ECONOMICS IN WATER RESOURCE PLANNING

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An Overview:

The essence of economics in general, and more particularly of economics applied to the governmental decision-making process, is the allocation of scarce resources. All organizations and individuals face situations of limited resources, usually defined in terms of money, and unlimited opportunities for expenditure or investment. This dichotomous situation is equally true for governmental bodies - be they federal, state, regional or local.

A situation of limited resources can be called, in the economist's terminology, a budget constraint. In the decision-making process, a budget constraint translates to questions of alternatives and choice among alternatives. In other words, all current problems can not be solved or potentials realized during any single time period, at least at the desired level of accomplishment. Moreover, more than one program or project can often be used to meet given objectives. Thus, choices must be made. This can be viewed as a situation similar to a family with limited income deciding on its needs and wants in terms of purchasable items, ranking them in importance and desirability, and buying the most important to the limit of their available funds. At some point in the governmental decision process, this same set of choices must be made.

However, governmental decisions are often far more complex and wide ranging. They encompass every aspect of human life and require a clear idea of public goals and objectives. As with the family situation, criteria of choice are needed. Good public decisions require adequate information and analysis of that information. This can only be accomplished in conjunction with one or more criteria.

Unfortunately, in governmental decision making, the cold hard facts of choice and criteria for choice may not be felt at the proper level. By this I refer to the fact that the information and analysis required in the decision-making process take a good deal of time and effort. Often, only those at the top level of government are fully aware of the requirements for data and analysis. If the proper type of information is not available when the decisions need to be made, they will be made based upon

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information and judgments available. Poor decisions often reflect this type of inadequate preparation and analysis.

Thus, the first requirement of economics in the governmental decision-making process is one of timeliness. This can only be accomplished if sufficient awareness of the many aspects of economic analysis is present at all levels of society and top level managers make their needs known. Given such an awareness, the second requirement of economic analysis is to look at and analyze, given specific criteria, alternative means of reaching given objectives. This process is much more difficult than it sounds on the surface. Problems arise immediately as to what alternatives any particular agency or group should relate. Specification of alternatives must always be done with one eye kept upon the context within which one is working. Within any given context it is important to compare alternatives both with respect to scale (i.e., size of project) and with respect to nature (different means of reaching a given objective).

For example, if your objective is water pollution control, there are a number of alternative means which differ in nature that could be used. Pollution dilution or the building of reservoir retaining structures is one possibility. Another is the use of airation techniques and still a third is the use of governmental taxation power and fees to stop pollution at its source. Within any one of these alternatives, which differ in nature, a decision must be made as to proper size or project scale. When the most economically feasible project scales have been determined, alternatives which differ in nature can be compared and the best alternative chosen. Finally, the relationship of the best alternative to given objectives, from the society wide point of view, can be determined by how well it meets the test of the criteria used to judge it, relative to all other possible expenditure alternatives

This last step of deciding tradeoffs between areas like water and education becomes the job of the top level government executive. Practicality and legislative mandate normally do not permit this process to occur within the confines of any one agency. In fact, often alternatives within a specific field, such as water resource development, are not even determined and analyzed. This more narrow objective of looking at alternatives which will satisfy given agency or resource needs seems, however, to be the minimum procedure required of any economic analysis. If this is carried out properly, the relevant analysis and information can often be used by higher level decision makers in making their tradeoffs among and between different areas of need.

In any case, criteria to judge among the relevant alternatives (with respect to both nature and scale) are needed. Absence of such criteria is sure to result in misallocation of resources. Several different criteria are available for economic analysis. They stem directly from the economist's model of the real world. The first, and by far most important of these, has been and is the concept of efficiency. The tool or model used to analyze alternatives from the standpoint of efficiency is called benefit-cost analysis. It is the most widely used of the concepts that will be discussed but it must be recognized that it springs from rather narrow assumptions and,

consequently, should not be the only criteria used in an economic analysis. Other economic criteria include income redistribution, at the personal level, and regional development. The latter can be viewed as another form of income redistribution and may be especially important, in some situations, to state, regional and local areas.

Efficiency Criteria:

When analyzing proposed governmental programs from the point of view of economic efficiency, benefit-cost analysis is the analytical tool most frequently used. Having as its foundation economic welfare theory, a benefit-cost study uses the projected estimates of a program's future benefits and costs as a basis for calculating the net national income effects of alternative courses of action. In this context, efficiency means the maximization of national output (usually measured in terms of dollars) per unit of input. The analogous concept in the private sector is profit maximization. In the governmental context, however, profit is defined more broadly to include general social welfare and costs to include all costs to society. Since no built-in incentive for profit exists in the governmental sector, the criteria of efficiency is needed. The resulting analysis is used as a means of showing the economic feasibility of a proposed course of action (if output exceeds input), its optimal scale (addition of scale until output equals input for the last unit of increase), and more importantly its ranking in comparison to alternatives.

If one's objective is the maximization of net national income, this type of analysis would seem to be the logical and appropriate tool to use. The correct use of the concept is conditioned, however, upon a number of factors and assumptions. The list of problems is long and often quite technical. They range from the theoretical basis from which the analysis springs to the practical questions of measurement and quantification of the relevant variables in the analysis. On the theoretical side, the analysis assumes what the economists call a perfect market. This concept includes many things such as full employment, complete information in the market place, resource mobility and market competition with no monopoly elements. However, the most serious theoretical limitation of the method is the fact that it assumes present income distributions to be constant throughout the lifetime of a proposed project. This concept is directly opposed to one of society's other major objectives. Namely, the relative redistribution of income from rich to poor. Consequently, the income redistribution effects of proposed programs cannot be incorporated into a benefit-cost analysis. This requires that a separate analysis of the possible effects of proposed programs on this important objective of society be carried out independently.

Second, different methods exist to measure economic efficiency. For example, benefit-cost analysis can be used to derive benefit-cost ratios, benefit minus cost statistics and internal rates of return. Derivation of any or all three of these efficiency measures procedes from the same type of data, but only under special conditions will their use lead to the same conclusions. No one form is necessarily correct. The choice depends upon the analyst's value judgment with respect to the proper budgetary

constraint to use in the analysis, the purpose of the analysis and the way in which he views the use of net annual benefits in the reinvestment sense. The benefit-cost ratio and the benefit minus cost statistic assume that the relevant budget constraint is the total cost of a project including fixed investment and operating expenses for all future time periods. Internal rate of return calculations, however, assume that the relevant problem is the allocation of investment funds only and that annual operating expenses will be met from annual benefits. This is a similar concept to that used in private industry but may be less realistic for governmental projects because repayments of benefits by beneficiaries is not common practice. In addition, the internal rate of return method assumes that net annual benefits are reinvested at the same internal rate of return as calculated for the overall project. Thus, it is apparent that choice of the statistics to indicate economic efficiency depends upon the assumptions one wishes to make with respect to the budget constraint.

In addition, the particular context within which the statistic is used is important. For example, most Corps of Engineer evaluation studies use the benefits minus costs criteria. However, this is clearly inappropriate when one is comparing alternatives of a different nature which vary in scale. As an example, if one is comparing reservoir proposals to the alternative use of the river as natural waterway, it is clear that the use of benefits minus costs will normally lead to the selection of the reservoir proposal whenever the benefit cost ratio exceeds unity. This occurs because most types of structural projects are of large magnitude and, consequently, will have correspondingly large net benefits. The proper statistic to use in such situations is the benefit cost ratio which measures the relative efficiency of projects without the effect of scale influencing the result. Given a sufficient list of efficient alternatives, this permits the most efficient projects to be chosen to the budget constraint limit.

Regardless of the explicit statistic chosen to represent efficiency, a number of parameters which must be specified for use in the analysis are based upon certain assumptions and value judgments which are not always made explicit. Among these are the choice of discount rates used in deriving the present value of future benefits and costs, the time period over which such discounting will occur; and the conceptual treatment of risk, uncertainty, multiplier effects, externalities and private costs not associated with the governmental unit undertaking the analysis. Often small changes in the way one or more of these factors is specified or handled can have significant effects on the resulting analysis.

Measurement Problems:

Involved in the problems of risk, uncertainty, secondary effects and externalities is the question of benefit and cost measurement. A few words need to be mentioned concerning these measurement problems since it can be critical in the subsequent analysis. Methods of handling risk and uncertainty in the estimation of future benefits and costs are available. However, often they are not the most sophisticated type of treatment and more often than not they are not used. For a number of reasons, I will not go into detail on these concepts. Of more importance, at the present time,

are the measurement problems with respect to secondary effects and externalities.

Secondary impacts, should, perhaps, be called the multiplier or expansion effects of a project. They stem from and are induced by the primary benefits of a program and have meaning only in a regional context. In other words, they are merely transfer payments from one region in the country to another. If the project under consideration were built in another location in the nation, substantially the same expansion benefits would be derived from the project. The only difference would be that they would occur and affect another region of the nation. Thus, from the point of view of national income expansion, secondary or multiplier effects should not be included in any efficiency analysis. On the other hand, these impacts are often substantial for a region and can have important effects on regional growth. Thus, if regional growth and impact effects are of concern as governmental objectives these types of effects should be measured. The point to be made here is that they must be measured outside the framework of the benefit-cost study if that study is to be theoretically correct in its conclusions. Separate studies and models, such as input-output models, must be used to measure such effects and the decision-maker must then evaluate the weight which he places on this type of criteria as opposed to the efficiency criteria.

Externalities present a different type of problem. By definition they are effects - either positive or negative - affecting third parties in a transaction. Normally, these third parties have no control over such impacts and do not have recourse in the market against their originators if they are negative. Conversely, the originators of such effects are not able to collect payment in the market for their provision - provided they are beneficial in nature. Quality of environment considerations may be one important type of externality. A more concrete example is the provision of flood control protection by an upstream flood control structure. If such a structure were built by a private entrepreneur, he would be unable to collect payment for its benefit from downstream land owners unless he had previous legal agreements with them. With respect to benefit-cost analysis, the externality question becomes a concern of measurement. The effect should be measured and included in the benefit-cost framework if possible because the concern of government is society wide. In this area, economists must be more diligent in applying their econometric tools to the quantification of proxy values for the types of benefits and costs we call externalities.

Finally, and perhaps most basically, many products associated with governmental investment are not sold in the market place. Consequently, estimation of the benefit which society derives from the provision of such products and services is difficult. An example of such a situation is the provision of recreational opportunities. Normally, users do not pay entrance fees commensurate with the value of the service provided. Thus, proxy values for such benefits must be used to carry out the analysis. Again, the use of various tools for estimation is required. These types of benefits should not and need not be left in a category of project effects called intangibles.

One should not become discouraged, however, by the various problems. A great deal of theoretical and conceptual work has gone into the perfection of the benefit-cost analysis technique in the past ten years. Much of this work by people in academic community as well as those in government has been put into practice. We are still a long way from home in completely perfecting the tool. Much of the work which remains, however, is not in the theoretical or conceptual underpinnings of the analysis but rather in the data sources and methods of collecting and generating data. Of secondary importance may be the necessity to guard against any reversion to previously used incorrect techniques. For example, because of recent increases in the discount rate, many are advocating the inclusion of secondary benefits in the efficiency calculations. Any attempt at such an inclusion would be unwise and theoretically incorrect.

Other Criteria:

Benefit-cost analysis may be an analytical tool that presents a criterion which can be used to evaluate and distinguish between alternative means of reaching a given objective. But objectives and goals are often varied, complex and unclear and large gaps exist between goals and the direct consequences of a governmental program. Therefore, as mentioned above, comparison of expenditures based solely on the criterion forthcoming from benefit-cost analysis may not be consistent with other objectives. Governments have numerous objectives at all levels. For example, in addition to economic efficiency the United States has traditionally been concerned with income distribution (both personal and regional), regional development impacts of public expenditures, economic growth and conservation. All these other objectives can be analyzed by economic tools. However, they cannot be analyzed by the tool of benefit-cost analysis. Of course, there are also other considerations of a non-economic nature.

Conclusion:

In closing I would like to suggest two principal thoughts. First, there is a great need for tools of economic analysis other than benefit-cost analysis to be used since efficiency is only one aspect of the overall picture. Tools like input-output analysis to quantify regional development effects and the various conglomerate of methods used to evaluate income distribution effects should all be applied more often.

Second, greater efforts should be made to obtain reliable empirical estimates of benefits that should be included in the various types of analysis. Only in this way can the full power of the analytical tools be realized and the reliance on incomplete and misleading measures like cost-effectiveness be reduced.