March 28, 2010

**How Uncle Sam Can Support Innovation**

*By Tom Katsouleas*

Universities evolve slowly, typically on century-long time scales, but they are changing again, and a new role is emerging—that of innovation engines.

This is a desirable and much-needed transformation in a world in which both polar caps and Wall Street are melting. But it won't come about without two key changes: an acceptance of this mission by faculty members and a new type of federal investment in translational research and education (geared toward bridging the gap between basic research discoveries and practical applications), analogous to the establishment of federal financing of basic research after World War II.

Shortly after the war, the United States began investing an average of 0.2 percent of gross domestic product in basic research, mostly at universities. That had a transformative effect on American research universities, turning them from repositories of knowledge into prolific creators of knowledge.

Today's university still needs to preserve and generate knowledge, but also to play an increasing role in addressing urgent problems facing society.

Recently the National Academy of Engineering and the National Science Foundation identified a list of the world's most critical challenges ([http://www.engineeringchallenges.org](http://www.engineeringchallenges.org)). The challenges span issues as varied as sustainability and health, security and joy. It is clear that no single discipline—whether public policy or engineering or medical science—can alone solve problems of such magnitude.

Unfortunately, few universities plan to aggressively go beyond research to its translation into practice. Something is missing from our teaching curricula and research plans—and that is innovation.

For research universities to realize their full potential in tackling global grand challenges and engaging society, revolutionary changes are needed in federal policy, educational programs, and the
treatment of intellectual property.

The first barrier is the lack of a broad support mechanism for translational research and education. The federal investment in basic research is approximately $43-billion per year. Yet the investment in translational research and education is negligible and has been left to efforts like the National Institute of Standards and Technology's Technology Innovation Program, private foundations like the Coulter Foundation, and projects geared more narrowly to the private sector, like Small Business Innovation Research programs.

The emphasis of federal agencies such as the National Science Foundation on basic research and basic-research education has inadvertently created a formidable "valley of death"—a gap in financing to take the promising new concepts discovered at universities and make them ready for licensing and commercial development by private companies. Why, in our current finance models, have we created such a barrier, and how can we fix it?

The United States has been fumbling with this problem since 1980, when the Bayh-Dole Act was passed. That made it possible for universities to profit from licensing their intellectual property to the private sector. It was a turning point in our history, representing both recognition of the value of universities' intellectual property and a desire to benefit society in the form of goods, products, and services.

The collective investment of American universities in licensing and tech-transfer offices, on the order of $400-million annually, yields more than 500 new start-up businesses, and many more licenses, per year. That's good, and one could even say an essential competitive American advantage. But it's still a small fraction of the basic-research budget, and an order of magnitude less than support for universities from philanthropy.

Two things limit broader translation of intellectual property: the gap, discussed above, in financing translational innovation, and the mandate that university licensing offices recover their costs as quickly as possible. To remedy the second problem, universities should reward the number and impact of technologies transferred rather than early revenue returns, and should allow for more back-end equity from private partners that use the university-created technology, in exchange for lower immediate licensing fees.

But what about the first problem, the "valley of death" in government funds for translational innovations? Recently U.S.
Secretary of Energy Steven Chu, Nobel laureate in physics, announced a program to create three energy research hubs aimed directly at research to bridge that gap. That is a good start, but it needs to be spread to all of basic research and to all universities, not just energy.

How can we do that, and how much would it cost? Fortunately for us, as recent surveys from the National Academy of Engineering have shown, we have a generation of students who are more motivated than ever to see their discoveries and inventions affect society. Why not offer translational-research education to every one of the 30,000 Ph.D.’s graduating each year in science and engineering fields?

Such an education should include performing an impact or market analysis of the student’s field; minicourses tailored to Ph.D.’s in business skills, finance and accounting, science policy, entrepreneurship, etc.; and mentoring from successful entrepreneurs and from faculty members outside the sciences on how their work is informed by and affects society at large. If one out of every five to 10 Ph.D. students were to take on that extra dimension in their training, and if start-up resources were provided for the top 20 percent, the total cost would be on the order of 1 percent of the federal basic research budget. But the multiplier of the benefits to the economy and for society would be far greater.

Such a federal investment is needed because unlike undergraduate and master’s education, doctoral education is financed almost entirely through faculty research projects. There is no agency with a mandate to accept proposals for translational research and education except on a pilot level—but we need our government to "own" this problem and the exciting possibilities for our country.

Now is the time to make a transformative change in the role of research universities. The United States will never recapture its title as a global leader until America turns its ivory towers into golden economic engines and engages future generations of students in tackling the world’s most important problems.

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The Chronicle of Higher Education 1255 Twenty-Third St, N.W. Washington, D.C. 20037