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Evolving Academic Culture to Meet Societal Needs

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Evolving academic culture to meet societal needs

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ABSTRACT Given today's complex societal challenges, academia should work better with government, industry and others in offering innovative solutions that benefit our society, economy and environment. Researchers across disciplines must work together and with decision-makers to understand how science can have better on-the-ground impacts toward longer-term, resilient societal outcomes. This includes, for example, by working with end-users in problem formation and throughout research projects to ensure decision-making needs are being met, and by linking physical science to additional fields like economics, risk communication or psychology. However, persistent barriers to collaborating across disciplines and with external decision-makers remain. Despite decades of studies highlighting the need for interdisciplinary research and science for decision-making, academic institutions are still not structured to facilitate or reward such collaboration. A group of researchers and educators used a mixed-methods approach to consider the knowledge base on interdisciplinary research and evidence-based policymaking, as well as their own experiences, and formed targeted and actionable recommendations that can help academia overcome these barriers. Their recommendations, specifically targeted to administrators, institutional leads, individual researchers, and research funders, align to three categories: define the role of academia in linking to policy; incorporate nontraditional standards in evaluating success; and build trust while drawing the line between knowledge dissemination and activism. By implementing the following recommendations, academics can foster the culture change that is needed to promote interdisciplinarity, strengthen the impact of their work and help society address urgent and multi-faceted problems.

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Introduction

Across the globe, societal and environmental challenges are ever growing in scale, complexity and urgency. Consider the worrisome problems we face—population growth, job displacement, climate change, extreme events, availability of quality freshwater, waste reduction and management, large human migrations, the faster spread of viruses. Countless decisions are needed to protect life and property, from strengthening resilience to implementing land-use regulations to securing water and food to identifying preventative health measures. Yet decision-support is complex, with interactions across living and non-living components—formal, natural and humanistic—that are ever changing and are often accompanied by a high degree of skepticism in trusting sources of information and/or unwillingness to act. Among other geographic areas, an apparent example is found in coastal zones, which are increasingly required to assess and reassess anticipated impacts from rising sea levels, as rates of relative sea level rise and ice melt are added to equations. However, though the science is improving, updating previous estimates can be controversial. Politics, economics, technology, and even psychology are at play (Amel et al., 2017) as decision-makers weigh the balance of development and adaptation. This tension was recently highlighted in the U.S. state of Georgia, where a proposed bill passed the State House of Representatives that includes a 25 ft. setback rule on coastal private property. While this is improved over the current 20 ft. setback, it is a far cry from the 100 ft. recommended by some scientists (Landers, 2017).[1]

In the oft-competitive and political setting in which decisions are made, the need to consider sound science should be a prerequisite for any decision-making process (Cairney, 2016), and academia can help. For academic science to be most impactful and usable in policy[2] it is widely recognized that interdisciplinary research (coordinated and integrated research across disciplines) and transdisciplinary research (the result of inter-subjectivity, requiring close and continuous collaboration during all phases of a research project) must be strengthened, as well as knowledge that is 'co-produced' with user communities (NAS, 2005; Lawrence, 2010; SPARC, 2010; Ciannelli et al., 2014; Brown et al., 2015; McKinnon et al., 2015; Poppy, 2015). Numerous experts have long-promoted such collaboration for varied purposes, including from government (UNESCO, 1970; NIH, 2007), academia (Heberlein, 1988; CGS, 2014), industry (Businaro, 1983; Nugent & Kulkarni, 2013), and non-profits (Visholm et al., 2012).

Consider an example on the importance of transcending disciplinary boundaries toward improved policy outcomes—the need to shift to renewable energy sources to mitigate climate change impacts. In the U.S. state of Hawaii, use of solar photovoltaic (PV) power as a renewable energy source has been on the rise. In Oahu alone, a 40% increase in PV permits was reported from 2014–2015 (Shimogawa, 2015), in large part due to federal and state subsidies for the cost and installation of equipment (Sunetric, 2015). However, as unused electricity from homeowners was metered and sold back to the grid, costs were shifted to homeowners that did not have panels, including economically disadvantaged households. To address this, the utility closed the net energy metering program, leading to a sense of distrust for some homeowners, a steep decline in permitted projects, and the layoff of thousands of workers (Pyper, 2015).

In advance of instituting the subsidies program, academia would have been well-suited to study the challenges of distributed energy across economic, societal, and technological perspectives, and offer solutions to government and industry that could have avoided the burdens placed on low-income households, preventing the collapse of the program. To do so, a different model of knowledge production is needed, similar to what Gibbons et al., (2002) term transitioning from Mode 1 to Mode 2. Whereas Mode 1 characterizes traditional knowledge production as homogeneous, hierarchical, and preserving its form, Mode 2 is characterized by less permanent and more heterogeneous practitioners that collaborate on a specific issue in a local, place-based context. Mode 2 emphasizes *application* of knowledge, and that knowledge production is ultimately intended to be *used* by someone in industry, government or society. Because of this, the needs and interests of user-groups or individuals must be included at the outset, and, further, those that will apply the knowledge gained should participate in its generation. Mode 2 shifts from problem-solving by following the codes and norms of a particular discipline, to problem-solving being organized around a particular application, which may evolve as research expands. This model can help researchers understand the broader implications of their work, and anticipate indirect impacts from proposed policies, which can help decision-makers avoid unintended pitfalls.

In a further analysis of Post-Normal Science (PNS), Funtowiczi and Ravetz, (2003) explain a new paradigm for managing complex, science-related challenges where risks are not quantifiable, damage is potentially irreversible, and uncertainty, value loading, and a plurality of legitimate perspectives are impossible to avoid. These issues, such as integrated water resource management or the spread of viruses, are constantly changing through interactions with humans. It is a process where surprises will always be possible, and flexibility in decision-making requires open dialogue across all stakeholders. These 'extended peer communities' help shape the conditions of tomorrow by offering local knowledge, anecdotal evidence, and other contextualized information through participatory processes. In doing so, the resultant policies reflect the legitimate interests, values, and desires of potentially impacted communities and, therefore, are more likely to succeed.

The importance of pursing interdisciplinary research and knowledge co-production is well known. Yet today academia struggles still to deepen collaboration and impact decision-making (Pan et al., 2015; Cairney, 2016). Perhaps this is due to what Gibbons et al. characterize as shifting to a "distinct mode with its own set of cognitive and social norms," some of which may "contrast sharply with deeply held beliefs about how reliable theoretical and practical knowledge should be generated…" Regardless, however, of whether a different type of knowledge production is unnerving some deep-seated belief, the fact is that the academic community continues to highlight the importance of these efforts, yet most academic and research institutions continue to lack the structure that cultivates and rewards inter/transdisciplinary solutions and linking to user groups. With a message that resonates today, Rhoten, (2004) aptly observed over a decade ago that "Across the spectrum of higher education, many initiatives deemed interdisciplinary are, in fact, merely reconfigurations of old studies—traditional modes of work patched together under a new label—rather than actual reconceptualizations and reorganizations of new research." Thinking about health sciences, Adler and Stewart, (2010) furthered that "Traditional approaches to science reward individual effort. As a result, relatively few people have experience working in a highly collaborative manner, and some are not particularly interested in doing so."

Across systems and within institutions, there remains little to no incentive for experts to engage in inter/transdisciplinary work to support decision-making. Rather, significant barriers exist to engaging in deep collaboration across fields of study and with decision-makers, not least of which result from the standards to which researchers are held, e.g., publications in narrow fields, citations, grants, and number of students, which are all success metrics that fail to show societal impact (Poppy, 2015). This

continues to result in, as historian Page Smith described, research that "…does not result in any measurable benefit to anything or anybody. It does not push back those omnipresent 'frontiers of knowledge' so confidently evoked; it does not *in the main* result in greater health or happiness among the general populace or any particular segment of it. It is busywork on a vast, almost incomprehensible scale" (Smith, 1991). Given our limited resources and the gravity of the challenges before us, with some real and near-term challenges to our very sustainability, we must better focus our efforts toward the betterment of populations, the public, the world. Conducting more impactful science also will help students acquire skillsets critical to the pursuit of careers outside of academia, which is increasingly necessary as the gap between PhD graduates and available tenure positions grows (Gould, 2015).

Methodology

We are presented with serious issues in addressing complex societal issues, not least of which may be that because academia is not better structured to deliver on the promises of interdisciplinarity, funding streams for such work may be at risk. While one analysis found that interdiscplinarity is on the rise (Van Noorden, 2015), another found that funders are failing to support collaborative research, perhaps because they do not prioritize its importance, use traditional review frameworks to assess proposals, or do not view proposed work as deeply collaborative (Shaman et al., 2013; Bromham et al., 2016). Nevertheless, funding does exist and is clearly prioritized by some key programs.[3] We must continue to make the case for increased support. While there will always be a need to maintain and grow deep expertise, academia must also enable conditions that recognize success by the degree to which we engage with each other and decision-makers toward solving societal challenges.

In 2016 a group of researchers set out to address these issues, responding to the question of, *with the case for enhanced interdisplinarity and co-produced knowledge in linking to decision-making being clear, why is academia failing to make greater progress, and what specific steps can be taken to overcome persistent challenges?* The researchers used a mixed-methods approach that relied on two data collection exercises. First, an integrative literature study identified, analyzed and synthesized the results from existing relevant studies by searching JSTOR, Google Scholar and a university database with the key search terms "interdisciplinary research academia," "science for decision-making academia," "knowledge co-production academia," and "applied research academia." In particular, studies from *Nature* were closely scrutinized because of the recent special series the journal ran on interdisciplinarity. Second, participatory workshops were held to encourage learning, sharing and co-generation of knowledge across experts, decision-makers, and educators/academic administrators. Workshops allowed researchers to gather findings from a range of stakeholders while analyzing results from the literature review, identify new sources of information that were not identified in the review, and to test emerging recommendations with experts and educators. Similar approaches have been taken elsewhere, especially where studies need to bridge recommendations of knowledgeable experts with actions of practitioners, as they are shown to lead to more targeted identification and analysis of constraints and opportunities (Mor et al., 2012; Van Turnhout et al., 2014; MacMillan et al., 2014).

Through this iterative process, experts and practitioners examined persistent barriers and converged around a set of high-priority recommendations in three categories. The experts recognize that while much has been written on the issues surrounding interdisciplinary research and evidence-based policy making, less has been offered on the specific steps academia can take to advance the next stage, i.e., to address cultural and structural changes. Thus, while these findings are not novel, they reinforce and take forward consistent messages from a large number of expert discussions, and offer discrete steps that are targeted to specific audiences. Care was taken to craft recommendations that are actionable by university system administrators, institutional leadership, individual researchers, and funders within 2–5 years.

Recommendations

Academia remains one of the few sectors in which the public's trust is consistently high (Funk et al., 2015; NAS, 2015). Further, solutions from academic research can be options-oriented, enabling decision-makers to weigh values across different approaches. Academia, with its 'honest broker' approach (Pielke, 2007), relative flexibility, and constant effort to test new concepts through observation, is well poised to assist society. Yet in order to play a more robust role, academic institutions must address persistent cultural and administrative barriers. Acting on the following recommendations would help academia evolve to meet this need, and would better demonstrate to funders that collaboration is necessary, possible, and rewarding.

Establish the role of research in linking to policy. Academia, both private and public, can and should play a more active role in linking natural science, socioeconomics, and other disciplines (e.g., engineering) to sensible policy. The need for this is particularly clear where concerted attempts are made to mislead decision-makers and the public with 'disinformation campaigns' (Oreskes and Conway, 2010; Michaels, 2008; Zatzman et al., 2008; Bessi et al., 2015; Thaler and Shiffman, 2015), which can lead to suboptimal, societally, or economically counterproductive—even dangerous—decisions. As we advance in the 21st Century, academic institutions should formally establish their role in informing policy by structuring for collaboration, and explicitly defining clear and timely pathways to distribute information and engage in knowledge building.

Recommendation 1: encourage shared definitions toward balanced solutions

At the university level, administrators should develop an explicit standard for developing solutions to societal challenges by pursuing a systems approach, i.e., accounting for physical, socioeconomic, and ecological aspects, as well as the institutions and processes that impact societal well-being directly or through interactions at different scales (Norris et al., 2008; Ostrom, 2009; KPMG, 2017). The standard should encourage institutions and researchers across disciplines to deepen collaboration and knowledge co-production in considering the feedbacks and linkages that occur within and across issues, and from there to advance solutions that address linkages and are able to meet multiple societal objectives (Waddell, 2014; Cairney, 2016). Promoting a research focus on complex issues such as water resources, food, environmental and public health, explaining uncertainty, risk, and resilience, etc. is one way to create opportunities for faculty, researchers, and students from different disciplines to work together in solving common problems. Standards should encourage institutional leadership and researchers to craft shared definitions across experts, especially by involving varied researchers in framing problems and scoping research questions (Rhoten, 2004). Deeper collaboration with decision-makers at the

outset also should be supported as useful in the early identification of interdependencies across an issue, as has been demonstrated, e.g., in Social Learning for the Integrated Management and Sustainable Use of Water at Catchment Scale (SLIM, 2004).

Recommendation 2: provide internal guidance on research collaboration and linking to decision-making

Institutional leadership should include university standards in internal frameworks that offer more detailed guidance on engaging in complex issues, deepening collaboration with researchers in and outside of an institute as well as with decision-makers and stakeholders, informing policy, and communicating results to the public. Guidance will need to be tailored to individual institutes, but in general frameworks should establish principles that target the main barriers to enhancing collaboration and linking to policy, including those detailed herein, e.g., on recognizing and rewarding success; allowing for intermittent but focused terms on specific policy projects; and building trust, especially by including diverse views and expertise through face-to-face meetings (Rhoten, 2004; Funk et al., 2015; Cairney, 2016). Frameworks should further provide advice to address the potential mismatch across timing and funding of academic research and decision-making cycles in policy (Shaman et al., 2013). Finally, frameworks should establish iterative processes to ensure system administrators are aware of applied research that may provoke external controversy.

Recommendation 3: leverage partnerships for collaboration and problem solving

Mechanisms are needed to support deeper collaborative research and to develop a culture of timely problem solving (SPARC, 2010). Internally, issue-focused task teams can be established across tenured and non-tenured staff, as well as students, to identify opportunities and barriers, or more formal research units can be created (NAS, 2005; Sá, 2008). Externally, institutional leadership or researchers can convene a broad range of experts to respond to an issue, or support the virtual alignment of partners in a coalition that has a common platform of communication, understands each other's capacities, proactively assesses when an issue is ripe for scientific input, and responds by communicating solutions to decision-makers in a timely manner. Such networks are developing both globally and regionally, e.g., the Climate Science Rapid Response Team, the Coalition for Epidemic Preparedness Innovations, and the Texas OneGulf Center of Excellence, among others. However, networks—convened or virtual—require significant investment, including professional staff to coordinate action. Public and private funding streams should increasingly support such collaborative, 'rapid response' research. Though some mechanisms exist, e.g., NSF's Rapid Response Research (RAPID) model, building stable funding support for these efforts will be key.

Incorporate and measure nontraditional standards of success at individual and institutional levels. Though individual universities, departments, and researchers can be starkly different, there are common issues around which a broader set of success criteria can be woven into new or existing internal frameworks. In promoting a new way of doing business, it will be key to affirm and reaffirm buy-in from faculty, non-tenured researchers, and external experts.

Recommendation 4: offer incentives and improve reward structures

While being cautious to rebalance workloads, system administrators and institutional leadership should implement credit and recognition in award structures across tenured and non-tenured staff for a diversity of useful products and engagement activities, including guest lectures, publications in other disciplines or interdisciplinary journals, development of decision-making tools, inter/transdisciplinary network development, mentoring toward policy involvement, recognition in policy-oriented media outlets, public policy initiatives, appointments on governing boards, Congressional testimonies, and for contributing to the development of laws and regulations. Rewards could include changes in salary, sabbaticals or mini-sabbaticals (especially in policy arenas), additional research assistants, seed funding for policy work or partnership engagement, and incentives in the renewal of contracts (Rhoten, 2004; NAS, 2005; Shaman et al., 2013, Townsend et al., 2015). Notably, the success metrics and reward structures of higher order accrediting societies, e.g., the American Association for Higher Education & Accreditation, similarly should be expanded to better recognize engagement and interdisciplinarity. In education, structural changes should better allow for policy work through, e.g., personalized graduate degrees scoping non-traditional career paths, or requiring individual development plans (Gould, 2017). For faculty, academic institutions might also consider interdepartmental hiring and tenure review as a practical way to remove some barriers to collaboration. Care should be taken to examine existing institutional regulations and ensure the currency of rewards in various service level components is defined as part of evaluation criteria (NAS, 2005; Sá, 2008).[4] Where it cannot be defined, institutions should identify and communicate issues in rewarding success.

Recommendation 5: institutionalize science to policy action

Within a system, the success of some institutions should include measures on securing policy linkages as a longer-term function, while still allowing separate disciplines to innovate and grow. One near-term strategy is to adopt a 'think tank' model to attract creative personnel and support them under contract to provide timely policy advice (Sutton, 2016). The London School of Economics, for instance, created LSE IDEAS to host interdisciplinary research and connect it to diplomacy and international strategy. There are such models worldwide, which can be looked to for insights on structure and operations. For example, though tenure has historically been awarded to protect freedom of thought and expression in academia, many of these programs engage post tenure and non-tenure scholars to deliver policy options more expeditiously. Within legal confines, academic and research institutions also could establish better links for students and faculty to participate in Congressional, Legislative Staff or Agency Fellowship programs, or programs that link academia and industry to help integrate science in decision-making (e.g., Pronk et al., 2015). Likewise, there could be opportunities for current or former decision-makers to help researchers

with policy development, analysis and engagement, as is routinely practiced at the Baker Institute at Rice University, which has longstanding and successful programs linking science to nonpartisan public policy.[5] If direct association across groups is restricted, more informal opportunities, such as inviting experts from other sectors to join dialogues as speakers, could facilitate joint solution building.

Draw the line between academia and activism while building trust. As institutions establish their roles in linking to policy they also must consider that scientific credibility is easy to lose and difficult to regain. Academic and research institutions should maintain flexibility to be opportunistic in venturing into new areas of work, but extreme care also should be taken to maintain credibility, a diversity of thought, and a strict ethical code. The optimal strategy to achieve this balance is to cast any recommended 'solutions' as a set of options for tackling issues, which also is likely to be most helpful to decision-makers who need to balance multiple social, economic, and political demands (Colglazier, 2016).

Recommendation 6: maintain neutrality and uphold scientific integrity

Institutional and individual credibility among peers and key stakeholders is essential (NAS, 2015). Researchers should ensure that proposed solutions are based on the best available scientific evidence, not opinion or political expediency. While internally, institutions should create and maintain freedom to express new thoughts openly, externally, stated positions should be defined and explained, and personal opinion should always be distinguished from that of the institution (Funk et al., 2015; NAS, 2015). Further, the treatment of data, observations, and models during analysis should withstand potential public scrutiny, and guidance should be available on collecting, handling, and storing data and information to withstand legal action. For example, following the Deepwater Horizon disaster in the U.S., universities mobilized quickly to assist in cleanup and collaborative assessment, but many did not understand the legal ramifications of their efforts, which eventually wrapped research institutes and their data into years of time-consuming, costly litigation. While maintaining the integrity of the scientific deliberative process, the transparency of, availability, and accessibility to data and information are critical to this end (Rossner et al., 2007).

Recommendation 7: build trust through dialogue and knowledge co-production

Directly including decision-makers and stakeholders in crafting solutions can facilitate the institutional and local changes needed to address complex or controversial issues, especially through processes like social learning (SLIM, 2004; Blackmore, 2007; Mott Lacroix and Megdal, 2016). Engaging user groups and stakeholders in the earliest stages possible is often necessary to build trust and buy-in that is essential to the usability of research findings and outputs (SPARC, 2010; Kammen, 2013; NAS, 2015; Beier et al., 2016). Institutional leadership and researchers should foster and maintain dialogue across stakeholder groups (government, private, and public), which also can help refine approaches to succinctly describe the impact and broader applicability of their work (Shaman et al., 2013). Institutional leadership and researchers may further consider engaging internal or external experts that specialize in iterative and adaptive communications, including industry associations and non-governmental organizations. Throughout, administrators should consider building their brand as a trusted provider of science for decision-making. In doing so, however, they must weigh the deeply politicized status of some science, around which adopting a policy role carries some risk, e.g., on climate research in some regions of the U.S. where universities rely on state funding. The transparency of, availability, and accessibility to data and information again is especially crucial in this regard.

Recommendation 8: develop policy options that explain risk and uncertainty

Ultimately, we must recognize that science is only one factor in the decision-making equation. Issues of social equity, economics, politics, and more weigh heavily, with interrelations across issues often at play (SPARC, 2010). For example, in disaster risk reduction, decision-makers may need to address multiple risks from a single hazard or even multiple hazards, as well as the interrelations across those risks with respect to communities, the economy, and the built and natural environment (Komendantova et al., 2014). Working in inter/transdisciplinary teams and with decision-makers and stakeholders, institutional leaders and researchers should offer a range of action-oriented policy options to facilitate decision-making across different priorities or competing demands. To be most useful, such options should clearly and effectively explain, to non-specialists, likely risks and consequences of major actions, including winners and losers identified in terms that will resonate (short vs. long-term economic impact, jobs created or lost, public health impacts, vulnerability to disasters, etc.), and where impacts cannot be specified, uncertainty ranges with explanations of how decision-makers might act despite uncertainty (NAS, 2006; Cairney, 2016). Given escalating complexity of societal challenges, clearly communicating risk and uncertainty ranges will be especially critical to avoiding decision paralysis (e.g., Pidgeon and Fischhoff, 2011).

Conclusion

In implementing these recommendations, each system and institution will need to weigh up the investment of time and energy in collaborative projects versus individual investigations. Where such collaboration is pursued toward creative and practical solutions for priority societal challenges, efforts toward these recommendations can build credibility, and can eventually incentivize science to policy action by providing good examples and best practices. Nevertheless, implementing these recommendations will take time. Immediate first steps institutions can take to foster collaboration and better link science to policy include:

- Promote the above ideas among associations of college and university presidents and deans, nationally and internationally, as well as across scientific groups and disciplines.
- Collaborate with professional societies across disciplines, nationally and internationally, in promoting these ideas, while linking major industry associations with university presidents, deans, faculty and researchers.
- Use MOUs or other collaborative agreements across departments and colleges that clearly define the role of researchers in

inter/transdisciplinary studies.
- Work with government relations offices in developing ties with local, state and national government decision-makers.
- Educate researchers in communicating science to decision-makers and the public, including through social networks and crowdsourcing exercises.

In the longer term, a deeper change in public culture is needed—one of a strengthened respect for science. We must infuse not only decision-makers but teachers, children, and parents with the knowledge and tools they need to craft a better society—one that finds in science a trusted method to understand problems and find solutions. Academia can better cultivate this respect, ensuring that science continues to help us navigate an increasingly complex world.

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Notes

1 As of the time of this writing the Georgia Senate Natural Resources and the Environment Committee has refused to vote on the bill and instead has assigned it to a study committee for further analysis.
2 Legislative frameworks but also agency decisions at local, state/province, national and international levels, including judicial decisions, as well as industry frameworks.
3 See, e.g., NSF support: https://www.nsf.gov/od/oia/additional_resources/interdisciplinary_research/support.jsp
4 Outstanding researchers will remain whose work will not directly link to policy. Crafting different guidelines and reward structures for researchers who do not focus on policy can enhance their collaboration with those who do. In doing so, the ability to tap into the entire talent pool can be strengthened.
5 Care should be taken in devising such fellowships to avoid any real or perceived conflicts of interest.

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