

techniques for assessing trade-offs among social, economic, and environmental effects of public investments in highways

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In the last decade, the United States has begun in earnest the difficult task of learning to live in an era of unparalleled material abundance. In the search for a rational accommodation to affluence, emphasis at the outset has been on broadening the range of factors considered in reaching public policy decisions and on reordering the relative priorities of factors thus considered. Increasing recognition of the interdependence of physical, economic, and social phenomena has stimulated a search for ways to incorporate the interrelated effects of change into decision-making processes. A dual effort has emerged that includes not only the task of redefining the range and magnitude of effects induced by change but also the related task of developing relevant analytical techniques for illuminating the interrelations of variables associated with change.

The general overtone of the last decade has been one of crisis and frustration: crisis because of the urgency associated with a belated recognition of the cumulative negative impacts of change; frustration because emerging problems have appeared intractable and impervious to rational analysis. The primary impetus underlying the accelerated search for analytical techniques capable of assimilating multiple criteria has been provided by reaction to crisis rather than by rational foresight. As in all crises, a pervasive sense of urgency places demands for information that cannot entirely be met. Although the questions asked are straightforward and logical, the answers are often fraught with a degree of hesitation born of uncertainty about measuring the heretofore unmeasurable.

We have embarked on a redirection of analytical alternatives to public policy evaluation from narrow and traditional approaches to complex new frameworks that call for simultaneous consideration of a wide spectrum of interrelated effects of public policies. Accordingly, it is appropriate to provide some methodological perspective about the analytical dilemma in which we now find ourselves and to indicate some directions that further analysis and research must take if future answers to multidimensional questions

are to improve in usefulness and quality over those answers now being provided. In an attempt to provide such a perspective, this paper will consist of 3 parts: First, the background and evolution of multidimensional analysis of public policies will be reviewed; second, the current status of analytical techniques now being used to evaluate multidimensional issues will be summarized; and third, the directions and implications for future research will be discussed.

EVOLUTION OF MULTIDIMENSIONAL POLICY ANALYSIS

The evolution of multidimensional policy analysis is a logical outgrowth of the continuing transition from evaluating the policies of scarcity to considering the policies of abundance. The task of learning to live with abundance has been found to be fundamentally different from the task of policy formulation throughout centuries of minimal physical survival. Only as the odds for physical survival improved, at least for the majority of people living in the western world, did it become possible to shift attention to the question of how the level of material progress could be enhanced.

The initial process of material enhancement focused primarily on capital formation limited in scope to physical resources. Capital formation could not appropriately begin until the problem of survival had been resolved, for capital formation, by definition, required postponement of present consumption so that future consumption levels could thereby be enhanced. Throughout the early periods of capital formation, decisions were frequently made and acts committed that in retrospect we condemn as socially unconscionable. The use of child labor and slavery and the exploitation of forests, minerals, and water are examples of historical expedients to accelerate growth through capital formation by whatever means were available.

Rapid rates of capital formation produced 2 significant results. First, the time-stream of consumption patterns became radically altered as prospects improved for increasing material welfare over time; and, second, to begin to consider a wider spectrum of effects induced by change became not only possible but also necessary so that future consumption patterns and prospects could be determined more effectively. In short, questions of economic, social, and environmental impact that once were relegated to positions of relative insignificance have emerged as paramount considerations in reaching current public policy decisions.

Accompanying spectacular changes in material well-being through a seemingly endless cornucopia of output has been an increasing crescendo of disquiet and concern about where we are either being led or where we are leading ourselves. From another era, Jeremiah, a harbinger of gloom and doom, might well have been the leading economist of his time (1). "And I brought you into a plentiful country, to eat the fruit thereof and the goodness thereof; but when ye entered ye defiled my land, and made my heritage an abomination."

Perhaps the most significant impact of living in a wealthy society as compared with living in a society dominated by minimal physical survival is the necessity of shifting relatively more attention from the present to the future (2). The reason for this shift of emphasis on time span is that the future becomes relatively more significant than the present in a wealthy society because the primary focus in such a society is no longer on short-run survival. The question of future considerations in a survival-level society must continually be subordinated to the crisis of meeting current needs. In an abundant society, however, rational foresight calls for considering the time span of the effects of past and current decisions. Increasingly, a wealthy society more than a society of short-run scarcity focuses greater concern both on the time distribution of resource use and consumption and on the composition of total output.

In summary, the principal impact of the transition from the economics of scarcity to the economics of abundance is a lengthening of the time span of analysis with relatively greater emphasis shifted from the present to the future. This transition has had an enormous impact on the directions, quality, and capabilities of affected disciplines to deliver answers required by policy-makers as their vision becomes less myopic and stretches farther into the future. It might be uncharitable to say, but traditional methods of analysis appear to have been caught largely unprepared to

deliver the answers now expected to complex questions posed by new directions in public policy.

The lengthened time span for public policy analysis has produced an accelerated search for a common denominator for appraising public policy impacts. This search for a common denominator has resulted in a convergence toward a similar theme from a wide variety of disparate disciplines. Increasingly, whether the point of origin be engineering or economics, ecology or sociology, the quest for answers broader than the originating discipline has provided impetus for a broad search for identifying and measuring relevant variables associated with a particular outcome and for evaluating trade-offs among these variables.

When a common denominator was needed to serve as a central proxy for all economic activity, the concept of gross national product emerged. Though factories and highways, ice cream cones and liquor were all counted in different physical units, each entered the mainstream of economic activity through conversion into a central aggregate measure.

With GNP as a central and objective measure of aggregate economic performance, economic-efficiency analysis took on added significance. The availability of a common denominator for economic performance allowed the evaluation of trade-offs to be done with considerably more precision. Economic analysis, in particular, became dominated by efficiency criteria that specified that limited resources must be allocated to produce maximum output. Little attention was paid to constraints on maximizing output or on the quality of the output.

Gradually, however, it became apparent that factors other than the incremental rate of GNP growth were crucial to public policy. Although the concept of GNP was never intended to measure social well-being, increasing criticism has been leveled against it for not doing so. It has also become apparent that no single yardstick can serve as a universal measuring rod for all of society's penalties and rewards (3).

Thus, a search is now under way for new common denominators or analytical approaches that can accommodate diverse multidimensional criteria for assessing public policies. The problem is that researchers are being asked to produce results as if such analytical frameworks had already been perfected. In fact, what we have, as mentioned previously, is a rather fragmented convergence of a variety of approaches, administrative procedures and directives, and analytical techniques, all addressing themselves in a common direction and seeking similar answers.

A possible list of approaches and procedures would include the budgeting process, the planning process, the economic impact analysis, the public expenditure analysis, regional science, and various strands from engineering and sociology. Although many similar answers have been sought from all of these approaches, the specialization and institutionalization of government and various administrative processes have produced varying viewpoints, jargon, methods of analysis, and concepts in each of these areas. Although an economist would reduce this list to the generic category of traditional economic-efficiency analysis, this simplification overstates the traditional differences among approaches followed to achieve various administrative objectives. Although similar types of questions have been asked through all approaches, the compartmentalization of disciplines, the variations in administrative goals, and the narrow frameworks within which the impacts of public policies have been considered have produced answers with as many dimensions as existed in the originating disciplines. Because new approaches to multidimensional analysis call for considerable inputs of ecumenicism, it should not be surprising that some of the initial dialogues are reminiscent of the Tower of Babel.

Regardless of the context within which the effects of a particular public policy are considered, all public expenditures must ultimately be channeled through the public budget. The budget, therefore, serves as a central point for considering diverse public programs. Trade-offs in the budget process are made in terms of additions to and subtractions from various requests for public spending. Only within recent years has supportive analysis for budget requests assumed any degree of sophistication (4). When the range of governmental activities and expenditures was minimal, the level of analytical sophistication required for supporting program funding levels was also minimal.

The budget process initially was one of narrow incrementalism, in which the overriding question usually was that of determining how much it would cost to run a particular program for the next year or biennium.

After national budgeting was implemented in 1921, it took nearly another half century before budget analysis was transformed into a process of specifying goals, evaluating alternative ways of reaching them, selecting the most efficient alternative, and evaluating performance (5, 6). To several generations of budget analysts, legislators, and lobbyists accustomed to viewing tangible line-item sums rather than intangible goals and performance evaluations, such a transformation was met with considerable consternation. The threat of superimposing some degree of objectivity on a system operating through trade-offs among power groups caused new concerns that obscure clerks generating benefit-cost ratios would supplant the elected representatives of the people in terms of policy-making influence.

Despite the difficulties involved in the transition from line-item budgeting to goal- and performance-oriented budgeting, the most significant impact of the transition may simply be that of effecting an irrevocable shift in basic conceptual approaches to thinking about public spending. The process of introducing objective analysis into the public-spending process was in itself no small accomplishment, even though the analysis conducted produced only incomplete or unsatisfactory answers. As one writer has indicated (5):

What analysis provides is an exercise in logical coherence, hopefully with knowledge of and respect for the underlying technical, economic, and organizational data. Coherence does not insure the "correctness" of policy. In fact, an incoherent policy will sometimes be closer to correct than a coherent one. But the incoherence itself scarcely makes a contribution. It is almost invariably a source of waste, and typically of policy muddles.

Although public expenditure analysis is a subset of budget analysis, research in the area of public expenditures is also conducted for reasons other than those related to budgetary objectives. In the first place, budget analysts have often had an accounting orientation, while economists have had the domain of public expenditure analysis. The emergence of public expenditure analysis is so recent that a brief comment is in order about the late appearance of an area of analysis that would appear to be necessary but that has been relatively nonexistent until the past few years.

Public finance analysis has meant tax analysis until recently. Even recent college courses in public finance usually included only a belated lecture on the mechanical aspects of budgeting and consisted primarily of a review of institutional and economic effects of specific taxes. Although some attempt has been made since the mid-1930's to examine benefits and costs of water resources, few similar analyses of other public expenditure categories were made until the 1960's. Moreover, the focus on most public expenditure analysis conducted by economists has been on adherence to rather strict tenets of traditional economic efficiency analysis. Accordingly, emerging pressures for examining trade-offs among economic, social, and environmental or physical aspects of public policies have strained the existing capabilities of analytical techniques developed within the area of budgetary and public expenditure analysis (7).

Another of the converging approaches to examining public policies is the planning approach. Although the planning approach is a subset of public expenditure analysis, planning is done by people who call themselves planners and who come from a wide variety of disciplines. Thus, the approach taken by planners is more often than not a function of the disciplinary perspective provided by the background of the planner. Moreover, planning has evolved through its own concepts and procedures. Planning originally focused on engineering and design criteria with primary emphasis on the physical environment and on the enhancement and control of this environment. A counterpart focus on physical dimensions of public policy was manifest through the budget process, in which fund appropriators long showed strongly ingrained preferences for the capital budget over less tangible monuments to budgetary wisdom such as human-resource and administrative expenditures. A bridge or a building could be seen and represented as a "wise" use of resources; expenditures on people could not be seen and, therefore, left no cornerstone to judicious use of public funds.

An appropriate distinction between the concern for physical criteria and the concern for other related considerations has been made by Boulding (8):

If I am going to live below a dam I would much rather have it built by an engineer than by an economist. Nevertheless, the economist comes into the picture perhaps by asking the awkward question as to whether the dam should have been built in the first place.

The term "planning" is still an ambiguous appellation for a wide variety of overlapping, disparate activities, all focused on improving the rational use of public resources in coping with the effects of economic and social change. Planning is seen today primarily as an alternative to chaos and inefficiency rather than as a threat to the operation of free-market forces. Planning received a major impetus in the last decade through rapidly expanding federal matching programs, each of which invariably required some sort of rational plan for spending the money so the feds would feel that the states knew how they would spend the money. Requirements for instant plans placed pressures on the planning profession not unlike the pressures placed on public expenditure and budgeting analysts. In some unknown percentage of cases, planning was seen as a process of producing a document as a necessary step to obtaining federal funds and was not entered into seriously as a continuing process that could be a potent adjunct to rational decision-making. Once the funds were allocated, planning was forgotten as a distasteful waste of funds that could have been spent on tangible program objectives.

As mentioned previously, the magnet drawing all of these approaches together is that provided by the need to develop a method for assessing trade-offs among multiple phenomena or effects of public policies. The ability to assess trade-offs requires forecasting the anticipated absolute and relative effects of the trade-offs. The success of any process of assessing trade-offs, therefore, will depend in large part on the relevance and accuracy of the forecasts. Recent experience with forecasting lends little confidence in our collective abilities to anticipate the future. Moreover, forecasts and data inputs required to produce them have taken on a mantle of political sensitivity and, in some cases, have been overtly interpreted in a political rather than an objective vein.

In summary, several approaches to public policy analysis, including the planning process, the budgetary process, and public expenditure analysis, with various permutations and combinations, have been converging toward a common goal of seeking common denominators for assessing trade-offs among multidimensional effects of complex social, economic, and physical phenomena. Were it not for the fact that planners, budget analysts, and economists have all tried to form the world into their own molds in different ways, these approaches could all be lumped together. The discussion will turn now from broad approaches to specific kinds of analytical tools and shift to an appraisal of specific techniques for assessing multidimensional trade-offs.

ANALYTIC TECHNIQUES FOR ASSESSING MULTIDIMENSIONAL ISSUES

Basically, the task of estimating multidimensional trade-offs consists, first, of establishing individual accounting frameworks for estimating each category of effects crucial to the analysis of a specific policy outcome and, second, of determining some common denominator for establishing objective trade-offs among categories. The experience of the Water Resources Council in developing background work in support of its proposed revised standards for appraising water-resource projects is directly relevant to this discussion. The work involved in developing these standards represents one of the few recent comprehensive efforts to develop multi-account appraisals of public policy.

First, a bit of background is in order. Beginning with the Flood Control Act of 1936, public expenditures on flood control were to be evaluated according to whether the benefits "... to whomsoever they may accrue" exceed estimated costs. As a result of this legislation and as a result of the inherent economic logic of the benefit-cost

comparisons, water-resource projects were appraised for nearly 4 decades strictly according to their potential contributions to national economic development, i.e., according to net increments to national income. The initial directive of the Flood Control Act of 1936 was augmented by Budget Circular A-47 (9), the 2 "Green Books" (10, 11), Senate Document 97 (12), and the report of the Special Task Force of the Water Resources Council (13).

The approach of the Water Resources Council represents the first fundamental shift in evaluation standards for public projects in several decades. Originally, the council proposed a multiple-objective framework for assessing costs and benefits of public water-resource investments. These objectives included national economic development, environmental quality, social well-being, and regional development (14).

Nineteen tests of the proposed evaluation standards were conducted by various universities and consulting groups. In each case, the proposed standards were applied to specific water-resource projects. At the completion of the test cases, the council summarized the results and concluded (15, p. ii):

The tests have indicated that the multi-objective approach to planning is practical. Meaningful results can be accomplished and reasonably uniform comparability in application can be achieved by establishing carefully structured principles, standards, and procedures.

The conclusion reached is more optimistic than the results of most of the test cases warrant. With regard to measurement of environmental benefits and well-being, the council concluded (15, p. iii):

Environmental benefits were generally given only cursory attention . . . and were reported in rather elementary physical terms. . . Well-being benefit measurement was also fairly elementary, but there was fair agreement on the types of effects to be measured.

The proposed standards were published in the Federal Register in December 1971 (16, p. 24144), and extensive hearings were held on these standards in the spring of 1972. The objectives defined in the Federal Register as relevant to water-resource planning include enhancement of national economic development, enhancement of the quality of the environment, and enhancement of regional development (16, p. 24145). The procedures proposed for development of requisite information in support of the contribution a particular project should make toward the enhancement of these objectives consist primarily of developing a ". . . complete display of accounting of relevant beneficial and adverse effects" (16, p. 24145). Beneficial and adverse effects of water-resource projects are to be displayed for national economic development, the environment, regional development, and social factors (16, p. 24146). Beneficial and adverse effects are to be estimated both with and without the proposed project, and recognition is given to the fact that many environmental and social factors can be estimated only in nonmonetary terms.

The conclusion reached here is that techniques for measuring the impact of the separate accounts have not been perfected, to say nothing of the unavailability of techniques for assessing trade-offs among the separate accounts. If we take as a starting point the analysis of the impact of public investments—be they highways or dams—on the basis of national economic efficiency criteria alone, there is even considerable debate over the adequacy of impact models, over the identification and range of costs and benefits, and over the estimates produced by the models. In some cases, such as that of inland navigation standards, Congress has legislated provisions that deliberately prevent federal agencies from determining an objective stream of benefits and costs and, thus, artificially biasing the results against economic efficiency. Recent outcries from those fearing loss of their proposed projects when a realistic interest rate is used for discounting the stream of future benefits are also indicative of the problems involved in introducing objective criteria into the analysis of public expenditures. A further dilemma occurs because "the state of benefit-cost analysis is such that it does not provide a complete analytical framework for evaluating public investment decisions, even if the analysis were conducted with a high degree of precision" (17, pp. 1-3).

A further indictment of the knowledge base against which conclusions are reached concerning impact of public investments on regional economic development is provided by Back (18, p. 1446):

The knowledge base necessary for developing defensible procedures for estimating the contributions of water projects to regional economic development does not exist. . . . To the agencies that want to construct water projects and to the people who want them, projects are considered economically justified in the absence of definite proof to the contrary.

In transportation analysis, inroads have been made only recently in the quality of estimates developed to represent the economic impact of transportation investments, including highways. Early highway impact analysis consisted primarily of physical land-use analysis, an outgrowth of the premise that highway impact ultimately could be resolved into visible shifts in land use and measurable changes in its value; thus, land use served as the common denominator for assessing economic shifts resulting from transportation investments. Early attempts to estimate economic effects of highways, either directly or indirectly, took the form of "before-and-after" estimates, or what I call the "five-gas-pumps-before and five-gas-pumps-after" method. Many of the early attempts at estimating highway impact were primarily statistical compendiums of data believed to relate in some way to the changed economic activity induced by the highway.

Recently, a major attempt has been made to examine the interrelated economic effects of highways by the use of models that are designed to incorporate interdependent economic effects of new public investments (19, 20, 21). The use of input-output analysis has produced a somewhat more logically consistent estimate of the aggregate economic impact of a specific public investment on a geographic area (22).

The problem with most traditional methods of research is that they are primarily static; they have no time dimension. The cumulative impact of social, economic, and environmental phenomena and effects is a process that occurs over time, and static answers are likely to ignore this cumulative process.

Although we have scarcely solved the problems of estimating separate display accounts for social, economic, and environmental factors, let alone come to grips with methods of estimating trade-offs among the accounts, we must, nonetheless, look ahead and ask what kinds of research techniques are available that can contribute to the solution of these kinds of multidimensional problems. Once increasing numbers of interdependent variables were introduced into the analytical frameworks of research, attempts were made to devise some method that remedies deficiencies of traditional, static models and produces results relevant only to a particular point in time and to the particular circumstances then in existence. The ideal analytical framework would, of course, be a multi-account framework within which each dimension or account would be measurable in comparable units and in which additions to or subtractions from each account could be done so that trade-offs could be assessed.

One approach that appears to warrant careful scrutiny in the examination of multidimensional effects is the simulation technique (23, 24, 25, 26). Simulation involves developing an abstract representation of the way systems function in the real world. The objective of simulation is to understand how the real world functions. Unlike most programming models, simulation techniques are not designed to estimate optimal resource-allocation patterns and are, therefore, relatively free from assumptions and constraints (23, p. 13). Simulation involves a trial-and-error approach to approximating reality; successive efforts improve understanding of the system being simulated.

Simulation offers a constructive alternative to isolated sector analysis. In fact, it can be argued that one of the reasons we have environmental problems is precisely because we have paid too strict attention to specific sector outcomes, without worrying about inter-sectoral effects. As a result, common-property resources have been vastly underpriced, leading to high rates of overuse and culminating in the environmental dilemma in which we now find ourselves.

The conceptual leap from analysis of individual sectors to the murky world in which everything is related to everything else is an enormous leap, and one that many are not

prepared to take. Only when the cumulative interaction of economic, social, and physical phenomena over time can be accounted for, however, will it be possible to net out the effects of each class of phenomena and to provide an objective basis for assessing trade-offs. The analytical problem confronting us would be infinitely simpler if it were possible to invent a "quality-of-life index," measurable in terms neutral of the units in which the data were originally expressed. Trade-offs could then be expressed in terms of impact on the overall index. Because such a common denominator does not appear on the horizon, simulation analysis warrants a serious look as a conceptually promising approach to examining impacts of interrelated phenomena over time.

In an attempt to consider the interrelations between ecology and economics, Isard and his colleagues examined 4 basic analytic tools from regional science in terms of their potential contribution to resolving ecologic problems (27). These techniques include the comparative cost approach, the input-output technique, the industrial complex analysis, and the gravity model (27). At the end of their pioneering research, the authors concluded:

Perhaps the most significant result of this research is the discovery that, by such extension and reformulation, it is feasible to handle jointly, and in combined fashion, both the economic and ecologic systems with all their mutual relationships and interdependencies. . . . The system of linkages governing natural and social phenomena is extremely complex. There are . . . few, if any, systems which are simple. We are operating in a world in which variables are all intricately inter-related. It is for this reason that there are some investigators who avoid empirical investigations because this approach cannot possibly portray accurately and comprehensively the interdependent web of real life.

Following a similar conceptual approach, Kneese and his colleagues developed a model "to study public policies directed toward ameliorating the social inefficiencies created by nonpricing of environmental services" (28, p. 89). The basic rationale for the model is that residuals from resource use patterns can be established through a materials balance general equilibrium model. The authors conclude:

We see an urgent need to develop more relevant and operational economic models for dealing with pervasive and subtle externality phenomena. A few economists have observed that external diseconomies increase rapidly (nonlinearly) and become more pervasive with economic and population growth, but comparatively little has been done to formulate analytical or normative models based on this insight.

In summary, the evolution of analytical techniques for appraising the impact of public investments has not progressed very far or very rapidly. Preoccupation with short-run crises and with compartmentalized policy problems within narrow spheres of political influence has prevented adequate attention from being placed on the complex interrelations of various phenomena over time. Most impact-oriented research has dealt with a relatively narrow problem in a specific geographic area. Because few alternatives existed, the predominantly descriptive early work was an attempt to gather together under one cover every indicator and data on every possible factor that might have a bearing on the outcome of a particular public policy. The contribution of such studies lies primarily in the role they performed in the transition toward the consideration of economic effects that, in many cases, were not previously considered at all. Such studies contributed relatively little, however, in terms of operational techniques or evidence that could enhance the quality of public planning. Much of the work was *ex post facto*, which meant that little impact could be made on patterns of public expenditure analysis through the findings of the research.

IMPLICATIONS FOR FURTHER RESEARCH

One of the major theses of this paper is that we are going through a transition in which the economic policies of scarcity are being transformed into economic policies of abundance. The results of this transition include the following: (a) The time span for public policy analysis must necessarily lengthen as short-run contingencies become

less crucial and as long-run cumulative impacts of change become more crucial; and (b) analysis of the effects of public policy must become increasingly multidimensional, and analytical approaches must increasingly take into account a widening range of economic, social, and physical phenomena.

The fact that analytical techniques have not been perfected for measuring relevant physical, economic, and social phenomena and for assessing their trade-offs should not concern us so much as should the directions that current research and planning efforts are now taking. Provincial, single-interest objectives must give way to comprehensive analyses in which simultaneous consideration is given to a complex array of effects of public policies. This task will not be easy, either conceptually or operationally. Many disciplinary purists argue that the net result will dilute the rigor of analysis and produce ambiguous answers devoid of meaning. This argument, it seems to me, misses the point: The point is that policy-makers are requiring administrative agencies to incorporate multidimensional criteria into their decision-making frameworks, whether academic purists like it or not. As, step by step, our comprehension of real-world systems improves, and as our ability to approximate or simulate real-world behavior continues to develop, the role of objective analysis in public-policy discussions will continue to grow.

It seems to me irrelevant to overly concern ourselves with assessing blame for not being able to cope with multidimensional problems any better than we now are. The fact remains that narrow agency goals result from specific administrative and congressional mandates and that the resultant view of the world and its components is often restricted to single-dimensional effects. How this process will change is not quite clear. Just as in the case of a pure public good, in which no single individual would pay for it for he would benefit from the good anyway, there is little incentive for a single agency to bear the cost of analytical work that does not impinge directly on the operation of that agency.

Moreover, the politics of reaction, rather than foresight, hardly lend much support to a future-oriented research framework. Initial attempts to consider environmental factors, for example, often take the form of insurance policies; i.e., an attempt is made to make sure that the agency is covered from every direction by having taken into account every possible source of complaint and every possible effect. Thus, current environmental analysis often takes the form of checklists, in which every possible contingency is allowed for.

There is another problem that must be mentioned: Evaluation standards require some yardstick against which effects can be compared and against which performance can be measured. In the case of national transportation policy, no clearly articulated set of goals exists. The completion of the Interstate System was a goal that could be clearly understood. But highways are a means to other ends, and not ends in and of themselves, just as in the case of all other transportation facilities. Most national policy statements tend to be ambiguous and nonoperational, or they would never pass over opposition.

In conclusion, considerably more attention must be given to substantive research efforts designed to come to grips with the issues discussed in this paper, namely, the identification and measurement of relevant economic, social, and environmental effects and the development of methods for assessing trade-offs among these effects. Single-dimensional, short-run crises must continually give way to a lengthened time span of analysis in which the future progressively becomes more important than the present. Attainment of these objectives will depend primarily on whether this point of view gains ascendancy among decision-makers confronted with making multidimensional appraisals of public policies.

Tunnard and Pushkarev (29, p. 159), in a landmark volume on problems of design in the urbanized landscape have concluded:

The highway as a cultural asset is long overdue for consideration in the United States. . . . Everyday we are missing opportunities to bring this beauty into our daily lives, an increasing proportion of which is spent on the highway—going to work, going to play, shopping, or going to school. Who knows? Familiarity with the mediocre, dull, or downright ugly in our travels may in future be as detrimental to the American Spirit as the in-city slums which we are now all committed to remove.

And finally, this quotation from Mumford, one of America's most articulate spokesmen for environmental considerations in highway and urban design (20, p. 236):

Perhaps the first step toward regaining possession of our souls will be to repossess and replan the whole landscape. To turn away from the processes of life, growth, reproduction, to prefer the disintegrated, the accidental, the random to organic form and order is to commit collective suicide; and by the same token, to create a countermovement to the irrationalities and threatened exterminations of our day, we must draw close once more to the healing order of nature, modified by human design.

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