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A Move Toward Interdependency

Over the last several issues of *Oceanography*, I have explored the topics of early career faculty, graduate student training, and private funding. At the heart of these issues is the search for sustaining support for research in an increasingly constrained funding environment. On the education side, state support for our public research institutions has dropped more than 25% per student FTE (full-time equivalent) between 1987 and 2010, adjusting for inflation (National Science Board, 2014). Moreover, net tuition per student FTE has more than doubled over this same period. Higher education is increasingly viewed as a private good, not a public good. Against this backdrop, how do we prepare our graduates for careers beyond academia? How do we nurture our new faculty when funding success rates appear to be dropping? How do we engage new partners (both private and public) in our scientific journey?

These dilemmas have no clear paths to resolution. Solutions will likely not come from individual scientists and individual institutions working independently. The need to cooperate and collaborate will be challenging from both an organizational and cultural perspective. We are comfortable working independently in a competitive environment. We value the high level of influence and authority that come with this approach. The individual scientist and the individual institution have a long history of competition, and this culture has resulted in enormous advances in our understanding of the ocean. On the other hand, we collaborate extensively on complex science projects and programs, such as the World Ocean Circulation Experiment and the International Ocean Discovery Program, as well as on

shared facilities such as research vessels. Deepening the level of interdependence between individuals and institutions beyond managing science programs and facilities will be much more complicated, especially when resources are scarce.

Cooperation is generally straightforward when resources are increasing. Reducing costs through outsourcing (i.e., increasing our dependence on an outside entity) is also a tried-and-true approach. But increasing interdependency as a means to reduce costs is relatively unknown. For example, let's suppose that a consortium of institutions decides to combine their independent graduate programs in ocean modeling. Rather than each one having duplicative courses (and faculty) and facilities, the consortium decides that each partner will focus on just a few aspects of the program. Such an approach greatly increases the dependency between partners and, hence, risk. What if one partner decides not to promote a key faculty member? Will critical courses become unavailable? Managing these and other more complicated risks will place significant stresses on the partners, including students and faculty.

Are we organized to assess and manage the risks associated with these and more complicated partnerships? Probably not today, but with flat (or declining) resources, the pressures to reduce costs will become more intense. We will need to think about how we as individuals and as institutions can work together in a more interdependent manner. We can take advantage of the more powerful digital infrastructure that is now available in our institutions and our homes. The proliferation of mobile devices means that much of our work and our interactions

are loosely coupled to a physical place. Teaching a set of courses to a class that is geographically distributed is feasible. Sharing a lab instrument can be done over the Internet. The challenges will not be so much technical as they will be cultural and organizational. Will universities accept courses from other institutions (let alone courses that are shared across institutions)? Will faculty be willing to forego having a locally owned instrument (from both a convenience and a prestige perspective) and rely on a system at another institution?

These issues have analogs in many areas, such as in water management where decision making and responsibilities are dispersed. In such situations, it is often preferred to follow a principle of subsidiarity, where decisions are made at the lowest level possible. In an era of increased interdependency, the level of decision making would move up from the local institutions to the partnership—a move that would require significant attention and thinking to ensure that we balance local and partnerships needs, resources, and responsibilities. Can we do it? I would appreciate hearing your thoughts at magazine@tos.org.



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