



Mobilizing the power of higher education to tackle the grand challenge of sustainability: Lessons from novel initiatives

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Introduction

The need for sustainable development, which seeks to improve human well-being while protecting the planet's life support systems, poses complex challenges. Regardless of whether these problems arise in the context of energy, food, or water supply, climate change, urbanization, or other pressing concerns, they involve interconnected economic, sociocultural and environmental components. These sustainability challenges also present unique leadership and research opportunities for higher education.

How can universities respond? At one level, academia has already risen to this challenge. In fact, an entirely new field – sustainability science – was launched in 2001 via a landmark paper in *Science* (Kates et al., 2001), and over 20,000 scientific papers have been published since 1974 that include the words “sustainability” or “sustainable development” in their titles (Bettencourt and Kaur, 2011).

Given the complex and stubborn nature of sustainability problems, however, many critics have argued that the traditional academy lacks an effective institutional structure and culture for accelerating progress towards sustainability (Hoffman et al., 2015; van der Leeuw et al., 2012; Whitmer et al., 2010). To counter these concerns, a number of universities have launched bold new initiatives to tackle sustainability problems. In the U.S. alone, recent investment in such programs exceeds \$500 million. In addition to their focus on specific sustainability problems, these initiatives are serving as “laboratories” in which to learn how higher education can become an effective societal partner in addressing a wide range of sustainability challenges. Our purpose in this commentary is to highlight some common themes and instructive insights that are emerging from our experiences leading such initiatives in highly diverse university settings. We draw on our presentations at the “What are the Roles of Knowledge Institutions in Sustainability?” symposium at a meeting of the American Association for the Advancement of Science.

The AAAS symposium brought together for the first time the leaders of sustainability initiatives at six diverse US academic institutions.^[1] We were joined by an eminent audience that included Robert Kates, senior author of the seminal paper framing the emerging field of sustainability science, and Anthony Cortese, co-founder of the nation's largest network of universities committed to sustainability.

Our commentary focuses on five emerging lessons that reflect the challenges in the design and implementation of six different sustainability programs. We augment our views with those of senior leaders (e.g. chancellors, presidents, and provosts) at our respective institutions, which provides a broader basis for reflecting on these lessons. Because these shared insights emerged despite our very different institutions – dissimilar in history, organization, size, and resources – they are potentially relevant for many other institutions seeking to grow the capacity and societal value of sustainability research programs.

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Lesson 1: Universities must realize that the well-honed academic habit of studying problems without emphasizing solutions is ever more troubling in today's world.

Universities are widely lauded as leaders in the creation of new knowledge; in contrast, they are often seen as ill-equipped to produce knowledge that advances solutions to the urgent and complex societal problems at the forefront of today's concerns. As emphasized by Arizona State University President Michael Crow, "We must accelerate the pace of our academic culture to move in sync with the needs of the world." Indeed, the pressing nature of sustainability problems underscores the need for a new "social contract" for academia – one that focuses at least as much attention on finding solutions as on generating knowledge per se (Miller, 2015).

To arrive at solutions, we need strategies for pursuing knowledge that more effectively span the worlds of theory and practice (Crow and Dabars, 2015). Although universities already support applied research upon which new sustainability initiatives could draw, at our campuses we are learning that a more creative fusion of basic and applied research, as argued by Stokes (1997) and other scholars, is needed to illuminate the path to solutions. The six campuses have been exploring different forms of this creative fusion and are finding this presents new research opportunities and encourages the crafting of new theory and analytic methods.

Won't this require too much? Isn't this moving us too far from our natural talents as academics? Contrary to the assumption that a growing emphasis on solutions might be regarded by universities as an unwelcome new obligation, the faculty and students we work with assert that a focus on problem-solving offers powerful rewards. They speak of the satisfaction of being part of something larger than themselves, and of using their knowledge to make a difference in the wider world. This is particularly true for sustainability issues, which evoke a sense of urgency and transcend traditional disciplinary divides. Policy makers, business leaders and citizen groups have also expressed deep appreciation for university engagement in solutions-oriented projects.

Lesson 2: Building effective interdisciplinary collaborations is difficult, cannot be avoided, and must start early.

Sustainability problems are multi-dimensional: they cannot be solved via the piecemeal analyses of any single discipline. Fortunately, universities house many disciplines with an enormous array of diverse knowledge. Despite this, in the past academia has done a better job of seeing the world through separate disciplinary lenses than it has of integrating knowledge across disciplines. This failure to bring our knowledge assets together reflects differences among disciplines in goals, traditions, languages, and professional reward systems. Rather than accepting these barriers, our universities are taking bold steps to integrate our knowledge in service of society, which can simultaneously enhance the image and relevance of higher education.

For example, some visionary university leaders have begun encouraging students to find innovative ways to combine disciplinary depth with interdisciplinary breadth. As Dartmouth College President (now Chancellor of the University of North Carolina, Chapel Hill) Carol Folt eloquently reminded students: "We know that your generation is going to need skills for weaving disciplinary threads into interdisciplinary solutions that can keep our fast-changing, globally-interconnected systems on stable, healthy, sustainable trajectories."

In our sustainability initiatives, we are using a combination of strategies to overcome barriers to interdisciplinary problem-solving. For faculty who want to make a difference by contributing to the development of solutions, it is immediately apparent that the resources of several disciplines must be mobilized and coordinated. We have found that these faculty are often willing to do the extra work required to build collaborative capacity (Hart et al., 2015), and programs like ours are creating novel mechanisms to support their efforts.

Funding focused on problem solving can also serve as an incentive for collaboration. For example, interdisciplinary research is essential in successful proposals to the National Science Foundation's Coastal Science, Engineering, and Education for Sustainability program.

The long-term nature of interdisciplinary research remains a challenge, as it usually takes longer to reach its full potential than research within any single discipline. Our institutions are gradually learning, however, that patience is required to allow collaborations to flourish, especially when individuals must cross significant epistemological divides. This extra investment is more than offset by the increased potential to generate solutions. As faculty and students from different disciplines gain experience working together, they create even greater capacity for future collaborations. Catalyzing this institutional growth and evolution leads to greater success in obtaining interdisciplinary funding, and serves as a model that others can emulate.

Although natural science and engineering programs may gain the most attention and funding, a focus on sustainability problems requires significant involvement by scholars from other fields. Indeed, the human dimensions of sustainability challenges are at least as demanding as the biophysical ones. Success requires strengthening connections with the social sciences, law, and humanities. For example, some of the thorniest sustainability issues require a shared vision regarding the obligation of the current generation to those of the future. Thus, scholars from the arts and humanities are needed to consider the moral, ethical and spiritual

dimensions of sustainability, and to help craft socially sophisticated solutions that will be possible, meaningful and fulfilling for people in business, government and civil society.

Lesson 3: In the absence of productive stakeholder partnerships—challenging as they are to build and maintain—our academic efforts will be misaligned, misallocated, and mistaken.

Building productive partnerships with diverse stakeholders contributes to the solutions-development process in multiple ways. First, stakeholder partners have their own valuable perspectives on problems and on strategies for solving them. As academics, we can benefit as much from the local knowledge and know-how of citizens, business and industry, and government, as they can from us. This view is underscored by Will Hopkins, a community leader for a sustainability project focused on coastal resources in Maine: “Any time you can get experienced fishermen who have lived their lives on the water together with university researchers who have the richness of their scientific background, generally, good things happen.”

Second, just as partnerships help bring diverse knowledge “into the same room,” partnerships are important to solving sustainability problems because changes in the behavior of diverse individuals and institutions are often required and these changes rarely happen in the absence of substantial contact. Through these partnerships, we are finding that we develop a better understanding of stakeholder perceptions, values and goals, and the result is a stronger commitment to shared problem solving which increases the likelihood that useful solutions will be the outcome.

Universities are not starting from scratch. There are models for university-community partnerships that can serve as important starting points for envisioning what form sustainability partnerships might take. For instance, the Cooperative Extension Service was established a century ago in the United States to facilitate translation of university knowledge for the benefit of the public. Now more than ever, we need to expand this collaborative capacity, with an emphasis on promoting the *two-way* exchange of knowledge and needs (e.g. Klenk et al., 2015). Indeed, this creative fusion of different sources and forms of knowledge for solving real-world problems is sometimes referred to as *transdisciplinarity*. As William “Brit” Kirwan, University of Maryland System Chancellor noted, “University partnerships with business and other sectors promote continual learning and discovery that can lead to solutions never before envisioned.” By establishing strong partnerships based on mutual respect and trust, we are also creating resilient social networks that can respond dynamically to the challenges of a rapidly changing world.

Lesson 4: The path to solutions will rarely be short or straight, which underscores the need for innovation, risk-tolerance, and persistence.

We have discovered that risk-taking, creative thinking and tenacity are key ingredients in reshaping universities to meet sustainability demands. Although change can begin with either a top-down initiative by senior administrators or a “grass-roots” effort by faculty, the prospects for long-term change are enhanced by a sense of shared commitment. In particular, faculty need to be involved early in transdisciplinary sustainability initiatives if collective ownership is to be achieved.

One effective strategy has been locational: we have created “gathering places” for faculty and students to learn about real-world problems, connect with outside stakeholders, explore interdisciplinary opportunities, and strengthen collaborative capacity. Whether configured as interdisciplinary centers, institutes, or schools, these places serve a different institutional purpose than do traditional departments. Given the need for trailblazing in sustainability problem-solving, such gathering places should be designed to foster a culture that facilitates risk-taking, tolerates and learns from mistakes, and maintains long-term focus.

A second effective strategy has been to re-envision the role of students. Students may have a new role to play in these institutional changes in that students are often more willing than faculty to wrestle with the messiness of real-world problems and less inhibited by the challenges of surmounting disciplinary barriers. They are also increasingly interested in professional paths that offer active engagement in solving sustainability problems, in addition to career advancement *per se*. Experience in our solutions-oriented projects is already helping undergraduates and graduate students find exciting opportunities in the nonacademic world.

A third effective strategy has been to encourage faculty to explore new opportunities for professional development and new types of faculty roles. Some professors are uniquely skilled in leading and fostering collaboration in diverse teams. In addition, the critical need to combine academic knowledge with real-world know-how has also placed a premium on engaging outside experts to help train students and participate on interdisciplinary teams. Whatever we choose to call these experts (e.g. professors of practice), they can play key roles in promoting the two-way exchange of ideas and strengthening stakeholder partnerships.

A fourth effective strategy has been for administrators to signal their support for the challenging task of working across boundaries. As stated by President Ana Mari Cauce, University of Washington: “Our most

urgent sustainability challenges cannot be solved by universities working in isolation. The need for engagement across multiple disciplines and sectors requires universities to mobilize a wide range of faculty, staff, students, and, importantly, external partners in the search for solutions. This can only happen in a culture that supports risk-taking and embraces working across boundaries.”

Such cultural innovation will occur more readily as incentive systems change. Towards this end, we are encouraged to see increased emphasis at some institutions on promotion and tenure criteria that give credit for university – community engagement, interdisciplinary collaboration, and a focus on problem-solving.

Lesson 5: Universities excel at researching others. But until we apply those same research skills to examine our own institutional initiatives, we cannot develop evidence-based principles to guide institutional transformation.

We have learned that the bold programs underway at many universities to tackle sustainability challenges provide special opportunities to study the factors that facilitate institutional change. These research results can in turn be applied to create more effective organizations and institutions. As articulated by Professor Susan Gardner, an organizational scholar in the field of higher education at the University of Maine, “By examining how researchers collaborate across disciplines and with diverse stakeholders, scholars can better understand how to create organizations and institutions that foster interdisciplinarity, stakeholder engagement, and solutions.”

Based on the lessons learned from pioneering studies of sustainability initiatives by several of our programs (e.g. Cosley et al., 2014; McGreavy et al., 2015; Meyer et al., 2015), we believe this strategy has great potential to strengthen the capacity for collaborative problem-solving. For example, research at the University of Maine demonstrated that faculty with a low tolerance for ambiguity had a low level of satisfaction with participation in interdisciplinary, solutions-focused research. Therefore, changes were made to increase the transparency and participatory nature of decision-making, thereby reducing ambiguity and increasing both morale and commitment.

Universities seeking to create or strengthen sustainability programs can often call on their own scholars (e.g. from sociology, psychology, communication, higher education, economics or business) to study such change, at the same time providing these investigators with a readily accessible “research laboratory.” There is even a new field – *the science of team science* – that focuses on organizational and institutional processes affecting interdisciplinary scientific collaborations (Bennett and Gadlin, 2012).

Such research can identify best practices for promoting change within a single organization. It can also develop comparative analyses across organizations to assess whether the most effective practices differ depending on a university’s size, its scope of research and partnerships, or its private vs. public status. Our symposium highlighted the value that such analyses would bring to the design of effective sustainability programs, but much remains to be learned.

In short, research can help higher education develop better strategies for responding to the fundamental challenge expressed so provocatively in a public lecture by Canadian sociologist Mark Renaud (2004): “Universities – Change is Mandatory; Survival is Optional; Choose Wisely.”

Summary and prognosis

We have gained invaluable experience leading innovative sustainability programs that depend upon effective mobilization of diverse university resources and collaboration with other sectors of society. The opportunity to learn from such experience must not be wasted – the analysis, synthesis and sharing of experiences is vital for informing the design and implementation of future initiatives. In our experience, innovation is driven by both faculty and administrative leadership, by new opportunities for faculty collaboration, and by novel education programs that include mentoring of students to help them thrive in the nonacademic world. Successful programs find creative ways to align their objectives with institutional culture, values, history, place, leadership, and available resources.

One key stumbling block is that solutions-oriented sustainability research requires a long-term investment, whereas available funding usually has a much shorter time horizon. We hope long-term support will grow as the value of these innovative research partnerships becomes more evident. We also need to integrate more effectively sustainable development’s dual emphasis on human well-being and environmental stewardship. Finally, we must learn via research to manage organizational and institutional change more adeptly.

Although there will never be a one-size-fits-all recipe for how higher education can increase its capacity to solve sustainability problems, we were heartened by the emergence of common themes despite very different institutional contexts and program foci. We would like to emphasize our bottom-line conclusion that the

timing is right for solutions-oriented sustainability programs that are responsive to environmental and societal needs, to student and faculty interests, and to opportunities in emerging career paths.

We recognize that there are many important roles universities must play in the 21st century. Tackling sustainability challenges is one of the big ones. The academic community can accelerate transitions to sustainability by mobilizing its remarkable expertise and expanding innovative collaborations with practitioners across sectors of society. In doing so, we are confident that universities will become an increasingly vital and valued partner in the quest to create a sustainable world.

References

- Bennett LM, Gadlin H. 2012. Collaboration and Team Science: From Theory to Practice. *J Invest Med* 60: 768–775.
- Bettencourt LMA, Kaur J. 2011. The evolution and structure of sustainability science. *P Natl Acad Sci USA* 108: 19540–19545.
- Cosley BJ, McCoy SK, Gardner SK. 2014. Collaborative voice: Examining the role of voice in interdisciplinary collaboration. *International Journal of Organizational Theory and Behavior* 17: 139–162.
- Crow MM, Dabars WB. 2015. *Designing the New American University*. Baltimore: Johns Hopkins University Press.
- Hart DD, Bell KP, Lindenfeld LA, Jain S, Johnson TR, et al. 2015. Strengthening the role of universities in addressing sustainability challenges: The Mitchell Center for Sustainability Solutions as an institutional experiment. *Ecology and Society* 20(2): 4. doi: 10.5751/ES-07283-200204.
- Hoffman AJ, Ashworth K, Dwelle C, Goldberg P, Henderson A, et al. 2015. *Academic Engagement in Public and Political Discourse*. Ann Arbor, MI: Michigan Publishing, University of Michigan Library.
- Kates RW, Clark WC, Corell R, Hall JM, Jaeger CC, et al. 2001. Sustainability science. *Science* 292(5517): 641. doi: 10.2139/ssrn.257359.
- Klenk NL, Meehan K, Pinel SL, Mendez F, Torres P, et al. 2015. Stakeholders in climate science: Beyond lip service? *Science* 350: 743–744.
- McGreavy B, Lindenfeld LA, Hutchins K, Silka L, Leahy J, et al. 2015. Communication and sustainability science teams as complex systems. *Ecology and Society* 20(1): 2. doi: 10.5751/ES-06644-200102.
- Meyer SR, Levesque V, McGreavy B, Johnson ML, Hutchins K, et al. 2015. Sustainability Science Graduate Students as Boundary Spanners. *J Environmental Studies and Sciences*. doi: 10.1007/s13412-015-0313-1.
- Miller TR. 2015. *Reconstructing sustainability science: Knowledge and action for a sustainable future*. New York: Routledge.
- Renaud M. 2004. Universities: Change is mandatory; Survival is optional; Choose wisely. *Fred A. Aldrich Lecture*. St. Johns, Newfoundland, Canada: Social Sciences and Humanities Research Council of Canada. <http://www.usask.ca/vpresearch/pdf/RenaudAldrichLecture.pdf>. [Online].
- Stokes DE. 1997. *Pasteur's Quadrant – Basic Science and Technological Innovation*. Washington, DC: Brookings Institution Press.
- van der Leeuw S, Wiek A, Harlow J, Buizer J. 2012. How much time do we have? Urgency and rhetoric in sustainability science. *Sustainability Science* 7(1): 115–120. doi: 10.1007/s11625-011-0153-1.
- Whitmer A, Ogden L, Lawton J, Sturmer P, Groffman PM, et al. 2010. The engaged university: Providing a platform for research that transforms society. *Frontiers in Ecology and the Environment* 8(6): 314–321.

Notes

1. Sustainability initiatives represented in AAAS symposium: Global Institute on Sustainability, Arizona State University (<https://sustainability.asu.edu/>) Environmental Studies Program, Dartmouth College (<http://www.dartmouth.edu/~envs/>) Senator George J. Mitchell Center for Sustainability Solutions, University of Maine (<http://umaine.edu/mitchellcenter/>) National Socio-Environmental Synthesis Center, University of Maryland (<http://www.sesync.org/>) Institute on the Environment, University of Minnesota (<http://environment.umn.edu/>) College of the Environment, University of Washington (<http://coenv.washington.edu/>)

Contributions

The authors made equal contributions to this commentary.

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Competing interests

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