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Report of the Committee on Research Enhancement & Transformational Research Collaboration; executive summary

Committee Members

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The University of New Mexico's Office of Research created a committee to study the potential to stimulate cross- and trans-disciplinary research through a planned strategic initiative. This was seen as an important campus research value to capitalize on the emerging grant opportunities provided by data intensive cyber-enabled research and to solve environmental and other global challenges through joint humanities and science approaches.

Executive Summary

Academic research is increasingly more global and requires the handling of a deluge of information and opportunities. It tends to require more cross-disciplinary and cross-institutional collaboration, and new forms of analysis, observation, and experimentation. To be competitive in this environment, the academic research enterprise needs to provide its participants with resources and processes that actively amplify opportunities for creative and compelling research, and to dynamically seed effective collaborations. The mission of this committee is to explore ways that this can happen at UNM.

To address these needs, our committee based its work on the following goals:

- Create a vision for a research environment that motivates and enables research in this new era of information overload, massive computational ability, and enhanced connectivity;

- Propose strategies for creating institutional tools, structures, processes, and career pathways that will achieve that vision; and

- Recommend a path forward that includes the development of an experimental prototype to test these tools and strategies, along with clearly defined evaluation metrics.

UNM's research enterprise will require an evolving institutional strategy to keep it competitive. Current institutional structures were designed to primarily support

disciplinary teaching and research within a network of peers, but were not optimized to support a cross-disciplinary (individual or group) research vision. Key needs are:

- Semi-automated methods of putting the right faculty together with the right research opportunities -- an eHarmony[1]-like service for research social networking. (In this document we will refer to this new system as "rHarmony".) This system will blend top-down opportunity priming from the OVPR with bottom-up self-organization from the faculty;

 - Dynamic creation of fluid, flexible, and temporary organizational arrangements for faculty that promotes the growth of new research collaborations;

 - Support of the above by a persistent infrastructure (facilities, technology and people) designed and dedicated to enable collaborations, both new and existing.

We describe the key needs in more detail in the following:

rHarmony. New research collaborations are generally formed either by the top-down distribution of research opportunities from funding agencies to static faculty lists by university research administrators or through chance connections made through academic social networks. Left to their own devices, the likelihood of successful research collaborations forming with these uncoordinated methods is small. This committee believes a systems approach could be taken to enhance the formation and success of new research collaborations. The research enterprise may be modeled as a hierarchical, social dynamical system, with research administration at the top and faculty at the bottom. Establishing specific interaction structures within this type of system, top-down opportunities can be encouraged to naturally resonate with bottom-up faculty efforts. The resonance analogy is appropriate here in that we want this system to seed and nonlinearly amplify research collaborations. Under the right conditions, this type of system will form stable self-organizing social research structures across the hierarchy. We envision the use of social networking methodologies and visual analytics (technology to support knowledge transfer and cooperative inquiry) combined with new interest-matching algorithms to create an approach to facilitate this natural resonance among faculty and research administration.

Organizational arrangements. To sustain the newly formed social research structures, two new forms of institutional organizations are required. The first is an arrangement by which faculty may temporarily reduce their commitments to their departments (cross-disciplinary research leave) in order to confront a new research problem that requires different knowledge than what they currently have. The second is a collaborative arrangement between enabling groups on campus (e.g. Office of the VP for Research, University Libraries, Health Sciences Library and Information Center, Center for High Performance Computing, Earth Data Analysis Center) that can address different aspects of the persistent infrastructure needs to provide a stable platform from which the faculty on cross-disciplinary leave, or other faculty striving to integrate a new disciplinary perspective into their research, may operate. All aspects of the new program, infrastructure and organizational arrangements must be evaluated over short and long terms. Evaluation should be formative and summative.

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[1] http://www.eHarmony.com

Physical infrastructure. Dedicated spaces should be available to faculty to which they may retreat to attempt cross-disciplinary work. Empirical evidence supports the need to disentangle researchers from their day-to-day environment in order to stimulate activity in new directions. This place should be conducive to creative thinking, promote cross-disciplinary discussion and dialogue, and encourage interactions among different faculty.

Personnel. To inject institutional memory into the system, two faculty roles should be cultivated: 1) research mentor positions and 2) senior faculty thought leaders.

Technical infrastructure. The appropriate information infrastructure needs to be in place (e.g., cyberinfrastructure) that supports collaborative work and working in complex, data-rich environments. That scale of infrastructure, currently a primary focus of National Science Foundation funding, must be connected with individual researchers or research teams, requiring intermediate levels of technical infrastructure. The three major categories of technical infrastructure needs recently identified by the NSF informed our work: 1) computing and simulation, 2) data, analysis and visualization, and 3) virtual organizations.

Recommendations

Our recommendations for action focus on an empirically based approach to leverage existing strengths at the University, with administrative incentives; and longer term infrastructure planning and building to capitalize on evolving national priorities.

Short term (2009-2010 academic year): Continue research on collaboration processes that impact the ability of individuals to cross disciplines themselves, and engage in cross-disciplinary collaboration. Begin construction of an eResearch Mall in Centennial Library that could house the technology infrastructure and collaborative spaces, along with an eScience Showcase that highlights success stories of emerging technologies enabling distributed research collaboratories. Focus on the detailed design, implementation, and testing of the "rHarmony" tool. Develop and test analytical methods to match interests and other social parameters with other researchers and external research programs (funding sources). Seek funding for further development of "rHarmony" based on outcomes from the pilot studies, and for new R & D on visual analytics. Visual analytics is an emerging field driven by the need for computer-assisted intelligent analysis of voluminous text based documents on the Web. Visual analytics shows promise as an approach for enabling individuals to cross disciplines and become familiar with the literature and semantics from another field. It targets a set of analytical processes and supporting tools for self-directed, informal adult learning and problem solving.

Medium term (2010/2012 academic years): Recruit three newly collaborating groups (with external funding) in difficult cross-disciplinary areas based on the principles described in this report. Continue research and development on collaboration workflows and tools. Continue development of the eResearch Mall in the Centennial Library.

Long term (2012/2014 and beyond): broaden application of the program to all NM research universities and national labs and begin to develop formal educational approaches to raise up a cohort of researchers already skilled at collaboration.