity. The Bureau of Reclamation more especially has come under criticism for illogical methods of analysis, but no agency has been immune from attack. Contrariwise, efforts by the Bureau of the Budget to secure uniformity have themselves aroused Congressional criticism as “usurpation of the legislative power,” but the expressed intention of the Senate to promulgate fresh criteria has so far not materialized.

#### CRITIQUE OF CURRENT APPROACH TO BENEFIT-COST ANALYSIS

Most unofficial criticism of the impasse into which officially employed benefit-cost analysis has fallen suggests that political factors are to blame and that but for these the analysis would provide a satisfactory means of evaluating water projects. This belief does not appear to be warranted. The pronouncements of the sub-Committee on Benefits and Costs, as embodied in the “Green Book,” are in principle unsatisfactory because they purposely eschew any practical administrative reference, and may thus be stigmatized as academic: moreover, even on their own chosen plane they display serious weaknesses of treatment. It is advised, for instance, that agencies should seek, for any given project, the maximum excess of benefits over costs, regardless of the amount of the costs: a recommendation likely to lead to the development of fewer projects yielding diminishing returns. In considering costs, no distinction is drawn between capital investment and current expenditure, so that the resultant benefit-cost ratio discriminates against projects having high levels of both current expenditure and income, compared with the capital investment involved. This is not only undesirable in itself, but inconsistent with the Committee’s own assertion that the excess of benefits over costs is all that matters.

Another weakness of the sub-Committee’s recommendations is the extent to which they are prepared to advocate the use of imaginary data (long-term projections and the like) in economic evaluation. This is particularly noticeable in the discussion of the effects of water-development projects on recreation, fish, and wildlife, in which the recommended methods resort almost wholly to imaginary data and must therefore lead to imaginary results. But critics of the sub-Committee have sometimes recommended even more extensive recourse to imaginary data. A report to the Bureau of Reclamation in June 1952 pointed out that consideration of a particular project logically involved not merely the alternative uses of the particular resources in question, but “any alternative uses made of any

of the Nation's available resources." The writer regards this dictum as a *reductio ad absurdum* of the claims made in some quarters for benefit-cost analysis and concludes that such large claims should be rejected.

A more limited field for benefit-cost analysis, firmly related to administrative needs, would appear desirable. Benefit-cost evaluations should be embarked on only when the scale of the project justifies their cost in effort and expense; furthermore, the viewpoint from which they are undertaken should likewise be appropriate to that scale, that is to say, in general local rather than nation-wide. Particular care needs to be taken to avoid confusing transference of economic gains with net national benefit. Some benefits that are largely intangible—for instance, those connected with recreation, fish, and wildlife—might be better excluded from an analysis which seeks to evaluate investment. Instead they might be treated as items of collective consumption. If for any reason it is thought necessary to bring recreational benefits within the scope of a benefit-cost evaluation, the least objectionable course would be to set up a notional user-charge, multiply it by the number of users (suitably diminished to allow for the deterrent effect of such a charge), and treat it as the measure of income forgone by the decision not to levy an admission fee. The author, however, regards this as a second-best solution.

As for "secondary" or "indirect" benefits, many critics have recommended their total exclusion from project analysis, on the ground that they are "ramifying, involved, and conjectural." But this objection loses force if one follows the course earlier suggested and evaluates most projects not nationally but locally. Such benefits should, however, never be lumped with primary direct benefits into a single benefit-cost ratio, for this is illogical and misleading. So too a limited approach to project analysis makes it possible to treat the actual rate at which the responsible agency expects to borrow as the most appropriate interest rate at which to compute long-term annual costs. (It has been argued that a higher interest rate, based on opportunity costs, would better represent the social cost of public works; but any such rate would be necessarily arbitrary and moreover involves the doubtful assumption that competitive private uses for capital are entitled to the same consideration, from the point of view of the public interest, as government-sponsored projects.)

This more limited, more practical approach to the problem would, in the author's opinion, serve to rehabilitate a useful but limited administrative tool that has fallen into discredit through overstrain.

#### THE CHARACTER OF THE WATER-POLLUTION PROBLEM

The disposal of wastes is but one of many competing uses to which man puts water, and it may be said to participate in other uses, such as drinking, ablution, fishing, manufacture, and power generation. Like most of these other uses, it is not consumptive and in this contrasts sharply with irrigation, which results in heavy evaporation losses (up to 70 or 80 per cent in arid regions). Most water uses, in fact, involve not consumption but alteration of water. Whether this alteration constitutes pollution depends on its nature and extent, on the previous state of the water, and on the purposes for which the water is subsequently required. Pollution may be either organic, by wastes that decompose in the

presence of oxygen and hence are "self-purifying," or inorganic, tending to become more concentrated as a result of evaporation. The disposal of wastes by water hence involves the use of two resources: the water itself as a diluent (and as a means of transporting wastes elsewhere), and its dissolved oxygen as a reagent. The water needs for diluting wastes are very large. Raw city sewage, for instance, needs to be diluted with some forty times its own volume of water if the dissolved oxygen in the receiving waters is not to fall below the level generally considered safe for maintaining aquatic life. Some types of trade waste make demands many times as great.

The growth of industry and population in the United States was bound eventually to overtax the waste-disposal resources and call for remedial measures, whether by waste treatment or flow regulation. But phenomena such as destruction of fisheries or other wildlife cannot invariably and with certainty be attributed to water pollution, and (in the words of the U.S. Government's Committee on Water Pollution in 1939) "estimates of the economic consequences are both difficult and hazardous." Even more difficult may be the apportionment of economic responsibility in individual instances where the equilibrium of water use has been disturbed and symptoms of pollution have resulted. Moreover, there are some instances where physical pollution of water has existed for generations and may be said to have been condoned. In such a case it cannot be said that the abatement of pollution will *ipso facto* restore a valuable natural resource, such as oyster-beds, that has been unusable for a considerable time; for new resources will have been developed to replace it and the demand for it may never revive. Indeed, it is always *possible* to argue that a polluter creates more economic wealth than he destroys.

#### APPLYING THE ANALYSIS

The existing U.S. federal law on water pollution appears to offer little scope for benefit-cost analysis (by the Federal Government). This is partly because the federal authorities must approve state-sponsored plans conforming with statutory conditions, partly because the apportionment of federal funds between states has to be made on grounds other than those of economic efficiency, partly because the scale of the projects, and of federal aid, is so small as not to warrant deploying the whole armory of economic analysis.

Such analysis might, however, be appropriate at the local level. So far as city sewage treatment is concerned, an adequate analysis of costs is simple, the more so since one would not be justified in pursuing it into the realm of secondary or indirect effects. But difficulties begin to arise almost immediately on the side of benefits. Such of these as the reduction in water-treatment costs to downstream users, or restoration of commercial fisheries, may indeed be capable of estimation. All else, however, is speculative. The benefits to public health, for instance, may well be negligible, bearing in mind that epidemic outbreaks attributable to bathing in polluted waters have over the past fifty years been extremely rare. As for the intangibles, such as public enjoyment of a clean stream, these seem unlikely generally to contribute much toward providing projects with a favorable benefit-cost ratio.

It can, of course, be argued that projects should not be evaluated separately

but as part of a comprehensive water-pollution abatement program, conferring regional or even national benefits. But to pursue this course might lead to difficulties in justifying the completion of such programs as that for the Ohio River Basin. There is bound to come a time when the contribution of the outstanding projects, in terms of investment and return, might be considered negligible, even though on grounds of public policy—such as the enforcement of equitable standards of treatment on all water authorities—it were regarded as desirable that the program should be carried through. Indeed, the whole concept of an all-out campaign against water pollution is at variance with the notion of the most efficient use of resources embodied in benefit-cost analysis.

The difficulties in applying the analysis to municipal treatment of sewage and industrial waste lie wholly on the side of benefits. For wastes treated by industry itself they extend to the estimation of costs also, inasmuch as treatment forms part of a manufacturing process. The apportionment of joint charges, particularly overheads, between different sections of a business must necessarily be arbitrary, and firms would be tempted to exploit this situation in arguments with water-pollution control authorities. In order to guard against exaggerated estimates of water-treatment costs, it would be necessary for such authorities to employ their own investigating accountants—a costly, time-consuming, and perhaps inconclusive procedure. It is noteworthy that the costs of waste treatment appear to be much more onerous where alterations to existing factories are called for than in instances where completely new factories are being set up; this offers scope for a gradual and comparatively painless tightening-up of industrial waste regulations.

To one form of pollution abatement benefit-cost analysis has already been applied in the United States—that arising from the construction of multiple-purpose dams, having as an incidental result the better regulation of stream flow and provision of dilution waters. The practice is to reckon the benefit as equal to the “alternate cost” of providing sewage treatment; but this is inconsistent with the view that sewage treatment itself confers economic benefits in excess of its costs. Either the multiple-purpose project should be credited with the (hypothetical) benefit of the alternate provision that would be necessary, or sewage treatment should be counted as collective expenditure instead of investment. In the writer's view, the latter course is simpler and in principle preferable.

#### FURTHER OUTLOOK

In general, water-pollution projects do not, therefore, lend themselves to benefit-cost analysis. This conclusion may be found difficult to reconcile with current notions and forecasts of increasing water demands and shortages, which, if true, might be expected to entail more care in the use of water. These forecasts, however, themselves appear exaggerated: most industrial uses of water are not consumptive, and even when consumptive irrigation demands are taken into account there still remains a wide margin in the United States between over-all consumption and average run-off. Moreover, forecasts commonly ignore the question of price. It is arguable that the price of water in the United States is too low to promote economy in its use. Water-supply undertakings commonly operate most efficiently at maximum capacity and their rate policies consequently

tend to encourage consumption. Moreover, their construction costs have often been incurred at a time when prices were much lower than they are today. In consequence, water is habitually, it seems, sold below replacement cost. (On the other hand, new water-development schemes are apt to ignore the influence of price upon consumption and provide expensive water that cannot be sold: the Metropolitan Water District of Southern California is one instance and the projected California Water Plan looks like another.) This suggests that the incentive to schemes of sewage reclamation (for instance) has hitherto been insufficient, but that, on the other hand, rising prices may damp down demand for water, and hence for some forms of pollution abatement, in the future. More information on this whole question of water prices is urgently called for; but if the opinion that they are too low is justified, then more stringent pollution-control regulations are to be welcomed as, in effect, tantamount to a price increase.

The writer concludes that no form of economic analysis, even freed from current ambiguities and contradictions, will obviate the need for administrative judgment in considering individual water-pollution control schemes. The chidings of the more ardent advocates of benefit-cost analysis are unjustified; the golden rule is that there is no golden rule.