46. Moving Competitive Integrated Science Forward: A US land grant research university perspective

M. Duane Nellis[1]

The year 2012 marks the 150th anniversary of the *Morrill Act*, which launched the democratisation of higher education in the United States. The Act, signed into law by President Abraham Lincoln, dedicated federal land and resources to the development and ongoing support of public universities in each State. Through this effort, people from all economic backgrounds were provided with greater access to higher education. Further, resources and faculty expertise in science, engineering and related disciplines at these institutions were committed to applied areas such as agriculture and natural resources to the benefit of each State. Often such research engaged stakeholders at the practical level, including helping stakeholders solve problems such as those related to crop or animal production, or community and family health. Historically, in addition to applied research in areas like agriculture, natural resources and engineering, a significant amount of the basic research and creativity that evolved in these settings tended towards unique disciplinary boundaries, and in many ways followed patterns of creativity and basic science research and reward structures at leading private US universities.

The Context and Challenge at the University of Idaho and Related Universities

At the University of Idaho, which was created as a land grant university in 1889, and at virtually all land grant research and other major public research universities, a more integrative applied research style is becoming recognised as critical to addressing a vast array of the essential questions facing our State, region, nation and the world. To secure and enhance the effective operationalisation of such research processes will require universities like the University of Idaho to overcome a number of barriers and disincentives as well as the development of expertise in integrative applied research consistent with methods in empirical, quantitative and theoretical research. Gabriele Bammer's

1 M. Duane Nellis was invited as a 'university leader who has a longstanding interest in interdisciplinarity and integration to tackle complex real-world problems. Your observations on whether the ideas in the book are workable in an organisation such as the University of Idaho will be very pertinent.'

book, through Integration and Implementation Sciences (I2S), brings into focus methods and concepts needed to effectively operationalise such integrative applied research practices, yet provides enough flexibility to accommodate unique strengths and needs. At the same time, the I2S approach helps preserve the value and importance of different disciplinary and stakeholder approaches, while bringing these perspectives together as a way to deal with unknowns.

Within the context of universities like the University of Idaho, there are a number of barriers and disincentives towards implementing the most effective forms of I2S. As articulated by Klein,[2] these include concerns and challenges in the context of organisational structure and administration, institutional procedures and processes, resources and infrastructure, and recognition, reward and incentives. There is the need for a more robust structural approach that allows the latitude for faculty to participate outside traditional disciplinary and related college or multidisciplinary organisations in ways that facilitate such interactions and provide appropriate reward structures. Too often there are issues of territoriality and turf battles over budget, ownership of the research budget and associated research overheads.

Within procedures and policies, there are often inadequate guidelines that govern faculty rewards for those who participate in cross-university, cross-disciplinary projects. Even when procedures and policies are set at the university level, traditional department and disciplinary boundaries make implementation uneven. And there is often inadequate funding at the university and college levels for those willing to reach out beyond historical boundaries and to find resources, for example, for graduate research assistantship support for such activities. In addition, at many universities, the infrastructure does not support networking channels that extend communication and interactions beyond traditional boundaries. Land grant universities like the University of Idaho have traditional college boundaries in areas like engineering, agriculture, business and the liberal arts and sciences, and college traditions and territorial protection practices may limit full support for university-wide networking and collaborations.

A part of this structural challenge, as articulated by Gabriele Bammer, also relates to the third domain: providing integrated research support for policy and practice change, such as in research translation, knowledge brokering, commercialisation needed to manage unknowns, and related consequences of integrated research. A key dimension of the integrative applied research team is the expectation that many team members have expertise in the complex research problems under consideration and can explicitly interact with stakeholders, policy makers and those in practice. The intentionality of many

2 Klein (2010).

current university and college structures in place today, including aspects at the University of Idaho, does not always lead to environments that fully realise the potential of such an integrated approach.

A crucial need in positioning an organisation like the University of Idaho is where we can better address some of the complex issues outside traditional discipline-based inquiry. A key question is 'what type of academic forum or structure creates the greatest sensitivities to facilitate progress towards such possibilities?'. How can a complex, comprehensive, land grant research university, like the University of Idaho, translate the I2S specialisation within the American university structure?

One key in the I2S process is being able to identify more robust ways that promote understanding the unknown in the process of addressing an integrative applied research question. Within the structure of an American university, how does the I2S facilitator operate and understand boundary issues and related unknowns? How have issues that might arise been resolved in case studies related to concepts linked to I2S? As Gabriele Bammer articulates, '[t]he point of integrative applied research is to effectively harness a range of relevant differences to broaden both knowledge about a problem and consideration of diverse unknowns' (Chapter 26). Many US universities have departmental entities, advisory boards or oversight structures that represent a wide range of interests and can add to understanding relative to the complexity of the problem being tackled. At the same time, such organising approaches can be a challenge as well in helping the research agenda work effectively towards addressing the range of complex real-world problems, and, in many cases, they come up incomplete. Departments, for example, can create territorial boundaries for their faculty members that reduce incentives for interdisciplinary work.

Facilitating strategies and mechanisms for interdisciplinarity and environments for I2S will require alternative administrative structures and leadership throughout every level of the university, with appropriate investment, infrastructural support and reward structures. Certainly, central and college-level advocacy and support are crucial, but without interdisciplinarity and facilitation of I2S percolating at the faculty level, such efforts will not work in the environment of a complex public research university like the University of Idaho.

At the University of Idaho, there is strong advocacy at all levels for interdisciplinary research. For me, as President of the university, this has been a key priority and one I speak to within and outside the university on a regular basis. Many of our policies and procedures have been changed in ways that allow for appropriate reward structures for faculty who participate in such activities. Two of the challenges, however, have been lack of central and college-

level resources to invest in such initiatives and policy changes that facilitate more robust implementation of these important cultural changes within the university. Significant state disinvestment of public higher education across the United States has created major new challenges for such institutions (and more limited central resources), but at the same time has created opportunities for structural and cultural changes that bring more efficiencies, and which, if implemented appropriately, can facilitate I2S-type efforts. Universities must look creatively at new ways to facilitate such resource investments as we build the 21st century land grant university.

I2S and Interdisciplinary Studies at the University of Idaho

At the University of Idaho, we have a number of key research initiatives that are examples of significant success in interdisciplinary research. Projects like the Institute for Bioinformatics and Evolutionary Studies (IBEST)[3] and Sustainable Agriculture,[4] in addition to efforts and approaches linked to the Toolbox Project[5] and university-wide forums for cross-disciplinary discussion, have each been highly successful relative to their project objectives and for the university, region and nation; however, each has elements that could further benefit from I2S. With the Toolbox Project, for example, they would profit from a better way of addressing unknowns and a more systematic way of identifying ways to impact policy.

The IBEST is a 'grassroots' interdisciplinary faculty group at the University of Idaho focused on understanding the pattern and processes of evolution that occur over comparatively short periods. IBEST places high value on interdisciplinary collaborations that blend the expertise of biologists, biochemists, ecologists, evolutionary biologists, mathematicians, statisticians, computer scientists and other related disciplines to examine the underpinnings of evolutionary biology. The institute facilitates productive interdisciplinary dialogue across the university through seminars, as well as common and open luncheon discussions with those involved in associated projects (including faculty and staff) plus others who may have an interest in dimensions of these projects. In the continuum of this research effort, extensive data sets collected by biologists in contemporary studies of natural and experimentally evolved populations enable mathematicians, statisticians and computer scientists to quantify the problems of various evolutionary events and develop models that can subsequently be empirically evaluated and refined by biologists.

3 <www.uidaho.edu/research/ibest> (accessed 14 February 2012).
4 <www.cals.uidaho.edu/sustag/> (accessed 14 February 2012).
5 <www.cals.uidaho.edu/toolbox/> (accessed 14 February 2012).

The National Science Foundation (NSF) funded Toolbox Project, led by the University of Idaho with partners at Boise State University, the University of Alaska–Anchorage and the NSF, has provided a philosophical yet practical enhancement to cross-disciplinary collaborative science. Rooted in philosophical analysis, Toolbox workshops enable cross-disciplinary collaborators to engage in structural dialogue about their research assumptions. This process yields both self-awareness and mutual understanding, creating a strong foundation for effective collaboration research.

Using principles linked to the Toolbox approach, the University of Idaho received its largest grant in university history in spring 2011 of US$20 million. The proposal was led by faculty member Sanford Eigenbrode and involved a team of 22 principal investigators and key collaborators in partnership with two other land grant universities (Oregon State University and Washington State University). This grant focuses on the development of a comprehensive and extensive infrastructure to support research, outreach and education that will support sustainable agriculture in the Pacific North-West region.

The university also has the weekly Renfrew Interdisciplinary Colloquium to facilitate ongoing cross-disciplinary dialogue. This colloquium is well attended by faculty from across the university including faculty from such areas as philosophy, music, chemistry and engineering. And a year ago, as university President, I started a Friday-afternoon faculty gathering once a month to foster informal dialogue with faculty from across the university. Each month these are sponsored by a different college, and have resulted in new connections of faculty from across the university. For example, dialogue with faculty from such diverse departments as English and natural resources has resulted in new opportunities for cross-disciplinary research. At the same time, the Renfrew Colloquium would benefit from I2S through better integration of information across campus.

A Possible Next Step at the University of Idaho or Similar Institutions

Although significant progress has been made in creating an environment that would recognise and appreciate I2S at the University of Idaho, there are additional steps that could evolve that would potentially heighten progress towards such efforts. One such concept that I have discussed with some university faculty, including one of the Toolbox Project investigators, Michael O'Rourke, is creating a School of Interdisciplinary Studies. Such a school might serve as a college-level incubator for interdisciplinary programming. The concept for the school might include joint appointments with traditional

colleges. Faculty appointments would need to be recognised and rewarded. The concept should appeal to faculty who want to spend quality time with others who share their belief in the value of interdisciplinary research. Such a school would help facilitate overcoming some of the barriers that were outlined earlier in this commentary. A council of deans could oversee the school to promote the sense of university-wide ownership and input.

Concluding Remarks

Gabriele Bammer's book provides a timely and important approach for conducting integrative applied research. Through I2S, integrative applied research can be more comprehensive, gaining a fuller understanding of the broad range of concepts and methods around key real-world problems. At the University of Idaho, significant progress has been made in facilitating an environment and approach that foster a more complete analysis of cross-disciplinary research. At the same time, there are evolving structural and cultural changes that should facilitate more robust and rewarding environments for such research as we look to creating a different dynamic for the US land grant research university as it moves beyond its 150th anniversary.

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Reference

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Brief Biography

M. Duane Nellis has been President of the University of Idaho since July 2009. He has been an advocate for key university priorities linked towards being more interdisciplinary, more entrepreneurial, more engaged, more globally connected and more diverse. Prior to appointment at the University of Idaho, he served as Provost and Senior Vice-President at Kansas State University. He is past President of the Association of American Geographers and past President of the National Council for Geographic Education. His research has provided him the opportunity to work in interdisciplinary teams to analyse issues such as desertification along the fringe of the Kalahari Desert in Botswana, and assessment of water-use issues in the Ogallala Aquifer region of western Kansas. He has published more than 100 articles and several books and book chapters.

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