

Science Policy Through a Local Lens: The Role of State-Level Advisory Groups in the 21st Century

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Executive Summary: As new challenges arise in the 21st century, state and local governments play an increasingly critical role in science policy, contrasting the traditional focus on the federal government in this landscape. To meet these challenges, states require access to subject area expertise and evidence-based advisory resources as part of their policy toolkits. Many states have independent academies of science that have potential to provide scientific expertise to state governments. However, steps need to be taken to capitalize on these resources and integrate them with other key elements in the policymaking process. By prioritizing the development of relationships with state and local governments, academies of science and other state-level scientific entities could improve the utility of their advisory resources. We present case studies from Connecticut and Missouri, where such a model has allowed scientists to contribute to policymaking on state-level issues. We further discuss the benefits and limitations of this advisory model and explain how this approach can benefit states with different political compositions and legislative structures. By partnering more intentionally with state and local governments, academies of science can make more effective contributions to address the growing science policy issues of the 21st century and beyond.

I. Introduction

Many national advisory organizations support federal governmental leadership of the US scientific enterprise, ensuring that scientific advice is available to Congress and the White House. One important scientific advisory organization to the federal government is the independent collective of the

National Academies of Science, Engineering, and Medicine (NASEM), which provides objective research, analysis, and policy recommendations to a range of federal agencies and offices (National Academy of Sciences n.d.). NASEM convenes interdisciplinary committees of technical experts to address complex problems, explore solutions based

on scientific evidence, and provide recommendations to policymakers. Importantly, NASEM is **independent of the federal government, and all branches of government can use it as an objective resource.**

As the 21st century progresses, states are contending with a growing number of science and technology (S&T) policy issues. As a result, state and local governments are rapidly becoming critical hubs for evidence-based S&T policymaking. Historically, state and local governments have taken a leading role in S&T policy areas such as healthcare, transportation and water infrastructure, education, and environmental quality (Nunn et al. 2019). Recently, these roles have expanded, and many states now fund research and explore S&T policy options to address important regional or local issues. For instance, in the Western United States and along the Chesapeake Bay, state governments play important roles in water policy (Reimer 2013). State governments also increasingly interact with new technology; for example, several states have passed laws on internet and data privacy (National Conference of State Legislatures 2021), while other regulations determine how governments themselves can use technology, such as limiting the use of facial recognition by state agencies (Greenberg 2020).

While state governments are increasingly important actors in S&T policy, they have varying levels of access to objective scientific expertise. Available resources range from state executive agencies and gubernatorial science advisors, to state legislative research and program evaluation offices, to public and private colleges and universities. However, access to government resources may be sporadic and contingent on annual funding levels. Although some S&T councils exist outside of the government to provide independent state-level advice, such as the California Council on Science and Technology, few states have similar resources. As a result, some states have excellent access to expertise during S&T policy development, while other states have very limited access to this expertise. Improving scientific advisory capacity would complement ongoing state-level efforts to expand the use of cost-benefit analysis (Pew-MacArthur Results First Initiative

2013) and evidence-based policymaking practices, which states use to direct limited funds to the most efficient and effective programs in areas such as behavioral health, child welfare, and criminal justice (Pew-MacArthur Results First Initiative 2017).

State Academies of Science (AOS) represent a category of scientific advisory resources that are largely under-utilized by state governments. Forty-seven states have state academies that vary widely in membership and function, ranging from honorific societies modeled after NASEM to open, paid-membership organizations or consortia of other scientific or educational entities such as museums (American Association for the Advancement of Science n.d.). Many academies hold meetings, issue publications and reports, or coordinate outreach and educational programs. In some states, the academies are involved in the policymaking process and offer policy recommendations. However, other state academies are interested in sharing resources and expertise with state governments, but feel they are not recognized or utilized (National Academy of Sciences et al. 2008). AOS have expertise and resources to assist state governments to develop evidence-based policies in key S&T areas, generate and interpret data for program evaluation, perform cost-benefit analysis, guide S&T educational programs, and lend a scientific perspective to states as they navigate new challenges. **To take on this advisory role, state academies and other scientific entities should be proactive in developing relationships with their state governments and offering support similar to the function of NASEM at the federal level.**

With the growing need of state governments to obtain consistent, objective, and non-partisan analysis on S&T topics, state AOS represent an untapped resource of scientific expertise that is largely unaffected by state budgetary restrictions and politics. Here, we present Connecticut and Missouri as examples of two successful, independent scientific advisory mechanisms in states with different S&T priorities and political leanings. To meet the evolving science policy needs of states and municipalities, state AOS should proactively engage

with decision makers in state legislatures and executive agencies, as well as municipal governments, and embrace an expanded set of responsibilities as independent, state-level scientific advisory bodies. Through these partnerships, state governments can use AOS more effectively to bring together interdisciplinary experts and innovative thinkers to tackle the rapidly evolving policy issues of the 21st century.

II. Policy Proposal

State AOS and scientific entities are uniquely positioned to leverage the expertise of their membership to address S&T issues in conjunction with state and local governments (Figure 1). In many states, AOS already serve one or more functions in the process of developing evidence-based policies, such as state-specific data collection and interpretation, publication of reports, providing expert testimony, and issuing recommendations

(National Academy of Sciences et al. 2008). Other state-level scientific entities, such as S&T councils and honorific societies, also perform these functions in some states.

We recommend that leaders of state-level academies and other scientific entities prioritize building relationships with state and local governments to engage more actively in advisory roles. State academies in particular can take advantage of their existing resources, membership, and organizational infrastructure to provide expert guidance on S&T topics through activities such as performing data analyses, writing consensus reports and state action plans, providing witness testimony, and holding direct meetings with state legislators or executive officials. This policy recommendation has several benefits and limitations when viewed through the lens of effectiveness, efficiency, equity, and ease of political acceptability (Table 1).

	Benefits	Limitations
<i>Effectiveness</i>	<ul style="list-style-type: none"> • Access to scientific experts • Analysis and interpretation of state-level data 	<ul style="list-style-type: none"> • Ultimate impact will depend on state government’s use of scientific advice
<i>Efficiency</i>	<ul style="list-style-type: none"> • Established organization that will not change year-to-year 	<ul style="list-style-type: none"> • Requires either state funds to support studies or experts to give uncompensated time
<i>Equity</i>	<ul style="list-style-type: none"> • Scientific entities will address issues affecting entire state 	<ul style="list-style-type: none"> • Membership of state academies or scientific entities may not be equitable
<i>Ease of Political Acceptability</i>	<ul style="list-style-type: none"> • Independent and non-partisan • Capitalizes on investments by states providing resources to institutions of higher education 	<ul style="list-style-type: none"> • Controversial science topics may lead to anti-science sentiments or other opposition

Table 1: Benefits and limitations of the policy recommendation

There are numerous advantages to using AOS for scientific input compared to current methods in place in many states. First, the direct participation of scientific experts from state academies and other entities — where members may come from universities, industry, or the non-profit sector — creates a broad pool of knowledge from which states can draw to analyze and address critical issues. This

is likely to be more effective than relying on a comparatively smaller scientific workforce in state-level agencies or legislative offices to take on large projects which may benefit from specific expertise. The practice of relying on AOS or existing organizations for expert analysis and evidence-based policymaking is an efficient route that takes advantage of established group membership and

infrastructure, which, importantly, is not contingent on state funding levels. This allows the advisory mechanism to be more stable from year-to-year and consistently available at a similar capacity. Direct collaborations between AOS and state legislatures could allow scientific experts to address issues in a more equitable manner than may be afforded by university research funding or industrial priorities, as state legislators are more attuned to issues at a

academies of science to strengthen state-level policymaking.

community level and may represent districts where there is less of a university or industry presence. Finally, the political acceptability of this recommendation should involve relatively few barriers, as the proposal capitalizes on existing state level funding for higher education and the training of scientific experts. The proposal does not require significant additional funding from state governments, as AOS already exists in some form in most states.

State AOS and scientific entities must navigate potential pitfalls to ensure a beneficial effect on state-level policymaking. Ultimately, the efficacy of advisory mechanisms depends on the willingness of the state government to utilize the mechanisms for guidance on S&T issues, which depends on the strength of the relationship cultivated between the AOS or scientific entities and policymakers. Initial work by scientific experts may be on a volunteer basis, unless state funds are committed to recruit and support participation in the policymaking process. Additionally, state academies, honor societies, and S&T councils must have equitable recruiting or induction practices for their own membership, so that the organizations themselves are representative and inclusive. These practices could include providing waivers for AOS membership fees, to ensure that socioeconomic status is not a barrier to participation. Furthermore, to preserve credibility of these advisory programs, experts must maintain their scientific integrity while remaining non-partisan and carefully navigate relationships with government officials.

In the absence of an effort by AOS and similar entities to engage with state governments as discussed above, many states will continue to have a disconnect between scientific expertise and state policymakers addressing S&T policy issues. Several state-level entities already exist to provide research and input for legislation, such as the Kentucky General Assembly’s Legislative Research Commission (Kentucky General Assembly n.d.). However, these entities only work within the

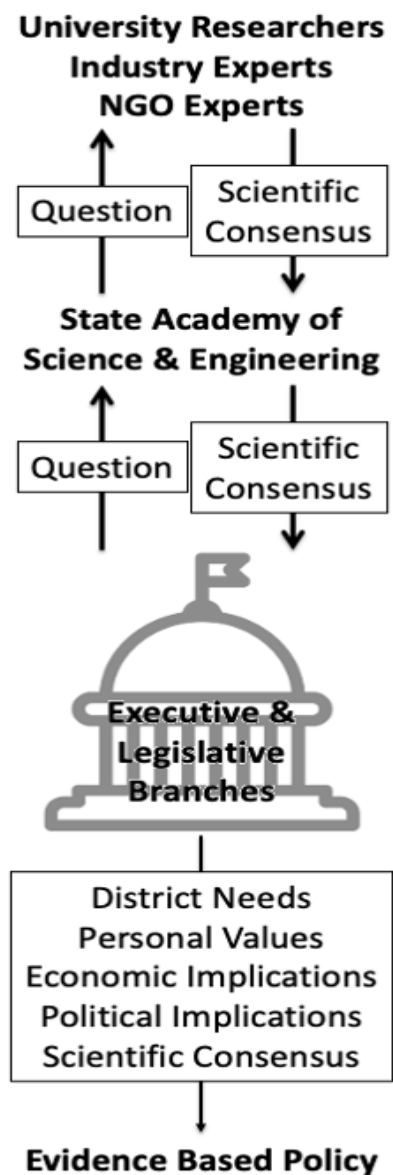


Figure 1: Illustration of the factors involved in the development of evidence-based policy, including the role of science. We propose an expanded role for state

legislative branch, and may not have S&T policy specific expertise. This expertise may exist in all branches of state government, but recommendations may be more influenced by politics and not as robust as a consensus of experts from a state academy. Private organizations such as Life Science Tennessee (Life Science TN n.d.) are formed by members from a scientific specialty. These organizations and university centers may also have specific interests or advocacy initiatives. Overall, a state AOS as the central resource for state-level policymakers is the most independent and comprehensive option for evidence-based policymaking on S&T issues.

III. Case Studies

Here we present two examples of independent scientific advisory organizations serving state governments with different political leanings and S&T priorities: the Connecticut Academy of Science and Engineering (CASE; a state academy and honorific society) and the Missouri Science and Technology Policy Initiative (MOST; an independent non-profit organization).

i. Connecticut

Connecticut is a densely populated coastal state that leans Democratic (270toWin n.d.). As of 2021, Democrats control both chambers of the state legislature and the governorship, creating a state government “trifecta” (Connecticut Office of the Governor n.d.). The bicameral Connecticut General Assembly (CGA) functions as a hybrid legislature, convening from January to June during odd-numbered years and from February to May during even-numbered years (Connecticut General Assembly n.d.).

To supplement its relatively small in-house research staff, the CGA chartered by special act the Connecticut Academy of Science and Engineering (CASE) in 1976 (Connecticut Academy of Science and Engineering 2020). As an honorific society, CASE members are elected by the membership based on scientific merit and must live or work in Connecticut (Connecticut Academy of Science and Engineering 2020). CASE is modeled after NASEM for its honorific function and provides similar reports with non-partisan, expert advice to the people and state

of Connecticut, primarily by working with industry and academic partners. For example, in 2018 CASE released a report commissioned by the Connecticut Department of Transportation detailing strategies to reduce carbon emissions from the state’s public bus operations (Connecticut Academy of Science and Engineering 2020). To determine the direction and needs of the study, CASE staff members and an advisor organized a 17-member committee of representatives from universities, government agencies from other states, and industry experts from across Connecticut as well as best practice and benchmark states. The study was conducted by researchers from the Connecticut Transportation Institute at the University of Connecticut and reviewed for release by Academy members. Study findings recommended four policy options to the Department of Transportation on reducing emissions.

In 2017, CASE expanded its role to include training the next generation of science advisors by establishing the Connecticut Science and Technology Policy Fellowship to extend its reach and impact within the state government. The fellowship places a doctoral-level scientist or engineer within executive departments for two years and continues to seek the opportunity to place fellows within the CGA. The inaugural fellow’s placement within the Department of Energy and Environmental Protection (DEEP) also provided opportunities to engage with multiple other executive agencies, including the offices of the Governor and Attorney General and the Department of Public Health. During the first year of her fellowship, inaugural fellow Dr. Anna Hagstrom helped colleagues to organize and write the state’s 2019 PFAS (per- and polyfluoroalkyl substances) Action Plan (Connecticut Interagency PFAS Task Force 2019). PFAS are chemicals that are common in consumer goods and industrial applications and are harmful to humans. In response to PFAS detection in Connecticut waters, Governor Ned Lamont established an interagency task force to formulate the 2019 PFAS Action Plan and develop a strategy for addressing this environmental and public health issue in the state.

In addition to providing advice to the Connecticut government and training science advisors, the program provides a network for future S&T policy advisors that centralizes Connecticut's needs. CASE has programs supporting local science engagement for younger students, including the Connecticut Science and Engineering Fair, the Connecticut Junior Science and Humanities Symposium, and the Connecticut Invention Convention (Connecticut Academy of Science and Engineering 2021). The S&T fellowship is one of the first opportunities for early-career scientists to engage with policy work at the state level. In summary, CASE helps to develop highly qualified science policy professionals who might not otherwise be aware of career opportunities in the state government.

ii. Missouri

Missouri is a populous Midwestern state which leans Republican and currently has a Republican trifecta controlling the state government. The Missouri General Assembly (MGA) is a part-time legislature, convening in early January and adjourning in late May (Missouri General Assembly n.d.).

The Missouri Academy of Science (MAS) is led primarily by faculty members from small teaching institutions and primarily conducts educational outreach, including hosting science fairs (Missouri Academy of Science n.d.). Independent of MAS, the Academy of Science of St. Louis (AOS-SL) focuses primarily on science education and outreach and is connected to major universities, stakeholders, and community organizations in the state (Academy of Science of St. Louis n.d.). Currently, neither MAS nor AOS-SL advises the Missouri state government as a primary function.

The Missouri Science and Technology (MOST) Policy Initiative, an independent non-profit, is working to fill the role of advising the state government on S&T topics (MOST Policy Initiative n.d.). MOST aims to bring together scientists and policymakers to improve the lives of Missouri residents and communities. The organization connects science to policy through policy initiatives and public engagement and hosts the MOST Policy Fellows program where fellows with advanced degrees in

science fields serve in the legislative and executive branch.

MOST engages directly with many policymakers and stakeholders on issues related to science by providing written testimony for legislative hearings and advising legislators and research directors at executive agencies. The organization also has industry and non-governmental organization members on its advisory board, which MOST leverages to share the information they provide to legislators with non-governmental organizations across the state.

MOST contacts legislative committee leadership to generate interest and potentially advise on science-related issues. The organization also facilitates projects with executive officials and agencies, functioning as an expert resource that provides highly trained scientists to work with executive groups in various capacities based on need. For example, in response to a 2020 request from the Missouri House Agriculture Policy Committee related to a bill (Kelley 2020) that modified provisions on selling pasteurized and unpasteurized milk, the MOST team compiled outbreak data into a science note (MOST Policy Initiative 2021) submitted to the chamber.

Prior to the MOST Policy Initiative, legislators used a variety of approaches, including reaching out to universities and lobbyists, to find expertise on relevant issues. As MOST provides these services, it measures its impact using metrics such as the number of requests for information from stakeholders, instances of MOST fellows testifying at legislative hearings, and instances of submitted written testimony.

IV. Science Policy Through a Local Lens

The examples of CASE addressing PFAS in Connecticut and MOST addressing unpasteurized milk in Missouri illustrate where state-level advisory organizations can play a unique role in developing policy.

As introduced above, following a major PFAS contamination incident (Hladky 2019) in 2019 in the

town of Windsor, Connecticut, the Governor established an interagency task force charged with developing a plan of action for the state. The resulting 2019 PFAS Action Plan (Connecticut Interagency PFAS Task Force 2019) addressed gaps and shortcomings in pre-existing guidance from federal agencies like the Environmental Protection Agency. Because CASE had already placed a S&T fellow in DEEP to bolster the agency's emerging contaminants efforts, that fellow was able to contribute scientific expertise and support the task force process, action plan development, and subsequent action across Connecticut's state ecosystem to implement action plan recommendations.

In Missouri, a bill was introduced to make changes regarding the sale of unpasteurized dairy in the state. In this case, legislators turned to MOST to offer non-partisan, scientific expertise on an important local issue. Typically, in a state without an advisory organization like MOST, legislators would turn to universities or lobbyists. However, MOST is able to advise and provide relevant state context on many scientific issues. MOST collected and summarized data and guidance from the Centers for Disease Control and Prevention to provide a locally relevant and non-partisan perspective on the issue.

In both cases, general scientific guidance on the issues was available from federal agencies, but acute local needs inspired state governments to look to state-level scientific expertise for immediate and specific advice. State-level advisory organizations — a state AOS in Connecticut and an independent non-profit in Missouri — were able to leverage existing relationships to engage in the policymaking process and provide a scientific, non-partisan perspective on these important issues.

V. Conclusions

As both science and policy have evolved, critical regional issues have made state governments an additional and necessary tool to complement science policy at the federal level. State-level AOS are a critical gateway to the future of science policy in an

increasingly global world. They allow decision makers in each state to take advantage of independent, objective scientific advice that will catalyze policy innovation and address societal challenges more locally.

We introduce CASE and MOST as case studies that demonstrate the utility of an independent body as a research and reporting service for the state government, academia, and industry. States can further extend the reach of these organizations by employing state-level science policy fellows to provide expert advice (Diasio et al. 2020). Additionally, such a structure benefits state decision makers even in hybrid or part-time legislature models and in states with a diverse array of political leanings. States that do not currently have an AOS, or those that do not fully leverage an existing academy, can adapt these models to implement a system of expert support in their own states. In these states, we encourage existing AOS or similar bodies containing scientific expertise (like CASE and MOST) to develop relationships within the Legislative and Executive Branches of their state and work to establish mechanisms to provide a service connecting the government to industry and academic researchers.

We have shown how this type of advisory structure has supported states in addressing local issues, such as concerns about PFAS in Connecticut and unpasteurized milk in Missouri. Besides these local issues, the COVID-19 pandemic has underscored the way state-level action can address science policy topics in unprecedented ways. States play an increasing role in policy, and if employed well, can propel the science policy landscape into the future. We argue that state AOS should more intentionally establish themselves as independent advisory resources for decision makers in the state government, non-profits, and industry. As we begin a new era of science policy, it will be crucial for states to strengthen their political toolkits to further meet the rising scientific challenges of the 21st century and effectively address local issues.

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