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Let me review, briefly, some of the reasons why we should be interested in the application of analysis to public policy decisions.

Dissatisfaction with the results of the decisionmaking processes in use by government is everywhere apparent. Complaints about ineffective programs and wasted money are growing. In the United States, for instance, voters are increasingly rejecting what elected officials and bureaucrats propose. To cite an example:

> *"From 1963 to 1970 the percentage of school bond issues approved by voters fell drastically--from 72 percent to 53 percent. Moreover, this inclination to turn thumbs down gained momentum steadily despite the fact that school officials, trying to counter the trend, used far more caution in going to the electorate--putting only 1,216 issues on the ballot in 1970 as compared with 2,048 in 1963"* [1].

The trouble does not lie with the goals of our elected officials (which it could, of course); the evidence indicates they mean well and are trying. But when they enact measures to effect such things as full employment, or to provide medical services for everyone, or to improve urban housing, the results seem to range from no noticeable improvement to making the situation worse.

Let me suggest three possible reasons for this failure of outcome to match intent.

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(1) Governments are today faced with many more and more complex problems than they have ever faced before. Change is rapid and the stop-gap solutions adopted soon face new problems. Industrial growth has not turned out to be an unqualified blessing. Many governments are now subject to pressures from sources that are different from those in the past. Too many people is one pressure. Less cooperation is another. Today rumors of a policy change affecting a particular neighborhood or interest group will normally find those affected alert, articulate, and determined to participate in the making--or blocking--of any decision which concerns them. Many actions of U. S. cities are now constrained by the courts. But in spite of these new problems and difficulties, the methods used by public authorities for seeking their solutions have hardly changed since government began.

(2) The resources, money and manpower, that can be brought to bear on these problems are limited. Of course resources have always been limited but today, when rapid industrial growth may be coming to an end, they seem to be far more limited than they have ever been before. The decisionmakers in every government are aware of a need to allocate their resources more effectively than they have done in the past but they often find themselves with little useful information to go on and no rational means for making these allocations.

(3) The organizations and bureaucracies the decisionmaker must work with--his own and those that interface with it--are often beset with red tape, poor communication, low morale, inadequate staff, insufficient data, and with pressure from special interest groups with ready-made solutions.

These remarks, of course, are based on the situation in the United States; from what I read, however, decision-makers throughout the world face the same difficulties.

A new approach is needed. My belief is that a greater use of analysis to guide public policy decisions can lead to better ways to handle many public problems and may even eliminate some. My name for this analysis is "systems analysis"; others call it policy analysis or just operations research.

This belief that analysis has the capability of being very helpful with public problems is fairly widespread, at least among analysts. Problem solving in the public interest has paid off, by and large, to those who try it, attested to by the growing number of firms and practitioners who seek to enter the business. We are discovering, however, that to be really helpful with public problems, systems analysis, or the systems approach, must be practiced differently than it has been, say, in the aerospace industry or for the U. S. Department of Defense. In addition to changes in methodology, analysts must pay a great deal more attention to aspects of the problem that in the past have often been considered to lie outside the analysis proper. These include winning the co-operation and assistance of the people currently dealing with the problem and seeing that the study recommendations are accepted not only at the top, but at lower echelons and even by collateral interests, and then implemented without being vitiated. This requires including within the analysis an attempt to understand how the institutions and individuals affected will constrain the policy being considered.

In this talk I will attempt to point out these differences in practice that I believe must be emphasized when

systems analysis is applied to public policy decisions. To this end, I'll first summarize the basic concepts and procedures, then discuss tools and techniques. There I will mention ways to proceed that seem to offer promise when the problem is not suitable for a quantitative model. Finally, I say something about the special difficulties with acceptance and implementation of analysis when it is applied to problem solving in the public interest.

CONCEPTS AND PRINCIPLES

The idea of analysis to provide advice is not new and is certainly not original with Rand. In concept, what needs to be done becomes rather obvious to anyone who pauses to think about the problem. An ordinary person, however, almost never approaches a problem systematically and exhaustively unless he has been specifically trained. It is much more natural for him to visualize the situation he faces and what he would like it to be, and to focus on the gap between these two states, than to seek out and visualize some huge set of alternative possibilities and systematically search out the best. But the required procedures have been used, often with full understanding, by decisionmakers from the time man first based his choice for action on something other than pure intuition or divine guidance. Systems analysis and the systems approach are thus not catch words to suggest we are doing something new; at most, we are doing something better. The process, nevertheless, *is* shot through with judgment and intuition.

Five key elements are involved, although they may not always be explicitly stated. Roughly, in the order they are usually encountered in thinking about a problem, they are:

(1) The objectives. The objectives are what the decisionmaker seeks to accomplish, or to move towards, by means of his decision. Often the most difficult task for the analyst is to discover whether or not the objectives as stated or implied by the decisionmaker are really the objectives that he wants and, if not, to get agreement on what they should be.

(2) The alternatives. The alternatives are the action or the means by which it is hoped the objectives can be obtained. Depending on the particular question, they may

be policies or strategies or actions of any sort and they need not be obvious substitutes for each other or perform the same specific functions. Thus, education, family subsidy, police surveillance, and slum clearance may (either alone or combined in varying degrees) all be alternatives to be considered in combating juvenile delinquency.

(3) The costs. The choice of a particular means of accomplishing an objective implies that certain resources will be required and thus no longer available for other uses. These are the costs. Costs are the negative values in the decision--the things we want to avoid, or to minimize, just as the objectives are the positive values we seek to obtain. Many, but usually not all, costs can be expressed in dollars or other quantitative terms. For example, if the goal of the decision is to lower automobile traffic fatalities, the delay caused to motorists by schemes that lower driver speed in a particular section of road must be considered a cost. Such delay not only has a negative value in itself which may be partially expressed in dollars but it may cause irritation and more speeding elsewhere and thus lead to an increased accident rate, a chain of consequences that one may find very difficult to quantify.

(4) The model (or models). The heart of any analysis is the creation of a clear, precise, manageable process designed to predict the consequences of choice. That is, if an alternative were to be selected and implemented, a device is needed to tell us what costs will be incurred and to what extent the objective will be attained. This role is fulfilled by a model (or by a series of models, for it may be inappropriate or absurd to attempt to incorporate all the aspects of a problem in a single formulation).

The name, model, comes from science. And, in fact, in policy analysis, in systems analysis, or in operations research, the most used models, on the whole the most useful, and often the only type even considered, tend to resemble "scientific" models. That is, they express the processes that determine the outcome of alternative actions by means of a set of mathematical equations or by a computer program. Our current capability to design and use such models is limited, particularly when social and political considerations dominate, and other, generally less satisfactory, schemes to predict the consequence of choice may have to be used.

(5) The criteria. A criterion is a rule or standard by which to rank the alternatives in order of desirability. An example would be: Given a fixed task, choose the alternative that accomplishes it at the least cost.

Three sorts of inquiry involving these five elements must be carried out:

(1) First, there is a need for a thorough investigation of what the objectives of the man or institution you are trying to help should be (as opposed to what he may say they are or, without some analysis, what they may appear to be); of ways to measure how effective the various means or alternatives are in achieving those objectives; and of criteria for deciding how to choose among these alternatives.

(2) Second, alternatives need to be discovered or designed, investigated thoroughly and then compared in terms of the consequences that follow from their choice as an instrument to achieve the objectives.

(3) Third, if it appears that we can do significantly better or if we cannot achieve the objectives, there should

be an attempt to select more ambitious goals or to design further alternatives.

In these inquiries, one must try to look at the problem as a whole, not just at its separate parts. Thus, if our problem seeks to reduce crime through an increase in police activity, we should consider the related activities of the other public agencies that affect the situation--courts, corrections, welfare, probation, and so on. Also, the analysis should consider changing training, communications, technology, work hours, the possibility of using auxiliaries of various kinds--everything that might influence the outcome. In addition, one needs to investigate the spillovers--the costs and benefits to those not directly concerned--as well as the direct effects--what increased police activity might do to the life in the area, for instance. Looking at the entire problem may sound like common sense, but also, if taken literally, is impossible in practice because everything in the world is connected in some way with everything else. To do analysis there must always be considerations left out. The determination of the boundaries is largely a matter of judgment. The point is we should at least think about the entire problem and deliberately decide what points we are going to tackle or include and what to leave out. Analysts and decisionmakers are often forced to suboptimize, to consider only part of a problem. What is crucial is that the criteria and objectives for the suboptimization be consistent with those that would apply to the full problem.

What is most obviously new about this approach to providing advice lies in the extensive use of quantitative models to compare and investigate alternatives and, where one cannot quantify, in the use of systematic processes which, while they don't have all the capabilities of quantitative models, make the same effective use of judgment

and intuition. In addition, the emphasis is novel; on working with the entire problem and looking at it as a whole, on the attempt at clarification of objectives, on the search for alternatives, on the explicit recognition of the presence of uncertainty and of steps to take it into account, and on the systematic use of judgment and intuition.

TOOLS AND TECHNIQUES

It is in the new tools and techniques that we have an advantage over analysts of earlier years; Archimedes, Descartes, and Franklin didn't have the computer, linear programming, and modern statistics when they were involved with problem solving in the public interest. Today, we have dynamic programming, game theory, queueing theory, network analysis, Montecarlo simulation, and a host of devices like PERT and SIMSCRIPT to help us. Moreover, when we cannot express our situation in the mathematical equations or simulate with a computer program, we have other processes to obtain our required predictions, superior to unaided judgment or committee deliberations.

Actually, a good many public policy questions--say, for example, those involved in an attempt by a city fire department to provide an improved level of protection within its budget--may require little more on the part of the analyst than careful data collection and the skillful application of standard operations research techniques to a model of the situation. Such questions are typically asked in an attempt to increase efficiency in a situation where it is clear what "efficiency" means. The situation can be modeled, or often, with minor modifications, can be handled by a known technique such as linear programming or queueing theory and the analysis reduced to the application of a well-understood mathematical algorithm. An "optimum" solution is then obtained by means of a systematic computational routine. The queueing model, for example, may be adapted to many operations of freeways, airports, service facilities, maintenance shops, and so on.

The most common objective of the work of the New York City-Rand Institute has been to improve the ability of city departments to provide improved levels of service within constrained budgets. As described by the former head of that Institute:

> *"....This is work readily performed by analysts whose training is in engineering, or operations research, or economics. It is the work to which quantitative analytic tools are best adapted and for which limitations of those techniques are least important. And it is work worth doing. In a city which commits some $6 billion annually to provision of services, efficiency gains even of 1/10th of 1 percent can pay for a major research institute many times over. Equally important, such gains increase disproportionately the sums available in succeeding budgets for innovative and discretionary uses. By fairly conservative calculation, the implemented results of Institute studies are now saving the City some $20 million annually."* [2].

In contrast, valid mathematical models, however, are particularly difficult to create when political and social factors predominate as they do in many public policy problems. Some examples: How much of the city budget should be allocated to welfare and what portion of that to birth control clinics? Are local transportation needs better served by a rapid transit system or by more and higher performance freeways? Is there some legislative action that might end the increase in juvenile delinquency? For many such questions the allocation of resources may become secondary. Here, rather, the objectives or goals of the action to be taken must be determined first and "who benefits" and "who pays" may require more attention than the question of net benefits. It is not clear that "more efficient" has a meaning in these problems and the difficulties almost always lie more in deciding what ought to be done than in how to do it.

Industrial and military decisions are likely to be concerned with a completely man-made and directed enterprise--a manufacturing process, a weapon system, a railroad network--something that was designed with a purpose in mind and with a structure that follows the laws of engineering and economics. When questions arise, the underlying design thus can be rediscovered and modeled. Defense agencies and business firms, moreover, have fairly well defined missions and are not beset by the problems of conflicting jurisdiction that make the job of implementing advice so much more difficult in the public policy area. In contrast, an attack on problems of air pollution or urban renewal involves working with goals that may be hard to make specific and are likely to conflict with each other and with the goals of other projects, in an arena where authority is diffuse and overlapping, and with a structure that has grown without conscious design. To discover the underlying model may require the same sort of profound digging that is required to determine something like the role of hormones in regulating body functions. It is not surprising, therefore, that attempts to build quantitative models with which one can optimize in the conventional sense often tend to fail. Linear programming, queueing theory, statistics, and the computer are still enormously useful here, but usually for segments of the problem, not for the central question.

The failure to quantify and build a valid model means that we must find some other way to fulfill its function.

In policy analysis the important function of the model is to provide a way to forecast the outcomes that follow

alternative actions. A mathematical formulation with which, in addition, one can optimize and thus indicate a preference among the alternatives is an extremely valuable aid to this process but it is not crucial; there are other routes. What is crucial to every prediction or estimate is reliance on expert judgment and intuition. This reliance permeates every aspect of the analysis--in limiting the extent of the inquiry, in deciding what hypotheses are likely to be more fruitful, in designing the model, in determining what the facts are, and in interpreting the results. The great virtue of model building is that it provides a systematic, explicit, and efficient way to focus the required judgment and intuition.

A model, by introducing a precise framework and terminology, serves as an effective means of communication, enabling analysts and various experts* to exercise their judgment and intuition in a well-defined context and in proper relation to each other. In addition, it provides feedback to guide the participants in the revision of their earlier judgments. It is these features of the model that are essential to its role in supplying a route from hypotheses to prediction, not how explicitly it simulates the real world or whether or not it provides a formal or quantitative scheme for optimization.

To get along in spite of difficulties that bar the use of computers and mathematical models, one can employ

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*In the area of public policy analysis, almost anyone the analyst goes to for advice may be considered an expert.

"partially quantitative" techniques that while they surrender some of the features of the traditional model still provide context, feedback, position, and communication.

Operational gaming, that is to say, exercises in which the participants interact by playing roles that simulate the actions of individuals, or factions in a society, or even such things as sectors in an economy, is a first step away from computers and mathematical models. Its predictive quality is very clearly a function of the intuitive insight provided by the participants. Because it allows the participants to introduce their judgment at every stage, a game provides an opportunity to take into account intangibles often considered completely beyond the reach of analysis. Both the expert on the control team and the player can let their decisions be influenced by their appraisal of the effects of the simulated environment. For example, the player can take into account how the success or failure of an economic action may depend upon assumptions about a population's willingness to accept a change in diet or the flexibility of the political structure to accommodate a new power bloc. In any mathematical formulation or computer simulation, factors of this type must be anticipated and decisions about how they are to influence other factors made in advance; in a game such decisions can be made *seriatim*, and in context, as the need arises.

But gaming--even though to use it sacrifices both the capability to replicate exactly and to optimize--is still, like the traditional model, a simulation. It may sometimes be an advantage to sacrifice this also.

When faced with issues where there is uncertainty, doubt, disagreement, and seemingly no way to build any

sort of quantitative model, common practice has been to turn to a committee or a panel of knowledgeable people or "experts," for advice. Systematic techniques for eliciting pooled judgments from such a group exist and the judgments obtained are better than those obtained from the group acting as individuals or as a committee. These techniques, used to obtain predictions of the consequences that are likely to follow from choice of an alternative, may thus serve to replace the traditional model. In other words, instead of using a mathematical model to calculate the consequences of choosing a particular alternative, we can use a panel of experts to estimate or predict what will happen. Let me describe Delphi, one such technique [3].

The Delphi procedures are designed to improve the forecast or estimate one obtains from a committee or panel by using controlled information channels, such as a series of questionnaires, to avoid the drawbacks associated with face-to-face confrontation. Three simple ideas are involved: anonymity, iteration and controlled feedback, and statistical group response.

(1) Anonymity. The participants are queried and they respond by means of a formal mode of communication, usually a written questionnaire or an on-line computer console. In determining an estimate or prediction, the responses are not matched with the respondents, and even the identity of the participants may be concealed from each other until the end of the exercise.

(2) Iteration and Controlled Feedback. [illegible] is replaced by an exchange of information [illegible] steering group or exercise manager. After [illegible] the information, or part of it, generated in [illegible]

stages may be fed back to the participants in order that they may use it to revise their earlier answers. In this way "noise"--irrelevant or redundant material--can be reduced.

(3) Statistical Group Response. Although the group opinion tends to converge with feedback, the normal outcome is a spread of opinion even after several iterations. Rather than making an attempt to force unanimity, a statistical index, usually the median, is used to represent the group response. This way of defining the group judgment reduces pressure for conformity and insures that the opinion of every member plays a role in determining the final response.

Experimental work has shown that the Delphi procedures lead to convergence of responses, to similar results when similar groups of respondents are used, and, more often than not, where results can be checked, to improvement in accuracy over estimates or predictions obtained from individuals or by groups meeting as a committee. The formal properties of the estimation process determined when factual questions are used (convergence, reliability, well-defined distributions) carry over into the area of value judgments (objectives, priorities) [4].

Although Delphi procedures are now widely used for forecasting and for determining objectives and goals, much more experimental work needs to be done, particularly to ascertain whether it is as good as or better than standard methods for resource allocation and as a substitute for a representative model. Large gains seem possible with respect to increasing the accuracy obtainable and with respect to creating procedures more responsive to the information needs of decisionmakers. There are difficulties also; panel resistance for one thing and undue influence or inept direction by the exercise manager another.

ACCEPTANCE AND IMPLEMENTATION

Analysts need to understand more about how to get the process of analysis accepted and its results implemented. I am very weak here, and here, in fact, the entire analysis community is at its weakest. We have not given these matters enough attention.

> *"In a competitive world--whether of profit or nonprofit operations--those who devise specific techniques are likely to adapt to the prevalent selling patterns of the society, and to leave problems of integration--if they think of them at all--to the invisible hand celebrated by Adam Smith"* [5].

As analysts, our attention has been on the techniques and procedures of modelling, not on how to convince public officials that they need analysis, should rely on its findings and see that its recommendations are accepted and properly implemented by their staffs. I have some thoughts as to how systems analysis must change but they are almost completely second hand, based on the experience of others.

For an analysis to take place, someone must have a problem; that is, be dissatisfied with some aspect of the state of affairs and want to make a decision with regard to altering it. But he will have his own ideas. Perhaps we should take a lesson from the OR people who work with industry. Success is often based on

> *"a willingness on the part of the operations researcher to devise a model that plays down the emphasis on producing rational decisions. The guiding idea has been to devise models that can inform an executive as to the likely effects of decision strategies that he himself has formulated"* [6].

In military or industrial situations, systems analyses and operations research studies have often been designed and carried out, although perhaps not consciously, as if they were to assist an individual decisionmaker make an isolated decision; a man who needs no authority but his own and no cooperation from above or below to implement his interpretation of the findings. This is far from a satisfactory formulation if an analysis is to be helpful in most public policy situations. The environment is such that there are likely to be many participants in any given decision, most of whom can counter or at least alter any recommendation but none of whom has the authority or capability to implement it without cooperation from the others. Furthermore, even if a policy recommendation is accepted at the top level, the program that comes out of the bureaucracy below may have been so changed by operating instructions as to bear little resemblance to the original.

> *"Two examples will help make the point: the pacification program in Vietnam and the introduction of PPBS in the federal government. Both were welcomed with fanfare at top levels and both came out as rather mangled versions of what the analysts thought they were recommending and the decisionmakers thought they were introducing"* [7].

There are costs involved with implementation also:

> *"Another cost that should be explicitly considered is the implementation cost, including the cost of the organizational changes, if any, that need to be made if a new program B is to supplant ongoing program A. Almost always there are problems with organizations and some individuals attendant to the use of analysis. It is more than resistance to the changes in practices that must ordinarily be overcome, for the use of analysis may itself affect the implementing bureaucracy in a serious way--for instance, by changing the power relationships, impairing incentives, or showing a tendency to increase centralization. One aspect of a cost-benefit analysis should thus include explicit discussion and evaluation of the implementation and organizational costs (and possibly benefits) associated with each alternative"* [8].

In addition, it is important that we pay attention to the cost associated with either the failure to actually initiate a project or to successfully implement the project after we initiate it. We must recognize that some projects have a better chance than others of being successful here. Hence the project recommended should not necessarily be the one with the greatest excess of benefits over cost unless the probabilities of successful initiation and implementation are estimated and the expected costs that would be incurred by failure at either phase taken into consideration.

Y. Dror [9] suggests that each recommendation proposed to a primary decisionmaker be examined in the analysis for political feasibility, that is, for the probability that it will be sufficiently acceptable to the various secondary decisionmakers, executors, interest groups, and publics so that it can be translated into action. In addition, Dror points out how important it is that the analysis cover all aspects of a policy. He maintains this must be done even if it requires the use of far less desirable means to arrive at the recommendations--for example, by measuring output in terms of input, say, by using the professional qualifications of the policymakers to estimate the quality of their policy.

Disjointed incrementalism, an approach better known as "muddling through" is often viewed as an alternative to systems analysis. In this approach the analyst does not necessarily seek a solution to the problem as a whole. He examines only those alternatives that differ incrementally from current policy. He does not analyze all the consequences of even these for he assumes that policy is made in steps,

that it proceeds through a long chain of political and analytic moves, and that other analyses, simultaneously conducted by the various interested parties, make it unnecessary for him to worry about completeness or fairness to other interests. He feels he can afford to make only minor changes and even to make mistakes because after the decision is made, if unanticipated consequences show up, more analysis will be done. Analysis is seen as helping the decisionmaker by contributing to his bargaining power as opposed to helping him by providing the means for him to make a decision. The two approaches are quite compatible and the systems analyst may do well to accept the incrementalist's view of the policy process and plan his analysis accordingly.*

What can we say are the important conditions for working with a client in the public policy area? The following remarks are largely based on those of Peter Szanton [2], following his work with the New York City-Rand Institute.

(i) The analysis must be supported by the target agency. Voluntary support is best;

> *"The support need not be wholehearted or entirely free of skepticism, but it must exist. Where it is absent, the analyst will find his access to data restricted, and the participation of city staffs in the study foreclosed. Perhaps most important he will be unable alone to identify the kinds of analyses which might affect policy, or the schedule on which they must be produced in order to affect it"* [2].

(ii) There must be time for the analysis to get started. At the beginning, analysis makes demands for attention, money, assistance in data gathering and interpretation, and even access to private files and for a time will return nothing.

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*For an illuminating discussion of this point, see [7].

(iii) The problem, and its solution, must be within the capability of the client to deal with. A bureau chief wants to find out what action will improve his situation, not support an analyses to show the Federal government how, if Congress and the courts approve, to act to eliminate the difficulty. The clarification of issues far beyond the capability of the supporting agency or even of the next few steps up in the hierarchy to cope with, are likely to generate little interest and have no impact on policy.

(iv) The client may have to be shown how to use the analysis. It may be difficult to find officials who can implement the work.

> *"And since making the analytic work useful is a central concern of the analyst and far from the central concern of the policy-maker, it follows that the analyst must take a special responsibility for helping the governmental client become an effective consumer. The analyst must engage in his work in such a way as to enlarge the chances that it will be not only technically competent, and timely, and realizable in its conclusions, but also that it can be understood, relied upon, and put into effect by responsible officials. This requires continuous interaction with officials--with a minimum of jargon, a generous understanding of the particular bureaucratic, fiscal, and political constraints at work, and a persistent focus on the key question: 'then what should be done?'"* [2].

Apparently unexciting issues such as "In what form should the records be kept?" may be clues to "what information is needed for more effective management" are often of genuine importance to lower level managment. They also may be keys to intermediate results so important to the success of a lengthy study effort.

(v) The interests of the client agency must be respected. The client agency may be imbedded in another organization--like the Air Force in the Department of Defense or a mayor's office in the city government--but their interests are not the same.

> *"It matters for at least two reasons. Information is an element of power. Analysts working for one branch of a city government, where that branch can restrict to itself access to the results of the work, disturb the balance of power. Where the work addresses problems of little social importance, the disturbance will be correspondingly trivial. But the more important the subjects of the research, the more likely are the other branches--especially legislatures--to observe the imbalance, and to respond. The response will be one of two kinds. The other branches will seek either to provide themselves with a corresponding analytic capability or to strike such an instrument from the hands of the executive branch. The former course is clearly preferable, not merely for the analysts who find themselves under attack, but for the development of a more rational decision-making process. But it is also the harder and less likely"* [2].

The second reason is that analytic work for government affects the balance of power as between government and the governed.

> *"More and more clearly, our society is coming to regard interest groups--ethnic and racial associations, labor organizations, and neighborhood communities--as legitimate participants in local decision-making. But these are groups with virtually no access to serious analytic support"* [2].

CONCLUDING REMARKS

The application of analysis to public policy decisions has spread rapidly in the last few years. Its acceptance in an environment populated with politicians is remarkable--for politics is geared to winning support by outlining the benefits of programs before the means and the costs are determined. I assume most of you believe that by appealing to analysis (as opposed to precedent, authority, bargaining, or trial and error) one is more likely (though not necessarily) to receive better answers to questions and solutions to problems and thus better advice. But that does not mean that more quantitative analysis is always to be preferred to less. For one thing, it costs more in time and money. If the costs of error are small with respect to the costs of inquiry, one might as well use trial and error. For another, its solutions may be far more difficult to accept and implement than those arising from more subjective and political processes.

There are critics who see dangers in an analytic approach. Many factors fundamental to public policy are not subject to quantification, hence we may find the more elusive political and social aspects neglected, improperly weighted or even deliberately set aside. But even though analysis does no more than provide relevant information on cost and performance, it is almost always useful. At the very least, it counters the purely subjective approach on the part of advocates of a program and may force them to change their line of argument and talk about specifics rather than merely expressing their personal opinion with statements of noble purpose. We have not and never will

be able to make the analytic approach a purely rational, coldly objective, scientific aid to decisionmaking--only one far more so than its alternatives. But it is not a static concept--new procedures and techniques are being constantly proposed--and thus there is hope for much improvement.

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