IMPACT:
Innovation Model Program for Accelerating the Commercialization of Technologies

A Proposal for Realizing the Economic Potential of University Research

Krisztina "Z" Holly
Vice Provost for Innovation
University of Southern California

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Executive Summary

University research has formed the foundation for many of the most significant U.S. technological advancements. However, many more ideas are left on the shelves and in the laboratories of academe, waiting to be discovered. Although thousands of university innovations have been transformed into startups and new products in the last three decades, there exists an even greater opportunity for economic and societal impact through ideas generated at major research universities.

This white paper proposes an approach for the federal government to accelerate and make accessible the great potential from the breakthrough innovations arising from academic research. This pilot initiative would invest a small amount of federal funding to coax existing research results into the U.S. commercial marketplace through ten local demonstration sites.

Funding would equal $2 million per year, per university, for five years. These local sites would nurture a culture of entrepreneurship within each university, create and enhance the innovation ecosystem around each university, and provide the resources necessary for researchers to effectively translate their ideas into societal impact. The three key components of each program would be: gap funding, community-building, and mentoring and education, though other aspects are welcome. The results would be measurable, reproducible, and scaleable.

Ultimately, a successful demonstration program would lead to a Phase II where the program is institutionalized on a wider scale across the country, successfully accelerating existing efforts to turn university research into economic and societal impacts in the form of innovations that improve the lives of American citizens.

Background

When we think of technological innovation, we think of entrepreneurs who join the genius of invention with market timing and capital formation. However, the partnership between the U.S. government's science and technology efforts and the nation's public and private universities plays a larger role than most observers recognize. A recent study found that the most important, world-changing innovations – those highlighted annually by the R&D 100 – are no longer being developed by private industry to the extent they were almost forty years ago (Block and Keller 2008). The majority of these award-winning innovations now arise from early discoveries supported through federal funding.

Universities are among the few places, including federal laboratories, that conduct the type of game-changing and disruptive research that has formed the foundation of many of the most significant U.S. technological advancements today. Entire industries such as

biotechnology and the Internet can be traced back to fundamental discoveries at universities. Universities play a crucial role in the innovation pipeline for the country.

But by its very nature, most university research tends to be early stage and removed from market concerns. Even the most promising breakthroughs face very real hurdles as they struggle to translate into the market where they can make societal impact (Price and Sobocinski 2002). These early innovations might emerge through a spectrum of knowledge-transfer routes, such as faculty consulting (Agrawal and Henderson 2002), students graduating and taking jobs in industry, inventions licensed to established companies, and university start-up efforts to turn ideas into new high-growth companies. Although many institutions have focused considerable amounts of their own resources on commercialization efforts, this crucial stage of the innovation process has been greatly underfunded to date.

Studies have shown that the university new venture process is deeply impacted by early stage capital (Carayannis et al 2000) as well as by programs that enable university innovators, entrepreneurs, and investors to connect with each other (Palmintera et al 2005). Some universities have been fortunate to receive assistance through major gifts or local funding and have created innovation centers with grant programs that have demonstrated great leverage and great success. Gulbranson and Audretsch (2008) wrote about two programs centered in engineering schools, the MIT Deshpande Center for Technological Innovation and the UCSD von Liebig Center. After granting less than $10 million to projects, these centers helped advance 26 startups that have raised a total of $160 million in outside investments. A different example is the USC Stevens Institute for Innovation at the University of Southern California, launched two years ago with a $22M gift. That funding has been used so far to significantly reengineer business development and licensing operations, extend beyond traditional technology transfer to support all schools and disciplines, and reach out beyond faculty to support student innovators to create a university-wide culture of innovation.

Despite the progress to date, this important part of our innovation economy should not be left to chance. The next step is a concerted effort to support a set of rational experiments that move this phase of technology transfer into business models that can be scaled for maximum impact.

Economic Impact of University Startups

In 1980, the Bayh-Dole Act enabled universities to own and manage the intellectual property (IP) arising from federally sponsored research. From an economic development standard, the Bayh-Dole Act was a boon to local economies and to society at large as new technologies were introduced to market. Shortly after 1980, startups and products based on university IP steeply rose as universities and faculty had incentive to commercialize their inventions. In 2007 alone, at least 555 startups based on university licenses were created across the country and 686 new products were introduced to market (AUTM 2008).

University technology transfer has a strong local economic development impact (Trune and Goslin 1997). According to Pressman (2002) 80% of all university startups are headquartered in the same state as the university from which they spun out. Between 1980 and 1999, university startups in the United States created $33.5 billion in economic value (Cohen 2000), at an average of $10 million per startup. By 2007, 3,388 university startups were still operational (AUTM 2008).

The Innovation Gap

Although the United States enacted the Bayh-Dole Act to encourage universities to commercialize their research and to encourage this type of impact, it did not provide resources to make this happen. University technology transfer offices (TTOs) on average tend to lose money (Trune and Goslin 1998), in part because a successful invention can take ten years or more to generate royalties. So, although TTOs provide benefits to their local communities, they have limited ability to reinvest resources to enhance interactions with industry in a strategic and proactive manner.

Some unfamiliar with the commercialization process may look to private industry to address this opportunity through investment in early stage innovations. However, as Gulbranson and Audretsch (2008) point out, “University research does not passively spill over for commercialization and innovation.” Early stage venture markets are inefficient (Shane 2008) and most university innovations are too risky for investors; therefore, they face a large feasibility and funding gap. Unfortunately, none of the tens of billions of federal dollars currently invested in early stage university research can be used to explore the commercialization potential of the resulting innovations and help bridge the gap.

Federal investment in this gap stage is more important than ever. Although universities have become more productive in transferring innovations since Bayh-Dole, the size of the global marketplace and the emergence of other national science and technology efforts call for the federal government to renew and facilitate the next level of translating innovation from universities for the benefit of the American taxpayer.

Existing Federal Programs of Potential Benefit

The proposed initiative takes into full consideration existing federal incentives beyond Bayh-Dole. Three programs are often mentioned in the context of addressing this missed opportunity: the Partnerships for Innovation (PFI), Small Business Innovation Research (SBIR), and Small Business Technology Transfer (STTR) programs. And more recently, the NIH has introduced the BRDG-SPAN program. While they are valuable programs, they do not address the opportunity discussed here.

The PFI Program, managed by the National Science Foundation, aims for economic development through knowledge transfer from universities, and focuses efforts on smaller institutions that would help broaden participation in the innovation process. The maximum amount of the awards is $600,000. These grants are too small to have the impact sought by the proposed initiative.

The Small Business Innovation Research (SBIR) Program provides research funding to the nation's small companies by enabling them to participate in the federal government's research and development efforts. Some university spin-offs have benefited from this funding, which plays an important role. However, SBIR grants require creating a corporation; university innovations are usually too early to form a company around. Premature start-up creation can stunt the growth of the corporation. Further, running a company requires the researcher to invest considerable overhead, whereas using existing lab space and infrastructure already in the university to advance an idea would be more efficient. Also, SBIR grants do not provide a structure for faculty and graduate students to learn more about the startup process, or inspire high-tech entrepreneurial ventures from individuals who may not otherwise think about doing them.

Creating a university spin-off leads to a greater chance of conflict of interest and conflict of commitment for faculty. This can usually be managed, but the STTR program requires the startup to fund research in a university laboratory. To manage the resulting conflict, most universities have guidelines that limit the researcher's ability to be involved in the commercialization process outside the university. These conflict of interest issues can severely limit the efficacy of the SBIR and STTR programs for early stage university projects, and it leaves a void that the proposed IMPACT pilot seeks to remedy.

Most recently, NIH has introduced the pilot BRDG-SPAN program. As described by NIH, "The purpose of this pilot program is to address the funding gap between promising research and development (R&D) and transitioning to the market – often called the "Valley of Death" – by contributing to the critical funding needed by applicants to pursue the next appropriate milestone(s) toward ultimate commercialization..." Clearly, NIH's introduction of BRDG-SPAN further underscores the real need for translational funding. The Institutes' goals are closely aligned with the proposed IMPACT program. However, BRDG-SPAN is a one-time pilot program limited to ten commercialization projects in biomedical informatics and bioinformatics at for-profit enterprises. It does not directly address the need to fuel early-stage innovation stemming from university research.

A successful program to accelerate academic innovations would create and enhance the innovation ecosystem around universities in addition to providing the resources necessary to assist researchers to effectively translate their ideas into economic and societal impact.

Goals and Success Metrics

The primary goal of this federal demonstration initiative is to create one or more models for accelerating innovation from universities, demonstrate effectiveness, and provide guidance for implementation on a larger scale.

Additional outcomes would include one or more sets of guidelines for universities to increase commercialization success and a growing community of university programs that share best practices. This initiative may even uncover new approaches that warrant further study. And, of course, each pilot university would be expected to demonstrate progress along predetermined success metrics.

The ongoing success of each program at the university level will be judged based on its ability to:

- Increase the enthusiasm and engagement of faculty and students across all disciplines in the innovation and entrepreneurship process;
- Broaden the impact of the most promising university innovations through commercialization and start-up formation; and
- Develop a local community that supports the innovation ecosystem around the university.

The demonstration sites, in partnership with the federal government, will be tasked with collaborating to further define and refine a set of metrics for success.

Ultimately, a successful demonstration would lead to a Phase II where the initiative is institutionalized on a wider scale across the country. For example, the initiative could permit all universities that receive federal research funding and meet certain criteria to be eligible for an IMPACT grant to accelerate the economic and societal impact of their most promising research results. If used effectively, additional support to a university on the order of only 1-2% of research volume could be transformative, because it would be so highly leveraged and focused on the most promising ideas.

Proposed Demonstration Programs

The first step in accelerating university innovation nationwide would be a pilot study, with ten model programs funded through grants to universities. Funding would equal $2 million per year per university for five years.

The funding from each demonstration grant would complement existing activities already in place at the university in order to provide, at a minimum:

- Proof of concept funding with appropriate project management;
- Community engagement, networking, and teambuilding;
- Business strategy and mentoring (universities may engage additional students and curriculum to support this);
- Educational resources;
- Media relations and showcasing of projects; and
- Measurement and evaluation of results.

The funding could be used to support any aspect of the above activities – materials and services, administrative salaries, and funding for innovative research as needed. Additionally, each program would be expected to develop additional experiments to enhance the innovation transfer process. The pilot programs, described below, would be university-wide so that researcher from any school or discipline would be eligible to participate.

Success Factors

The most effective innovation centers and programs to date have had strong leadership – with highly dynamic and dedicated directors who have startup and business development experience, as well as experience working with universities so that they understand and relate to the unique culture within academia.

For maximum long-term impact, the programs should strike a balance between culture change and the commercialization of the most promising ideas. It might be tempting to focus as a top-line metric nominally on the number of ideas commercialized, but this would overlook the longer term benefits of investing in lifelong innovators within the university. If encouraged and coached, such innovators will continue to develop innovative ideas and inspire others, even if the commercial potential of their initial ideas is questionable.

Local control of each demonstration program is critical in order to engage the local business community and to select and coach the researchers that are the most likely to benefit from the program. This program can only achieve its objectives if all of the activities and grants are run by, or in close association with, the recipient university.

Community engagement should be a cornerstone of the program. This can take the form of project selection, mentoring, and industry and investor connections. Mentors would be paired with innovators, providing business and industry insights and coaching them on the commercialization process. Volunteers from the business community should be carefully selected with clear guidelines and expectations and would serve for a fixed term that can be renewed. Participants should view this as a prestigious affiliation.

Public relations are also important in order to facilitate community engagement and increase the projects' chances of success. This can range from media relations to showcase events.

Ultimately, the investment in each program works only if the technology transfer operation at the university is effective and closely linked to the IMPACT program. It is critical for the university's licensing operations to be streamlined, with a service and societal impact orientation.

Proof-of-Concept Grants

Each demonstration site will dedicate a portion of its budget to proof-of-concept grants. Depending on the research expenditures of the institution, each demonstration program would likely fund anywhere between four to twelve projects per year. Of these, approximately one third should become viable (funded) startups or licenses within two years, and the researchers involved in the other two-thirds will have a better indication of which direction to take their idea. At least as importantly, the faculty and students involved should gain greater skills in business strategy and understand better whether they would be interested in pursuing startups in the future.

Based on experience gained from past innovation funds and centers, the projects supported by IMPACT grants must be selected locally and carefully, based on the following criteria:

- **Team:** Are they coachable and committed to the program? Can external investors and entrepreneurs work with them? Are they likely to continue being engaged in the program past the term of the grant?
- **Idea:** What is the feasibility, novelty, and intellectual property (IP) strategy for the idea? If IP is important strategically, there must be no premature disclosures preventing protection or any contractual obligations blocking the dissemination of foreground and background IP. In some cases, however, open source, public domain, and generous licensing strategies should also be considered for maximum impact, as appropriate.
- **Opportunity:** How important is the problem and potential for societal impact? What is the market feasibility for creating an organization that will make great impact, through job growth or societal impact? What are the chances for sustainability and growth? Non-profit concepts could be eligible if the potential for sustainability and impact is high.
- **Timeframe:** How likely will the project spin out within 1-2 years if selected?
- **Plan:** Is the project plan and budget reasonable, with measurable outcomes?
- **Risk:** What is the expected outcome for the grant? Is there appropriate risk, with a corresponding high reward?
- **Value:** What is the amount of impact the grant program would offer the project and vice versa? Is there appropriate community support and available expertise to properly assist? Is the team likely to be inspired by the program, and in return inspire others and help create a culture of innovation?

The selection process should engage a wide range of reviewers, such as investors who have previously worked with universities, industry experts, serial entrepreneurs, and academics.

Of all of the above criteria, the team is the most critical for success. Investors expect the inventor to be involved, but generally not become the CEO of the new company (Holly 2009). No matter how promising an idea, if the inventor is not committed to the innovation process, or willing to be flexible about the approach to commercialization, the grant funding will not be a good investment.

The gap funds are most appropriately used to cover the cost of materials and labor – students, contract developers, or faculty as appropriate – as opposed to large equipment purchases. Grants should be seen as a carrot to attract the best innovators, but not the end goal, as the programmatic support of mentoring, networking, and media relations is at least as important. Projects need an appropriate level of project management by the demonstration program to set and track high level milestones. Individuals involved in

supporting the projects must have the scientific and business knowledge to provide effective support.

Funding, project management, and educational programs will lead to success stories. However, for long-term impact, developing the innovator's skills and experience is even more important than developing the individual innovations. Sometimes the original idea doesn't work, but learning from mistakes should be rewarded. If engaged properly, the researcher will continue to come back again and again with new ideas, and will inspire others to do the same. Flexibility in the direction of projects is crucial, as is spending resources on setting expectations and providing information about the entrepreneurial process is very important for success (Holly 2009). Participation in mentoring and workshops should be set out as expectations and conditions for the grant.

If promoted properly, the grants will provide a sense of cache to the projects. This, in conjunction with requiring researchers to participate in special programs for grantees, will attract the right researchers and the best mentors. Selectivity is important.

Deliverables

Each university should be expected to show initial progress along the objectives in innovation advancement, community-building, and education outlined in the Goals and Success Metrics section, above.

Additionally, during the pilot phase, the ten demonstration programs should share key findings with each other, the Department of Commerce, other relevant federal research agencies, and the Office of Science and Technology Policy and learn from each others' mistakes. Possible venues for this would be:

- Annual best practices roundtable;
- Proposed approach to measuring success (metrics);
- Annual report for each program; and
- Faculty and student participant survey.

Mistakes should not be treated negatively if they are shared and learned from. Experiments with results should be valued as much as successes. Ultimately the end goal will be to develop and scale effective models nationally for maximum economic and societal benefit.

Structure of the IMPACT Initiative

Although many agencies, each with its pros and cons, might be well-suited to administer the demonstration initiative, IMPACT would best be managed from within the Department of Commerce's Economic Development Administration (EDA). In addition, the National Science Foundation would contribute to the articulation of program guidelines and serve in an advisory capacity to EDA.

The Department of Commerce, and in particular the Economic Development Administration (EDA), is committed to the stimulation of industrial and commercial growth. EDA has experience working with universities on the development and implementation of concepts relating to clustering and regionalism, and the agency can train universities to develop improved economic development strategies. In addition, EDA has mechanisms in place to award grants to universities.

As proposed, IMPACT would complement EDA's initiative outlined in its FY 2010 budget request to provide $50 million to create Regional Innovation Clusters with a focus on regionally-specific economic development and job creation. These regional clusters would depend upon universities and the initial demonstration projects will facilitate an atmosphere of increased collaboration and competitiveness within regions to jump start regional economic growth. In addition, EDA plans to use $50 million of the FY 2010 budget to facilitate public-private incubators to assist start ups and encourage the transfer of best practices for specific industries between different regions.

Criteria for Selection

The ten demonstration sites would be selected with the input of an independent panel with broad experience in industry, technology transfer, venture capital, academia, and entrepreneurship.

Criteria for selection could include:

- **Plan:** Proposal must feature a feasible plan, including analysis of opportunities and gaps, how funding would be applied towards addressing these gaps, and how other resources would be leveraged.
- **Potential for success:** Universities receiving grants must demonstrate high potential for success, given the limited scope of the demonstration stage of this program. This includes having sufficient research budget to create a critical mass of projects; an existing local community of industry, entrepreneurs, and investors that can be engaged; and infrastructure and leadership in place to support a pilot, preferably with commercialization experience and knowledge of best practices.
- **Potential for broader impact:** Universities should demonstrate the impact the grant would have on their innovation ecosystem and must be committed to the success of the demonstration initiative as a whole through the sharing of best practices and helping with scale-up. A track record of developing and sharing best practices should be considered.
- **Innovation vs. best practices:** Universities can propose novel structures for their programs and should dedicate resources to experimentation of new approaches that have not yet been tried, but must leverage best practices and provide, at a minimum, the resources listed in the "Structure of Demonstration Programs" section, above.

- **Diversity of candidates**: Programs should be distributed across region, size, public vs. private, etc. to determine whether these factors require different approaches.

Institutional Commitment

The selected universities for IMPACT must be committed to the program and provide an environment where it can flourish. Because measurable outcomes of innovation activities often take 5-10 years, and many universities are experimenting with new approaches, universities should not be measured based on their commercialization track record alone. No two universities will be identical; their success will depend on their unique circumstances. As a result, universities applying for an IMPACT program should use their own discretion in demonstrating to the reviewers their institutional commitment to innovation and to the IMPACT initiative.

Key criteria would likely include the following:

- Demonstrated strategic priority of meeting societal needs through innovation; this should include a wide range of educational and knowledge dissemination activities, including but not limited to patenting and licensing;
- Strategic placement of an innovation champion in the hierarchy of the university (vice president or vice provost) who is a PI on the grant;
- Presence of existing infrastructure (internal or external) to support a university-wide program;
- Budget and staff already committed to interdisciplinary commercialization and innovation activities;
- Comprehensive conflict of interest policies that provide a mechanism for faculty to engage in the startup process while maintaining academic integrity;
- Commitment to flexibility in faculty engagement, including support for leaves of absence to pursue start-ups;
- Willingness of the university to take equity in startups, which has been shown to be an important factor in university spin-off activity (DiGregorio and Shane 2003);
- The university TTO reporting to the PI, or serving as co-PI;
- TTO performance being measured primarily on service, societal impact, and/or economic development, rather than primarily revenues and number of patents; and
- Technology transfer staff with business development and startup experience.

Summary

Since the Bayh-Dole act first engaged universities in the commercialization process in 1980, university research has had a profound impact on economic development and the well-being of Americans through the creation of new companies and new products. Today – with our growing investment in science and technology research and our renewed appreciation for the important role that technological innovation plays in global competitiveness – it is time to ensure that our investments in early stage research find their full potential. The proposed IMPACT initiative is a highly leveraged and scalable way to harness these great opportunities from our country's research universities.

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