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Science Advice for State and Local Government

Several factors affect the increasing role of science advisers in state and local affairs.

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Many policy analysts and public figures have, in recent years, urged state and local governments in the United States to emulate the federal government by extensively utilizing the advice of scientists in the formulation of public policies (*1, 2*). This suggestion is pressed, in part, because of the general belief that science and technology offer potential solutions to important public problems and, in part, because it is thought that rapid scientific and technological change itself has caused many of these public problems. In this paper we will examine the factors that inhibit and enhance the utilization of scientific advice in state and local government.

First, we should note that there is already a widespread interest in the use of science advisers at this level of government. A survey conducted in the spring of 1967 found that 22 states and territorial governments have established or are actively planning to establish general science advisory units charged with guiding the government on questions in all fields of science and technology (*3*). The same survey discovered that 5 of the 50 largest municipal governments in the United States have also established some comparable formal mechanism for general science advice (*4*). In responding to the survey five governors and five mayors indicated that while they had not previously considered the idea of establishing a general science advisory unit, they were intrigued by it and would like to have information on the organization of such a unit.

Irrespective of whether or not they have a general science advisory unit, all state governments and most large municipal governments have established specialized science groups to advise the chief executive or particular governmental agencies. On a less formal basis, many state and local governments have sought advice on specific science questions from research institutes and scientists affiliated with local public and private universities. Professional science advice on such matters as agricultural research, public health, wildlife management, forestry, geology, and mine safety has long been a part of normal government operations at the state and local level, but the search for specialized science advice on such topics as oceanography, atomic energy, and air pollution is clearly the product of changing economic and political conditions.

The interest in formal mechanisms for general science advice appears also to be the result of changes in the economic and political environment. The oldest operating state general science advisory unit was formed by New York State only in 1959, and most of the existing state and municipal units were established in the years since 1963. Although there are no detailed studies of the origins of these advisory mechanisms, an examination of the first reports and statements that they have issued indicates a preoccupation with the locality's relative standing in the distribution of federal research and development expenditures and a concern with the role of science in regional economic development (*5*). States and communities whose economies are either most dependent upon or most noninvolved in research and development activities tend to have the greatest interest in establishing a formal science advisory mechanism. Those in the former category appear to be seeking a device to protect their relative position in federal science allocations and to build upon their strengths, while those

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in the latter category appear to be seeking a method to improve their ranking and to gain the economic benefits of research investments. To a large extent, then, the motivating factor for the use of science advisers in state and local government appears to be the desire to enhance economic development rather than the desire to apply science and technology to the entire range of local problems.

Organization and Experience of Advisory Units

State and local governments have used a variety of organizational forms to obtain general science advice for the stimulation of local research and development activities. Committees analogous to the President's Science Advisory Committee have been established by the governors of Hawaii, Kentucky, Massachusetts, and Pennsylvania, and by the mayor of New York City. The states of Connecticut, Louisiana, New York, and North Carolina have organized grant-dispensing public foundations or commissions that are similar in form and function to the National Science Foundation. Groups parallel to the Science Advisory Committee of the U.S. Department of Commerce have appeared in Georgia, Maryland, New York, and Oklahoma, while the city of Los Angeles has set up a nonprofit corporation that is said to resemble the Air Force's Aerospace Corporation. The California experiments with contract research and advice are well known (*6, 2*), but the attempt of the New York State legislature to establish its own science advisory committee has not been widely discussed (*7*). Despite the range of experience, no state or municipality duplicates the entire set of federal science advisory mechanisms and few have had more than one type of advisory unit operating at any given time. The characteristics of the currently active state general science advisory units are described in Table 1.

Although the specific organizational forms selected by a particular state or city must fit to some degree the science resources and needs of the state or city, the suitability is usually very unclear. In at least three cases the advisory mechanism selected appears to be the result of chance relationships, the organizational ideas of individuals—scientists and lawyers—who happen to be personally close to political decision-makers. Few states or municipalities have systematically surveyed their needs and resources for science advice and the stimulation of research and development activities before adopting a specific organizational form.

It is not surprising, then, to find that many states and municipalities are not satisfied with the science advisory mechanism that they have selected, even for the limited goal of economic development, and that the advisory groups themselves have not been able to claim any significant impact on public policies. Despite their recent origins, over one-third of the science advisory units formed by state and local governments

Table 1. Characteristics of operating state and local general science advisory units. The governor of the state was the appointing officer in every case except the New York City Science and Technology Advisory Council which was appointed by the mayor.

State	Organization title	Type*	Founding		Membership	Staff	Finance	
			Year	Method			Budget (dollars)	Period
Connecticut	Connecticut Research Commission	NSF	1965	Statute	10	Full-time	833,000	1965–67
Georgia	Georgia Science and Technology Commission	Dept. of Commerce	1964	Statute	40	Full-time	96,970	1967
Hawaii	Governor's Advisory Committee on Science and Technology	PSAC	1964	Informal	18	Part-time	200	
Kansas	Research Foundation of Kansas	Mixed	1963	Statute	12	Full-time	100,000	1967
Kentucky	Kentucky Science and Technology Council	PSAC	1965	Statute	24	Full-time	50,000	1965–67
Louisiana	Louisiana State Science Foundation	NSF	1964	Statute	11	Full-time	400,060	1967
Maryland	Maryland Science Resources Advisory Board	Dept. of Commerce	1963	Informal	61	Maryland Dept. of Commerce staff	7,000	1967
Massachusetts	Governor's Advisory Committee on Science and Technology	PSAC	1966	Informal	14	Massachusetts Dept. of Commerce staff	None	
New York	New York State Advisory Council for the Advancement of Industrial R & D	Dept. of Commerce	1959	Statute	40	New York Dept. of Commerce staff	20,000	1967
	New York State Science and Technology Foundation	NSF	1965	Statute	9	Full-time	1,000,000	1967
	New York City Science and Technology Advisory Council	PSAC	1965	Informal	20	Part-time	25,000	Foundation grant
North Carolina	N.C. Board of Science and Technology	NSF	1963	Statute	16	Full-time	850,000	1965–67
Oklahoma	Governor's Advisory Committee on Science and Technology	Dept. of Commerce	1964	Executive order	26	None	None	
Pennsylvania	Governor's Science and Technology Committee	PSAC	1965	Informal	20	Full-time	209,000	1967

* NSF is the National Science Foundation and PSAC is the President's Science Advisory Committee.

have either fallen dormant or have been disbanded. Unlike their federal counterparts, very few of these advisory units have survived an election that brought about a change in administrations.

Some of the science advisory groups have presented imaginative proposals and have met with some success in getting their proposals implemented. The New York State Advisory Council for the Advancement of Industrial Research and Development, for example, suggested the formation of the New York State Science and Technology Foundation which has embarked on a program of financing pilot projects that initiate new areas of teaching in science and attract leading specialists for visiting positions in institutions of higher education in the state. The Research Foundation of Kansas conceived and helped implement the Kansas Vocational Education Research Coordinating Unit which seeks to stimulate research efforts in vocational education topics.

In general, however, the state and local science advisory groups, by their own admission, have accomplished very little. Their members have complained of the frustrations of trying to distill the group's central tasks from the vague guidelines formulated by political officials. In turn, political officials, while enjoying the publicity that accompanies the establishment of a science advisory group have often not found it necessary or useful to consult with these advisory groups on important public problems other than those that they believe are directly related to economic development.

Obstacles to Utilization of Science Advice

But the utilization of science advisers in state and local government is inhibited by factors other than the ambiguous nature of their charge or the skepticism of the political officials. A useful way to highlight these factors is to contrast the federal science advisory situation with that of the state and local government. We must caution here, however, that much more is known about the structure and operations of science advisory mechanisms in the federal government than is known about the structure and operations of the state and local mechanisms.

As Don K. Price and others have pointed out, the groundwork for the federal involvement in science and for the utilization of expert advice in the formulation of federal programs was laid long before World War II (*8, 9*). The early placement of scientific activities in military agencies, and the civil service reforms beginning in the late 19th century provided the federal government with technically competent personnel who were prepared to receive and to apply scientific advice. The merit principle and congressional preference for the technical specialist over the general administrator, as Don Price has shown, allowed many bureau positions to be held by scientifically trained civil servants (*8, 10, 11*). When the political executive turns to the outside scientist for advice, as he increasingly has during the postwar years, he does so with the knowledge and confidence that the advice can be understood, evaluated, and implemented by the existing bureaucracy.

The technical competence of the personnel in state and local government is less obvious. There are, of course, some states and municipalities that have built civil service systems that are at least the equal of the federal civil service in their adherence to the merit principle and their concern for professional qualifications. Many others, however, are unreformed in this sense, staffing their administrative and even their technical agencies on the basis of a variety of subjective criteria (*12*). These states and municipalities are unprepared to evaluate and to apply the advice of the nongovernmental scientist and may, in fact, be preventing themselves from receiving that advice at all.

The federal government, predisposed as it is toward science and expertise, has actively sought the assistance of university and industrial scientists, as the problems that face it have become increasingly more scientifically and technologically complex. In numerous instances, outside specialists have been given access to privileged information and have been invited to advise on alternative courses of governmental action. Although their recommendations may not always be followed, scientists know that they can have a significant influence on federal policies and, because of this, they are prepared to devote a considerable portion of their time to advisory work on federal problems.

State and local governments appear less inclined than the federal government to invite specialists to participate in the policy-making process. The absence of an invitation to participate directly in governmental policy-making increases considerably the personal costs to an individual scientist of being deeply involved in work on state and local problems. To gain a hearing in state and local affairs, the scientist may be forced to engage in overt political acts, such as appealing directly to the public, which can be an enormously time-consuming and a personally risky enterprise.

Within the scientific community more prestige accrues to those working on problems of the federal government than to those engaged in state and local projects. The leading scientists in most disciplines are oriented toward Washington and seem to have little interest in or knowledge of the ways in which their disciplines can be useful in solving state and local problems. The availability of research funds and the opportunities to influence public policies at the federal level, of course, help determine these patterns of prestige and interest.

There are also sharp contrasts between the structures of the federal science advisory groups and those of the science advisory groups that have been established by state and municipal governments. The federal advisory groups have often been criticized for their failure to be fully representative of the scientific community; their selection policy is said to be based only on scientific prominence which leads to biases in favor of scientists from certain regions and certain types of institutions. The state and local science advisory units appear to be vulnerable to criticism on just the opposite grounds; their membership composition seems to reflect a deliberate attempt to balance institutional and geographic interests. Thus, the membership of state advisory committees may include spokesmen for such potentially conflicting pairs as the state university system and the state college system, the private nonsectarian universities and the private sectarian universities, the urban areas and the rural areas. While this kind of balancing may make the group a representative one, and open up new avenues of contact to the scientific community, it may also bring together men of varying scientific competence and conflicting loyalties, and hinder the coordinated functioning of the units.

Although government scientists have served on certain federal science advisory committees, the federal govern-

ment has largely avoided the awkward situation in which federal agency representatives are included as formal members of advisory groups. When there is a need for interagency discussions on science issues, a separate body, such as the Federal Council for Science and Technology, has been established. Many of the state and local science advisory units, however, include both elected and appointed government officers among their regular members. This official representation is likely to restrict rather than enhance the scope of the advisory unit's activities since its members may not be inclined to examine critically the science activities of a particular agency in the presence of its official spokesman or a higher state officer.

The location of the advisory unit within the governmental structure is likely to lead to a similar restriction on the activities of state and local science advisory units. Although all the existing state and local science advisory units nominally advise the governor or the mayor directly, many are officially attached to a line agency, usually a department of commerce and development. Thus, the advisory unit is placed on an organizational level equal to that of the science agencies that it may be most interested in examining and evaluating. The same situation used to exist in the federal government, where the National Science Foundation long had the task of examining and evaluating the science programs of other federal agencies that not only were on the same organizational level as the National Science Foundation, but that also commanded many times its budgetary and political resources. The awkwardness of this situation apparently was one of the major factors leading to the establishment of the Office of Science and Technology, an agency that is located within the Executive Office of the President (*10*, p. 239).

To be more than sporadically effective an advisory group would appear to need some minimum amount of financial and professional staff assistance. The science advisory units in the federal government in most cases have been provided with resources adequate enough to carry out their own studies. Those in state and local government, however, often do not have directly available to them the technically trained personnel and the budgets necessary for thorough and independent studies and are forced to rely upon the benefi-

cence of other government agencies and institutions, that is, universities with which their members are connected.

Resources for Science at the Local Level

One of the reasons federal science advisory groups have a large impact on public policies is that they have an influence on the size and direction of federal research and development expenditures. These expenditures are a major portion of the discretionary federal budget and variations in them affect the operating programs of numerous governmental and private organizations. Even if the state and local science advisory units were to become deeply involved in the allocation of local government research expenditures, which few of them have, they would not gain a very powerful lever on research activities within their jurisdictions because state and local governments spend comparatively little on research.

Recently the National Science Foundation completed the first general survey of the science expenditures of state governments, excluding state universities and colleges (*13*). The survey found that research and development activities of state agencies accounted for only 0.2 percent of total state expenditures. In 1965 the research and development expenditures (including plant and equipment) for all state agencies amounted to $93 million. The federal government was the source of approximately 40 percent of these funds. State universities and colleges, of course, have a considerable involvement in research and development activities as their science expenditures are nearly nine times those of the state agencies ($646 million versus $72 million in 1964), but they received less than a quarter of their science funds from state governments (*13*, pp. ix, 55). There are no reports on local government science expenditures, but the expectation is that the amount would be insignificant and substantially less than that spent by the states.

The largest and most influential science expenditures within any jurisdiction in the United States are those of the federal government, and the allocation of federal research expenditures is directed by a process in which state and local governments do not directly participate. It is just this science allocation process that has led political scientists to discuss the emergence of a new federalism—a federalism in which private institutions such as business firms and universities deal directly with and are partially supported by the central government without the intervention of any intermediary political units (*10*, p. 71).

The outlook for a significant increase in the relative share of state and local government budgets devoted to research activities would not seem to be great. To be sure, several states have established foundations to encourage research on state and related topics by the distribution of grants to scientists affiliated with local universities and business firms. In some cases these foundations have sought to encourage the introduction of new fields of research in their states by providing initial support for the purchase of equipment and the establishment of laboratories. These programs may be productive, but few states and municipalities are large enough to gain for themselves the full benefits of sustained efforts along these lines. State and local governments are subject to the same problem of appropriability of research benefits that limits research expenditures of the business firm. The products of all but the most applied research are uncertain. Organizations that support research often want assurance that they will be able to utilize the findings in their own operations. Moreover, research results tend to become available to others (competing firms or neighboring jurisdictions) relatively quickly and relatively inexpensively. The costs of many research activities, particularly those of a fundamental nature, are too large relative to the benefits of research for all organizations that cannot absorb within their own operations or jurisdictions a considerable portion of the research findings. The burden of research support tends to fall on the federal government which, within the United States, encompasses all who may potentially benefit from new discoveries.

Opportunities and Incentives for Science Advice

The obstacles to increased science spending by state and local governments and to the increased participation of scientists in the policy-making process at this level of public administration are counterbalanced, however, by several circumstances that could enhance the

concern for science and technology on the part of state and local governments. And, as we shall see, it is action or potential action by the federal government that provides the opportunities and the incentives for the utilization of science advice by state and local governments.

Congress in recent years, for example, has become increasingly aware that the existing procedures for the awarding of research contracts and grants has led to a situation in which federal science expenditures are concentrated in a relatively few states, firms, and universities (*14*). Tables showing the distribution of federal funds for science have aroused great interest among state governments in public science policies. Discussion at times has centered on the possibility of allocating science funds directly to the states as a way to widen the distribution of science resources. If Congress were to require such a distribution procedure, the state and local science advisory units, and particularly the state science and technology foundations, could become influential organizations in the allocation of science resources because they could be the coordinating agencies in the distribution of state shares.

Recent legislation in several science-related areas appears to indicate a growing federal interest in regional cooperation which could lead to the increased use of science and technology in meeting state and local problems. The establishment of regional commissions under Title V of the Public Works and Economic Development Act of 1965 provides one forum in which joint action in science is being discussed (*15*). With the wider perspective and the larger resource base of a region, it is possible that local science communities will find more opportunities than they have had to participate in the solution of local problems.

Another avenue of access for the scientist is in the expansion of higher education facilities that is currently under way throughout the United States. Governments and taxpayers who cannot be induced or even expected to support much science directly are providing increased indirect support for science through programs to enlarge local undergraduate and graduate facilities. Academic scientists are inherently involved in these programs and can legitimately use their role in educational planning to influence the level of research activity within a particular locality. Moreover, there is growing evidence of a tie between the location of excellent university research facilities and the subsequent location of rapidly growing science-based industries. With their interest in the promotion of industry, state and local governments thus find new reasons for liaisons with the university scientific community.

The ability of any particular state and local government to achieve its goals in education, in economic development, in urban transportation, in pollution control, in welfare, and in many other areas, however, is heavily dependent upon its ability to compete successfully for federal grants with other state and local governments. In fiscal year 1967, federal grants-in-aid to state and local governments amounted to over $14.6 billion or approximately 15 percent of total state and local revenues (*16*). Since the federal government has increasingly formulated its local assistance programs in technical terms and since it uses experts to help evaluate the applications submitted for these programs, state and local governments must eventually begin to attain a comparable level of technical sophistication in their own operations. As Harvey Brooks points out, "Those localities which can prepare technically sound and well thought out proposals are going to win out in the competition for Federal grants" (*17*). Scientific advice will be vital in the preparation of applications and in the identification of research groups to carry out the detail planning and data gathering that will be necessary to formulate persuasive proposals. The needs of state and local governments for federal aid would seem, then, to be a very important factor in increasing the utilization of science advice by these governments.

One cannot expect, of course, state and local governments to acquire in the near future a science advisory network equivalent to that currently in existence in the federal government. The channels for science advice in the federal government have taken 30 years to reach their present stage of development and they have been constructed in an administrative environment that was already predisposed to science and expertise. Moreover, as we have noted, there are substantial obstacles that prevent state and local governments from utilizing the advice of scientists to the extent that it is utilized by the federal government and from supporting science to the extent that it is supported by the federal government. Nevertheless, the trends in the federal government seem to indicate that state and local governments will rely increasingly on the advice of scientists in the formulation of their public policies.

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