

The Innovative & Entrepreneurial University: Higher Education, Innovation & Entrepreneurship in Focus

U.S. Department of Commerce

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Table of Contents

Forward	Page 4
Letter from NACIE Co-Chairs	Page 6
Acknowledgements	Page 10
Executive Summary	Page 12
Introduction	Page 18
Promoting Student Innovation and Entrepreneurship	Page 24
Encouraging Faculty Innovation and Entrepreneurship	Page 29
Actively Supporting Technology Transfer	Page 33
Facilitating University-Industry Collaboration	Page 40
Engaging with Regional and Local Economic Development Efforts	Page 45
Conclusion	Page 51
Appendix One	Attached
Appendix Two	Attached

Foreword

Over the last several months, the Department of Commerce's Office of Innovation and Entrepreneurship has been speaking directly to colleges and universities around the country to understand how they are nurturing and promoting innovation and entrepreneurship. This effort was conducted in response to a letter that was marshaled by the National Advisory Council on Innovation and Entrepreneurship to the Department in 2011, which described how university-based innovation and entrepreneurship is blossoming, and outlining steps that the university community would like the US government to take to further nurture economic value creation in conjunction with universities. This report announced the results of those interviews and conversations in a report entitled, "The Innovative and Entrepreneurial University: Higher Education, Innovation and Entrepreneurship in Focus."

Innovation is a key driver of economic growth in the United States. At the Department, our agencies and bureaus are focused on nurturing innovation, developing advanced manufacturing in the United States, and increasing exports to the world. Innovation is a priority for the U.S. Department of Commerce because it helps American industry, universities, and research institutes to develop the next generation of technologies and increase the number of high-growth American startups.

In 2009, the National Advisory Council on Innovation and Entrepreneurship was created as part of the implementation of the America Competes Act. This council, comprised of some of America's leading entrepreneurs, investors and university leaders, has been a tremendous asset to the Administration by providing ideas and feedback on policies that nurture innovation and entrepreneurship. Over the last two years, the Council, under the leadership of co-chairs Steve Case, Dr. Mary Sue Coleman and Dr. Desh Deshpande, has had a major impact on several Administration accomplishments including Startup America, the American JOBS Act, and a letter from university presidents that is the focus of this report.

This letter, entitled, "Recommendations to Facilitate University-Based Technology Commercialization", mobilized the higher education community. It provided a strategic framework for universities, colleges, and its partners in government, philanthropy, and business to think about university-based innovation and entrepreneurship. This framework has become part of the discussion on campuses everywhere as higher education thinks about its future and the desires of its students, faculty, and communities. Signed by 142 of America's leading universities, this letter spawned similar efforts by community colleges, state colleges, Historically Black Colleges and Universities (HCBU), and several government research labs.

The Department's Office of Innovation and Entrepreneurship spoke directly to nearly every signatory of this letter. As expected, we found that universities and colleges across America are engaged in an exciting and comprehensive set of programs to nurture innovation and entrepreneurship among their students, faculty and communities with the goal of supporting industry and the regional economy. While their approaches vary based on geography, history and size, they are all committed to the innovation economy and the role of entrepreneurs in driving that economy. In addition, the universities are all strong partners of the U.S. government, its research agencies, and the U.S. Department of Commerce.

Moving forward, the Department will work collaboratively with our partners in higher education to develop a common agenda to support and nurture university-based innovation and entrepreneurship. The insights in this report will serve as a starting point in a long-term discussion about the roles of universities and the federal government in nurturing innovation and entrepreneurship to support America's economy.

National Advisory Council on Innovation and Entrepreneurship

The National Advisory Council on Innovation and Entrepreneurship (NACIE), and on behalf of the full membership, would like to thank the U.S. Department of Commerce for its follow up work with universities, national labs, community colleges and Historically Black Colleges and Universities.

Since its inception, NACIE has been very focused on the issue of the commercialization of federally-funded research, and the opportunity to create economic value and jobs in the United States through greater commercialization by our university, lab and corporate research partners. In April 2011, four of our members led the charge to engage universities directly in this effort. Through the combined efforts of Presidents' Mary Sue Coleman, Bud Peterson, Michael Crow and Holden Thorp, and the outside support of several higher education groups, we submitted a letter to the U.S. Department of Commerce focused on university-based innovation and entrepreneurship. America's higher education institutions are engaged in a variety of exciting programs to nurture innovation and entrepreneurship as part of the education of their students, faculty and alumni, and as a tool to leverage their assets to create economic value in their communities. The letter emphasized key steps taken by the higher education community to enhance those programs, and suggested ways in which the federal government could enhance it even more. While there are certain characteristics that all the universities share, this report highlights the diversity of programs across the United States in a way that reflects the diversity of size, geography, culture and research capacity of our higher education institutions.

This report should be the start of similar outreach by the U.S. Department of Commerce and other federal agencies to universities, federal labs and private companies to more deeply understand the nature of our innovation and our capacity to commercialize. In addition, NACIE looks forward to engaging more deeply on many of the ideas in this report and to promote those that can be replicated for greatest impact. We know that these activities will lead to greater innovation, commercialization, and broad-based entrepreneurship from our university communities.

We look forward to continued involvement with the U.S. Department of Commerce and to making future recommendations in this area as well as other critical areas of importance to NACIE, including access to capital and the celebration of entrepreneurship in the United States.

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This report would not have been possible without a sustained effort by many individuals and organizations that deeply care about universities, commercialization, innovation, and entrepreneurship.

Foremost, we at the Office of Innovation and Entrepreneurship (OIE) would like to thank the National Advisory Council on Innovation and Entrepreneurship (NACIE) for its leadership in many areas since its inception in 2010. NACIE members have been critical in advising the U.S. Department of Commerce and its federal agency partners about the importance of innovation and entrepreneurship. In particular, the four major university presidents in NACIE were our key contacts to the university community. We would like to thank Dr. Mary Sue Coleman, Dr. Michael Crow, Dr. Bud Peterson, and Dr. Holden Thorp for their leadership in the creation of the letter to former Secretary Gary Locke on “Recommendations to Facilitate University-Based Technology Commercialization” and support of our subsequent follow-up (Appendix 1). This letter has become an important resource for universities and colleges around the country as they plan and develop their innovation and entrepreneurship programs. It is often cited within the academic community for its thoroughness in outlining the role of universities in innovation, and entrepreneurship.

In addition, OIE owes tremendous gratitude to several associations representing higher education, innovation and entrepreneurship. These organizations have long advocated for greater federal support for research and development (R&D) as well as for greater commercialization. Most notably, the American Association of Universities (AAU) and the Association of Public Land Grant Universities (APLU) have been dedicated partners since the beginning of this effort. These associations helped NACIE to marshal the original 142 signatories for the NACIE University Presidents’ letter.

Several other higher education associations also supported our effort through outreach to their members. In particular, associations representing institutions at the state and regional level worked with us to understand their members’ approaches to innovation and entrepreneurship and to highlight their strategies—which we found were often similar to those at the major research universities. The American Association of State Colleges and Universities (AASCU) connected us with over 60 state universities and hosted a number of forums from which we obtained valuable insights. The National Association of Community College Entrepreneurship (NACCE), has over 170 community college members that have made a similar commitment to entrepreneurship as part of the Startup America Initiative commitment. And the United Negro College Fund and the Historically Black Colleges and Universities’ (HBCU) Deans Summit helped us reached out to their member schools, which are looking at developing entrepreneurship programs around the technical programs they have historically had and around social innovation. We also received support and encouragement from the Association of University Technology Managers (AUTM), the American Council on Education (ACE), and the National Council on Entrepreneurial Tech Transfer (NCET2). We look forward to working more closely with them in the future.

We would like to acknowledge the work of many members of the U.S. Department of Commerce family who have provided support and encouragement of university-based innovation and entrepreneurship. We would like to thank Deputy Secretary Rebecca Blank for consistently discussing the importance of innovation to the U.S. Department of Commerce. Additionally, we received support and encouragement from the Office of the Secretary, the leadership of the U.S. Economic Development Administration (EDA), the U.S. Patent and Trademark Office (USPTO), the U.S. National Institute of Standards and Technology (NIST), the Commerce Executive Leadership Development Program (ELDP), and of course, the staff and supporters of OIE.

Office of Innovation and Entrepreneurship

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Executive Summary

America's colleges and universities have got the entrepreneurial bug. From the i6 Proof of Concept Center at the University of Akron to the University of Wyoming's Technology Business Center, America's higher education institutions are embracing the importance of innovation, commercialization, entrepreneurship, and the creation of economic value for their communities. Most people are familiar with the traditional centers of university-based innovation and entrepreneurship such as the Massachusetts Institute of Technology (MIT) and its connection to the Greater Boston entrepreneurship ecosystem. But over the last decade, more universities, community colleges, Historically Black Colleges and Universities (HCBU), and regional state colleges have embraced innovation and entrepreneurship as critical to their mission and role in their communities.

In 2011, 142 major research universities and associations submitted a letter to the Secretary of Commerce renewing their commitment to innovation and entrepreneurship on campus and in their communities, and asked the federal government to continue to work with them in these areas. This report is the next step in a two-year effort by the U.S. Department of Commerce and the National Advisory Council on Innovation and Entrepreneurship (NACIE) to understand exactly what America's colleges and universities are doing programmatically and strategically to nurture innovation, commercialization, and entrepreneurship among students, faculty, alumni, and within their communities.

In order to determine what efforts the signatories have made in innovation and entrepreneurship, representatives from the Office of Innovation and Entrepreneurship (OIE) spoke to the leaders of 131 research universities, located around the United States. OIE also collected information from community colleges, regional colleges, and HCBUs about their programs. Time and again, the leadership at these universities and colleges emphasized the pedagogical value of entrepreneurship, their vision for entrepreneurship in their communities, and the organizational infrastructure they are developing to maximize the research, ideas, and talent associated with their colleges and universities. The results from these discussions will encourage anyone concerned about America's capacity to innovate and create the next generation of high-growth startups, especially those who feel that institutions of higher education have an important role to play in this arena.

Over the last two decades, the majority of job creation in the United States has occurred in young, startup companies.¹ In addition, innovation, and the real-world application of that innovation, is all around us. From breakthroughs in medicine and genetics to clean technologies, social media, or education technologies, innovation is becoming a more critical part of all of the products and services available today. While the United States remains the global leader in innovation and entrepreneurship, there is constant competition from around the world to maintain that leadership.

And as global competition continues to grow, it is critical that the institutions driving innovation improve their ability to develop products and services with market relevance and economic value. Historically, a large portion of America's investments in innovative companies have been centered in the metropolitan regions of San Francisco/Silicon Valley, CA; Greater Boston, MA; New York/New Jersey; Austin, TX; Seattle, WA; Washington D.C., and San Diego, CA.² However, universities outside of these areas are now leading the charge to model new entrepreneurial ecosystems. This is best exemplified by the University of Michigan's efforts in Michigan, Arizona State University's impact in the Phoenix area, and the University of Southern California's efforts in the Los Angeles area. In addition, hundreds of colleges and universities across the U.S. are creating entrepreneurship programs with the short-term objective of creating educational value for their students and the long-term objective of driving economic growth in their communities through locally-developed enterprises.

¹ Haltiwanger, John C., Ron S. Jarmin, and Javier Miranda, "Who Creates Jobs? Small vs. Large vs. Young," NBER Working Paper No. 16300, August 2010, see http://www.nber.org/papers/w16300.pdf?new_window=1.

² PricewaterhouseCoopers and National Venture Capital Association, "Investments by Stage of Development Q1 1995- Q2 2012," MoneyTree Report, see <https://www.pwcmoneytree.com/MTPublic/ns/nav.jsp%3Fpage=notice&iden=B>

Nearly all of the university leaders that participated in the discussion emphasized the importance of the U.S. government and the university community working together to maximize innovation commercialization. Over the last decade, universities have been the largest sector to receive federal R&D grants –receiving nearly \$36 billion from federal agencies in FY2009.³ Universities have received funding and assistance from a variety of federal agencies, including the Departments of Commerce, Education, Agriculture, Labor, State, Health and Human Services, Energy, Defense, U.S. Agency for International Development (USAID) and the National Science Foundation (NSF). In short, universities and the U.S. government are key partners in research, development, and innovation. Furthermore, leaders of universities and federal agencies share a common desire to increase collaboration and bring innovative ideas and research to the market to create real-world solutions and high-growth startups.

The NACIE University Presidents’ letter, “Recommendations to Facilitate University-Based Technology Commercialization” identified five focus categories at the heart of the innovation and entrepreneurship activities within America’s universities. These categories are student entrepreneurship, faculty entrepreneurship, technology transfer, industry collaboration, and engagement in regional economic development. The universities affiliated with the letter are each addressing innovation and entrepreneurship in diverse ways relevant to their research budgets and programs, student population, geography, history, and culture. Through their distinct approaches, these institutions hope to improve their own partnerships with the federal government and pursue their broader organizational goals. Following are summaries of some of the best practices and emerging trends at universities and colleges.

Promoting student innovation and entrepreneurship

Colleges and universities are investing heavily in the development of their students’ entrepreneurial skills. While many students dream of starting the next Facebook® or Twitter® (both of which were started by students), universities are more focused on the pedagogical value of entrepreneurship as a set of skills that can be applied across professional environments and activities to supplement the students’ classroom experience. Universities are investing both in formal programs as well as in extra-curricular activities to channel students’ interest in solving global problems through entrepreneurship. Examples of formal programs include degrees and certificates in entrepreneurship, while examples of extra-curricular activities include business plan contests, entrepreneurship clubs, and startup internships. Many universities are even experimenting with on-campus accelerators, entrepreneurial dorms, and student venture funds. At the very least, these activities provide critical organizational skills to students, and at the very best, may create the next great university spinoff. Some of the most effective practices include:

The University of Colorado System’s Innovation and Entrepreneur Degree Program – Offers a Bachelor’s degree in Innovation (B.I.), through a unique multi-disciplinary team and course work approach.

The University of Illinois’ Patent Clinic – Provides law students the opportunity to draft patent applications for student inventors.

Washington University in St. Louis’ student internship program – Offers 25 paid internships per summer for students to work in a start-up’s.

Rice University – Raised and provided \$1.2 million in cash and in-kind services for its business plan contest in 2011. This money has served as a de-facto angel round of funding for the recipient companies.

³National Science Foundation, “Science and Engineering Indicators, 2012,” see <http://www.nsf.gov/statistics/digest12/portfolio.cfm#4> and <http://www.nsf.gov/statistics/digest12/funding.cfm#3>.

University of Washington – Hosts a multi-level business plan competition comprising of different competitions throughout the school year, in combination with seminars, courses, and mentorship to assist in pushing student ideas to the next level.

University of Florida- “INSPIREation” Hall – Is the nation's first entrepreneurship-based academic residential community - encouraging student interaction with fellow students, leading researchers, distinguished faculty, business professionals, and entrepreneurs.

Encouraging faculty innovation and entrepreneurship

Faculty and doctoral graduate students conduct the research powering many of the innovations that spawn high-growth startups. However, even at our nation's most entrepreneurial universities, many faculty and graduate students do not always consider the market and societal relevance of their research. To address this issue, universities are putting in place a series of policy changes to encourage more faculty entrepreneurship, which in turn will complement the student entrepreneurship. These changes include greater recognition of faculty entrepreneurs, integrating entrepreneurship into the faculty tenure and selection process, and increasing faculty connections to outside partners - through externships, engagement with business, and targeted resources for startup creation. Finally, universities are actively working with federal agencies to address some of the regulatory challenges around faculty entrepreneurship, in particular, those related to conflict of interest and national security issues. Some of the most effective practices include:

The University of Pittsburgh – Offers a Business of Innovation Commercialization course aimed at educating and motivating both student and faculty researchers in innovation development, commercialization, and entrepreneurship.

University of Southern California – Promotes faculty entrepreneurship and innovation by supporting, rewarding, and funding the work of faculty members.

University of Virginia – In 2010, the University's School of Medicine was among the first to include commercialization and entrepreneurship activities among its promotion and tenure criteria.

University of Nebraska Medical Center's Entrepreneur in Residence (EIR) – The EIR works with licensing staff and researchers at the University of Nebraska's Medical Center to help identify, evaluate, develop, and support the creation of new companies based on UNMC innovations.

Actively supporting the university technology transfer function

University Technology Transfer Offices (TTO) and Technology Licensing Offices (TLO) have traditionally been the hubs within universities where innovators and outside business leaders engage to commercialize inventions. The recent burst of entrepreneurship on campuses has greatly expanded the role of the TTOs and TLOs. Instead of merely focusing on the commercialization of individual technologies, these offices now act as a central point where students, faculty, alumni, entrepreneurs, investors, and industry can connect with each other. These offices are now focused on identifying and supporting entrepreneurship on campus, helping startups find the best opportunities and building successful business models, changing the culture of their universities, and creating companies that will be based in the communities around the university. TTOs and TLOs have also expanded support beyond their traditional areas, such as energy and life sciences, into education, social innovation, and agriculture. Some of the most effective practices include:

Utah State University's Intellectual Property Services – A university unit within the Commercial Enterprises office that is dedicated to helping faculty and staff manage and protect and commercialize university intellectual property and support institutions in the surrounding areas.

University of North Carolina Chapel Hill's Technology Transfer Internships – Offers internship and fellowship opportunities for students within the TTO.

Cornell University's IP&Pizza™ and IP&Pasta™ – Is an outreach activity for faculty, research staff, and students to increase appreciation of the importance of making university research results useful to society and provide a basic knowledge and understanding of intellectual property issues and an awareness of capturing and protecting valuable intellectual property and its importance to entice potential industry partners.

California Institute of Technology (CalTech) – Files a provisional patent application for every single disclosure that goes through their TTO and later evaluates the technical and business merits over the first year.

Regional Tech Transfer Centers – Serve the needs of research institutions and non-profits throughout a region and are of particular benefit to institutions without TTOs or TLOs. Examples include the South Texas Technology Management Center, the University of Utah, and the Massachusetts Technology Transfer Center. These have been particularly useful for institutions with entrepreneurial faculty but without large TTO's.

Facilitating University-Industry Collaboration

Businesses and industry benefit greatly from university research and innovation. Universities are constantly looking for ways to connect their research and students' education to emerging industry interests. In recent years, universities have put greater emphasis on supporting startup companies, while continuing to engage established companies that have traditionally been their licensing partners. To facilitate greater collaboration and innovation, universities are opening up their facilities, faculty, and students to businesses (small and large) in the hopes of creating greater economic value. Universities are strategically partnering with companies, offering internships and externships, sharing facilities with startups, such as accelerators, and creating venture funds and incentive programs funded by industry, all of which drive increased innovation and product development by university students, faculty, and staff. Some of the most effective practices include:

Clemson University's International Center for Automotive Research (CU-ICAR) – Is an advanced-technology research campus where university, industry, and government organizations collaborate.

University of Minnesota's Industrial Partnership for Research in Interfacial and Materials Engineering (IPrime) – Is a university-industry partnership based on two-way knowledge transfer. The partnership is a consortium of more than 40 companies supporting fundamental and collaborative research on materials.

University of Delaware's Office of Economic Innovation & Partnership (OEIP) – Has established partnerships with the College of Engineering and the Lerner College of Business to establish a program entitled Spin In™. The program works with local entrepreneurs who 'spin in' a technology, patent, or product that needs further technical development.

Georgia Institute of Technology's (Georgia Tech) Flashpoint – Is a startup accelerator that offers entrepreneurial education and access to experienced mentors, experts, and investors in an immersive, shared-learning, open workspace.

Engaging with regional and local economic development efforts

Historically, local economic development has been an important mission of the nation's large universities. Many of America's leading universities, particularly land-grant universities, have always felt a strong responsibility for the betterment of their surrounding communities. These days, universities are increasingly focusing on innovation and entrepreneurship as key contributors to the growth and success of local communities. Universities are requesting the

federal government to include commercialization and innovation-driven economic development in their grant programs. In addition, regional economic development planning now often starts with an assessment of a local university's research strengths. In turn, universities are seeking partners to supplement their strengths and overcome their weaknesses through partnerships with community colleges, non-profit economic development agencies, governments, and entrepreneurship groups. Some universities, such as Tulane University, are asking their students and faculty to contribute to local community development through service and projects. Others, such as North Carolina State University, are building innovation-driven campuses that help surrounding cities and communities prosper. Some of the most effective practices include:

Tulane University's Social Innovation and Entrepreneurship Program – Integrates the university with the surrounding economic ecosystem, thereby contributing to local economic development. Students are required to engage outside the campus with the community, often through entrepreneurial projects.

Purdue University's Technical Assistance Projects – Brings faculty and graduate students together to provide cost-free consulting and assistance to local entrepreneurs on business and technical issues.

University of Georgia's Service-Learning Program – Offers enhanced courses incorporating service learning opportunities into all of the University's schools and colleges to increase student involvement in their local communities.

University of Kansas' RedTire's Initiative – Helps link graduate students and alumni with struggling local small/medium-sized businesses. Through a collaborative effort, these businesses receive support and mentorship.

We have learned a great deal from our discussions with university and college leadership. While one size does not fit all, there is certainly something for everyone in this report. It highlights the most interesting and creative programs in each of the five categories summarized above. The goal is for universities and colleges to look at these examples for inspiration and relevance to their programs and objectives. The innovative and entrepreneurial university is the aggregation of all of the great efforts identified in this report, and it is exciting that many institutions are already engaged in a number of these efforts.

Higher education clearly has made great strides in expanding America's innovative capacity. Their innovation and entrepreneurship efforts converge with similar efforts being pursued by the federal government. For example, President Obama issued an Executive Memorandum in October 2011, entitled "Accelerating Technology Transfer and Commercialization of Federal Research in Support of High-Growth Businesses." It calls on all federal agencies to create plans for improving technology transfer of federally-funded research and development (R&D), at federal labs, and with universities, companies, and contract research organizations that receive federal support. The 131 universities we spoke with provided many insights about their relationship with federal agencies. Some of those ideas are referenced in this report. Over the next few years, federal agencies, under the leadership of the National Institute of Standards and Technology, will develop plans for greater commercialization of their research and development (R&D) efforts. This report is part of a larger effort by the federal government to improve its technology transfer activities and external partnerships, thus enabling more effective targeted federal support of university and college programs that promote innovation and commercialization.

Introduction

“The key to our success...will be to compete by developing new products, by generating new industries, by maintaining our role as the world’s engine of scientific discovery and technological innovation. It’s absolutely essential to our future.”⁴

– President Barack Obama, November 17, 2010

America’s innovative and entrepreneurial culture is often regarded as one of this country’s greatest national advantages in an increasingly competitive world. This innovation infrastructure includes a large number of universities and colleges, research institutions, laboratories, and startup companies all across the United States - from major cities to rural areas. Every day, these institutions, often in partnership with federal agencies, develop breakthrough technologies in the life sciences, energy, telecommunications, information technology, education, social innovation, and other areas. This, in turn, has attracted many of the world’s best and brightest people to pursue careers in R&D and innovation in the United States. Many of these same minds become leaders and entrepreneurs across the nation – creating cutting-edge innovation products and services and building our great companies.

As other nations increasingly compete with the United States for leadership in innovation,⁵ America’s colleges and universities are doing their part to maintain our leadership and to nurture more innovation, create processes and programs to commercialize that innovation, and promote entrepreneurship as a viable career path for students. Universities use different approaches to encourage innovative thinking. Their approaches depend on their local environment and objectives, which in turn varies on geography, institutional size, history, culture, and funding resources. This diversity of approaches is proving to be both appropriate and successful for universities and colleges as they seek to create academic and economic benefits through innovation and entrepreneurship.

Across the United States, state and local governments, economic development agencies, non-profits, universities, and business groups are trying to develop innovation ecosystems that foster market-focused innovation and nurture startup companies to drive job creation. They all share some common goals - to find ways to create millions of new jobs in emerging industries where the United States can maintain its economic leadership, gain market share or create entirely new industries. At the same time, the challenges of globalization require that America remain nimble and constantly deliver new, innovative products and services. Research has shown that business startups and surviving young firms disproportionately create jobs relative to their size in the U.S. economy. For example, while firm startups only account for roughly three percent of total U.S. employment in any given year, they are responsible for about 20 percent of gross job creation.⁶

For the United States to remain economically competitive there is need for a strong national infrastructure to commercialize innovation and support high-growth entrepreneurship. If the nation needs to create millions of jobs, and many jobs are created by startup companies, then America will need to significantly increase the number of high-quality, startup companies in the coming years. In the United States, universities are a significant source of the ideas and R&D that are the value proposition of these high-growth startups. But those startups cannot be based solely in the traditional centers of American innovation, such as Silicon Valley, Boston, New York, and North Carolina. In order to develop local

⁴ See <http://www.whitehouse.gov/the-press-office/2011/02/03/remarks-president-innovation-penn-state-university>.

⁵ U.S. Department of Commerce, “The Competitiveness and Innovative Capacity of the United States,” January 2012. See http://www.commerce.gov/sites/default/files/documents/2012/january/competes_010511_0.pdf.

⁶ Haltiwanger, John C., Ron S. Jarmin, and Javier Miranda, “Who Creates Jobs? Small vs. Large vs. Young,” NBER Working Paper No. 16300, August 2010, see http://www.nber.org/papers/w16300.pdf?new_window=1.

entrepreneurial ecosystems, these startups must also be based in new cities and rural communities in order to build their long-term economic prospects.

Unfortunately, the rate of startup formation has slowed over the past several years. According to a report from the McKinsey Global Institute (MGI), the United States could have created almost two million more jobs in 2010 if new business creation and employment at new businesses had remained at the same pace as in 2007. Furthermore, the report stresses that returning to historic rates of startup formation will be key to achieving high future growth rates in employment.⁷ Another MGI report also highlighted the importance of startup companies to economic growth, finding that around one third of the change in economic growth can be explained by changes in startup rates.⁸ In other words, when economic growth increases, about one third of that growth can be attributed to increases in startup rates. These statistics, when factored in with research findings based on Census data,⁹ validate the critical and growing role of the startup company in job creation and economic growth.

Fortunately, in many industries a combination of innovation and development of new business models has drastically reduced the cost of starting and building a company. Startups can launch and grow quickly without necessarily depending on large quantities of elusive venture capital. This change has been well documented and is facilitated by the emergence of cloud computing; the ability to find contract partners to manage administrative services, such as payroll, human resources, and accounting; the growth of micro-targeted “apps” for a wide variety of needs; the ability to use social media for targeted marketing; and access to inexpensive credit. Finally, the rise of “Do-It-Yourself” prototyping companies and affordable 3-D printers has led to a flourishing community of startup manufacturers that can leverage these tools to create and market products in a customized, but scalable, manner. These low-cost opportunities are being embraced effusively by college students as they “bootstrap” their businesses while remaining students.

Scattered throughout this report are examples of colleges and universities that are nurturing innovation and entrepreneurship in unique ways - from creating educational value and outlets for their students to providing new economic opportunities for their local economies.

We know of at least 450 colleges and universities across the United States now have entrepreneurship programs. Although universities are starting at different places, their ability to mobilize their communities to become entrepreneurial is vital in creating a legion of high-growth startups. By engaging a broad yet diverse swath of the university community (students, faculty, alumni, local business and civic leaders) in entrepreneurship activities, universities and colleges aim to catalyze more solutions to major societal and economic problems—from inside and outside the lab—and to create an infrastructure supporting startup creation. Research universities in particular, are creating a culture of student and faculty entrepreneurship and seeking greater industry collaboration and commercialization of new technologies from their R&D efforts.

As the Office of Innovation and Entrepreneurship (OIE) at the U.S. Department of Commerce’s Economic Development Administration talked to university leaders across the United States, they spoke about their growing roles in driving regional economic development. Universities are expanding beyond being primarily providers of innovation for their communities to also being a partner in vibrant local and regional ecosystems that include other universities, federal labs, startup companies, accelerators, and state and local organizations and improving access to public infrastructure. Many

⁷ Manyika, James, Susan Lund, Byron Auguste, Lenny Mendonca, Tim Welsh and Sreenivas Ramaswamy, “An Economy that Works: Job Creation and America’s Future,” McKinsey Global Institute, June 2011, see

http://www.mckinsey.com/insights/mgi/research/labor_markets/an_economy_that_works_for_us_job_creation.

⁸ McKinsey & Company, “The Power of Many: Realizing the Socioeconomic Potential of Entrepreneurs in the 21st Century Economy,” G20 Young Entrepreneur Summit, October 2011, see

<http://www.mckinsey.com/locations/paris/home/The%20Power%20of%20Many-%20McKinsey%20Report-%2020111005.pdf>.

⁹ U.S. Census Bureau, Business Dynamic Statistics (BDS), see <http://www.census.gov/ces/dataproducts/bds/>.

universities and colleges regard the model developed by the Massachusetts Institute of Technology (MIT) as a means of benchmarking their own roles in their communities.¹⁰ MIT measures the economic value created by companies started by or affiliated with their alumni. In addition to creating tremendous economic value around the world, MIT found that nearly one-third of their entrepreneurs were not engineers, but from other disciplines, reflecting the broad-based nature of high growth innovation.

A McKinsey Global Institute (MGI) report on entrepreneurship indicated that there are three pillars to the platform that enables innovation and entrepreneurship to flourish, and universities are increasingly driving or involved in each of these factors: developing fertile innovation ecosystems, creating an entrepreneurial culture, and providing sustained financing for new ventures.¹¹ Foremost, creating an innovation ecosystem is critical for the long-term success and quality of entrepreneurial activity. It is important to have a strong local base for entrepreneurship that is supported by regional economic development plans. American colleges and universities often are the centerpiece of regional economic development strategies because they are often the main source of innovation, but also train the local talent base and workforce, and can connect various actors to drive a common agenda. Secondly, they often push for cultural change on their campuses and within their communities, which sustains the innovation ecosystem. This includes everything from targeted entrepreneurship education to greater ties with local industry, such as licensing technologies locally.

The third factor suggested by the McKinsey report is the importance of available financing, in particular, early-stage and sustained financing. While colleges and universities traditionally have not provided financing for company startups, they have begun creating their own investment funds to support their home-grown entrepreneurs. Sometimes these funds are created through university endowments, specialized donations, or sponsorships. In addition, many university leaders have called upon the federal government to create funding and other assistance programs to fund the “valley of death” that innovative technologies face before their business model is clear. This has become very important to the major public research universities – many of whom are not based in major urban areas. According to data from the National Venture Capital Association, in the first half of 2012, almost three-quarters of venture capital investments in the United States were concentrated in three states – California, Massachusetts, and New York, and accounted for about 60 percent of all venture-backed deals. In the same time period, half of the states had only five or fewer venture-backed deals. This has led universities to step in and fill the void themselves and ask for federal support.

A recent report by the National Research Council, “Rising to the Challenge: U.S. Innovation Policy for the Global Economy,” highlights the importance of university linkages to the market to better promote university-based innovation and entrepreneurship.¹² The report reflects, and encourages the idea of universities developing their own entrepreneurial infrastructure through four support strategies:

The creation of matching funds to a fund that is set aside by universities to nurture innovation and entrepreneurship;

The creation and support of accelerators on campus or affiliated with universities to help spinoffs grow without losing their connection to local innovation;

The creation of funding mechanisms to help with commercialization and overcoming the “Valley of Death;” and

¹⁰ Roberts, Edward B. and Charles Eesley, “Entrepreneurial Impact: The Role of MIT,” MIT Sloan School of Management, February 2009, see http://entrepreneurship.mit.edu/sites/default/files/files/Entrepreneurial_Impact_The_Role_of_MIT.pdf.

¹¹ McKinsey & Company, “The Power of Many: Realizing the Socioeconomic Potential of Entrepreneurs in the 21st Century Economy,” G20 Young Entrepreneur Summit, October 2011, see <http://www.mckinsey.com/locations/paris/home/The%20Power%20of%20Many-%20McKinsey%20Report-%2020111005.pdf>.

¹² National Research Council, “Rising to the Challenge: U.S. Innovation Policy for the Global Economy,” The National Academies Press, Washington, DC. 2012. See www.nap.edu

Helping universities and colleges learn from each other and stay aware of best practices, emerging trends and new ideas.

This year, OIE began a series of discussions with the leadership of major research universities, regional state universities, community colleges, Historically Black Colleges and Universities (HBCU), and federal research labs to understand the diversity of approaches to innovation, commercialization, and entrepreneurship that they have undertaken. Initially, this outreach was conducted as follow up to a letter addressed to the U.S. Secretary of Commerce that was submitted by 141 university presidents, chancellors, and higher education association leaders through the National Advisory Council on Innovation and Entrepreneurship (NACIE). This letter identified five areas where universities were supporting innovation and entrepreneurship (Appendix #1). Those categories included:

- Promoting student innovation and entrepreneurship,
- Encouraging faculty innovation and entrepreneurship,
- Actively supporting university technology transfer,
- Facilitating university-industry collaboration, and
- Engaging in regional and local economic development efforts.

These five categories reflect the widespread importance of innovation and entrepreneurship to the mission and activities of higher education. OIE found that universities do not view innovation and entrepreneurship as a short-term revenue opportunity, but as a long-term investment in their students, faculty, alumni, supporters, and communities.

Student entrepreneurship serves as a critical gateway for universities to comprehensively embrace innovation and entrepreneurship. While many universities may hope that their students are secretly working on the next Apple® or Google®, their main objective is to provide educational value in a way that will focus students' energies to help them identify and embrace their areas of interest, and supplement their classroom education with the development of life skills, such as budgeting, marketing, and professionalism. Many universities believe that they will benefit more through sustained relationships with their graduates, rather than by acquiring financial equity from student startups.

Faculty entrepreneurship policies are designed to connect research to market and societal relevance and to find solutions to real-world problems. Universities are encouraging faculty entrepreneurship by creating flexible work place policies, financial awards, and making seed funding available to faculty, researchers, and graduate students, as tools for retention, revenue, income supplementation, and as a way to keep faculty motivated and engaged. It is also a reflection of a larger desire among a new generation of faculty to be more relevant to the world around them.

The traditional home for commercializing university-based innovation and entrepreneurship is its technology transfer office (TTO). In recent years, and despite criticism, the TTO continues to be the hub and engine of commercialization on campuses. However, TTOs are taking on a greater role than merely assisting with patenting and introducing faculty and students to investors. TTOs are organizing networks across the universities' communities, growing their teams in order to better understand new technologies, and organizing programming across campus departments. TTOs also are aligning their goals with university advancement, and are developing shared strategies around fundraising, alumni engagement and corporate relations.

The need to collaborate with industry has grown in importance as access to federal funding declines. Not only are universities licensing inventions to, and collaborating with, established companies, but they are also increasing their support for home-grown startup companies. They continue, though, to recognize that larger, established companies remain an important source of revenue. Universities remain keenly aware of the importance of the private sector to their

mission, because private industry will ultimately house both their innovations and students when they leave the university. In addition to licensing innovation and hiring their students, private industry is actually a producer of innovation itself, and has a much deeper understanding of the broader business climate and models to commercialize any given invention.

Finally, universities are looking at innovation, commercialization, and entrepreneurship as part of their role in the economic development of their local economies – at the local and state levels. While universities have always had an important role in their communities, the points of engagement are rapidly changing. Instead of focusing solely on the economic impact of their graduate hires or of the physical expansion of university facilities, universities are establishing programs to engage their globally competitive talent to develop local and regional economies—the engine of job creation and economic growth in the United States.

The NACIE-sponsored university presidents' letter was just one of several efforts by higher education institutions focused on innovation and entrepreneurship. As part of the Startup America Initiative,¹³ the National Association of Community College Entrepreneurship (NACCE) also enlisted 170 community college presidents to commit to entrepreneurship programs on their campuses. The HBCU community, through the work of the United Negro College Fund and the HBCU Business School Deans, is reaching out to its schools to help launch entrepreneurship and social entrepreneurship programs. Regional state colleges also began entrepreneurship programs as a means of keeping their graduates in their local areas. These efforts have many of the same characteristics as those of the NACIE-letter signatories, with a focus on idea generation, business model and leadership development, and local and regional development. This report seeks to highlight this alignment and assist colleges and universities that are striving to expand innovation and entrepreneurship opportunities.

The NACIE-sponsored university presidents' letter identified multiple areas where the federal government could engage the university community.

First, it became clear in conversations with university and business leaders that federal agencies will need to adapt to emerging technologies and ideas in two very important ways. Today's innovation is multi-disciplinary in nature – across geographies, specialties, and fields. Wireless health is an example of a complex technology that merges the functionality of wireless technology, information technology, medical devices, and biotechnology – areas that are not currently within the purview of a single federal agency. The development of such a multi-disciplinary technology changes the relationships between federal agencies and their interactions with the university and business communities. The Economic Development Administration's (EDA) i6 Challenge and Jobs and Innovation Accelerator Challenges,^{14,15} and the National Science Foundation's I-Corps,¹⁶ are attempts to address this emerging issue, with multiple agencies pooling their funding for targeted support in multi-disciplinary areas such as advanced manufacturing or proof of concept development.

Secondly, those organizations that seek to better support high-growth innovation and entrepreneurship, from government agencies to non-profits and accelerators, must be able to understand the needs of high-growth startups and their emerging technologies. Universities are recruiting outside partners to better train their students and faculty on the strategic needs of innovation-driven, high growth companies. University and business leaders see these areas of integration as critical to the success of those startups, and in helping the United States in areas of strategic national importance, such as manufacturing, exports, and investment.

¹³ See <http://www.whitehouse.gov/startup-america-fact-sheet>.

¹⁴ See <http://www.eda.gov/challenges/i6/>.

¹⁵ See <http://www.eda.gov/challenges/jobsaccelerator/>.

¹⁶ See http://www.nsf.gov/news/special_reports/i-corps/.

The “Innovative and Entrepreneurial University” is a combination of the most innovative, interesting, and successful examples of what universities and colleges are doing around the country to foster innovation and entrepreneurship. This report will leave the reader optimistic about America’s leadership in innovation and the ability of our entrepreneurs to grow our economy and create high-quality jobs. America’s universities and colleges are indeed on the move. Whether just getting started with entrepreneurship clubs or raising multi-million dollar gifts to scale up their commercialization efforts, the nation’s colleges and universities have elevated the topics of innovation and entrepreneurship to national prominence. The hope is that this report will spark the generation of even more ideas and discussions in higher education that will continue to move these topics forward.

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II. Promoting Student Innovation and Entrepreneurship

The main priority of any university and college system is education. Many universities are expanding their educational curricula and programs to foster innovation and entrepreneurship. Universities increasingly offer courses and programs in entrepreneurship and related fields for undergraduate, graduate, and postdoctoral students. Students develop a better understanding of innovation and entrepreneurship, through newly-established curricula, minors, majors, and certificate programs that cut across educational disciplines, and through educational programs that emphasize hands-on learning. Many universities are also augmenting traditional classroom instruction in novel ways. Universities are increasing educational opportunities outside of the classroom to include student housing and dormitories that directly foster the entrepreneurial spirit. Student clubs, centered on multi-dimensional entrepreneurship activities, also are on the rise. Most campuses run a variety of business plan and venture competitions that offer students support networks, such as mentors and training opportunities, to help them further develop their innovative ideas.

Courses and degree programs in innovation and entrepreneurship

Many universities are seeing an increase in student demand for innovation and entrepreneurship, broadening course and program offerings. Entrepreneurship courses and programs equip students with a wide range of valuable skills, including business-plan development, marketing, networking, creating “elevator pitches,” attracting financing (such as seed capital), and connecting with local business leaders. Some universities are offering bachelor and master’s degree programs and concentrations in innovation and entrepreneurship, expanding upon traditional Bachelor of Arts (B.A.) and Bachelor of Science (B.S.) degrees (Box 2.1). Many business schools are breaking down traditional barriers and encouraging entrepreneurship through multi-disciplinary courses and programs to students of all academic disciplines.

Box 2.1

The University of Colorado’s Innovation and Entrepreneur Degree Program

Located at the Colorado Springs campus, this program offers a Bachelor’s degree in Innovation (B.I.), which provides a unique multi-disciplinary team approach. For example, in addition to completing classes in computer science, a B.I. in Computer Science requires students to develop strong team skills, study innovation, engage in entrepreneurship, practice proposal writing, and learn business and intellectual property law.

Accreditation remains an important issue to the academic community. While many schools now offer entrepreneurship courses, many commented about the inability to develop certificates, programs, and degrees without proper guidance and standards for entrepreneurship education. Many anticipate that in the coming years the leading accreditation agencies, along with state education agencies, and the U.S. Departments of Labor and Education, will come together to address this issue, and that this will eventually lead to a great expansion of formal programs in this space.

Experiential learning

Experiential or applied learning has been increasing in popularity at universities and colleges for many years now. This type of education improves upon traditional classroom instruction—which consists mainly of lectures and fact-based memorization—by actively engaging students in innovative and entrepreneurial activities through workshops, conferences, internships, hands-on experience, and real-world projects (Box 2.2). Experiential learning in innovation and entrepreneurship has spread outside of business schools and moved into the fine arts, science, and engineering programs. Universities and colleges also support specialized internship programs focused on entrepreneurship education and technology innovation that match students directly to start-up projects, technology transfer offices, venture capital firms, and industry. This variety of educational opportunities allows students to address real-world challenges in a supportive educational environment.

Box 2.2**Examples of Experiential Learning Opportunities**

University of Illinois’ Patent Clinic provides law students the opportunity to draft patent applications for student inventors. Student-innovators with potentially patentable inventions are referred to the Patent Clinic by the Technology Entrepreneur Center (TEC) at the College of Engineering. The Patent Clinic then reviews the innovations, searches for relevant prior art, and selects one innovation for each law student. Each law student then proceeds to work with the inventors to draft a patent application on their innovation in consultation with an instructor.

The University of Wisconsin-Madison’s “Entrepreneurial Deli” borrows a food court metaphor to help students meet and learn from experienced young entrepreneurs. Using the tag line “Grab ‘n Go Entrepreneurship” and a speed-dating-like format, the workshops encourage students to learn first-hand about solutions to different problems that confront startup ventures from experienced entrepreneurs.

Washington University in St. Louis’ student internship program offers 25 paid internships per summer for students to work in a start-up company four days a week and attend experience learning workshops one day a week.

The University of California at San Diego’s Rady School of Business requires its management students to take a course entitled “lab to market.” In Lab to Market, MBAs create new products or services and go through the commercialization process, with advice from faculty and business mentors.

Competitive opportunities

Competitions are an excellent way to actively engage faculty and students in the learning process. As a whole, business plan competitions are geared toward teaching students how to think outside the classroom, fostering collaborations across disciplines and increasing access to businesses. Competitions provide an exciting platform for students to learn practical skills, such as how to craft a business plan, access venture funding, and pitch ideas. Sequential competitions build upon project ideas, ultimately leading to completed business plans that are ready for possible funding from investors. Universities understand this, and are transitioning away from single monetary rewards for competitions and are increasingly recognizing milestone achievements with a multitude of prizes, including non-monetary resources such as incubator space and mentorships (Box 2.3). Some universities are expanding their student team competitions to include faculty and alumni, and increasing the scope and size of the pool of resources through collaboration with industry and local partners.

Box 2.3

Examples of Business Plan Competitions

Rice University makes over \$1.2 million available in cash, prizes, and in-kind resources to winners to provide seed funding to launch companies. These funds serve as seed funding for many of the winning teams.

Florida Atlantic University (FAU) provides the winner of their business plan competition with free space in the incubator for half a year.

Michigan Technology University's business plan competition winners are rewarded with a monetary prize that goes directly to their business, instead of to the individual. The following year, the winners will highlight their business milestones that have resulted from the funding.

University of Washington has a stage-gated business plan competition comprised of different competitions throughout the school year in combination with seminars, courses, and mentorship to assist in advancing student ideas to the next level. The competitions range across disciplines and industries, bringing students together from different departments.

University of Oregon's Venture Launch Pathway program, student teams pick from technologies from many sources included federal labs, companies, universities and technologies from other countries. The technologies that look most promising are advanced by student teams, with backgrounds in law, business, and sciences, into the international business competition circuit.

The University of Wisconsin has a 100 hour challenge in which students must purchase a product, change it, and create a public URL for outreach. They are then tested on many different aspects of entrepreneurship.

University of Louisiana—Lafayette hosts the Innov8 Lafayette program. This eight day, community-wide program includes specific activities centered on the importance of innovation. Some activities are focused on the environment, entrepreneurship, and the arts.

When discussing the role of federal agencies in this space, many universities commented on two recent actions by the Obama Administration. First, on the possible expansion of an innovative program launched by the U.S. Department of Energy in 2012. This National Business Plan contest¹⁷ provided seed funding and technical support to regional business plan contests at universities and in communities. The program connected the Department of Energy with a large group of leading entrepreneurs and innovators in the energy space for a relatively small amount of sponsorship. Many universities hoped that other agencies would also look at this model as a way to access market intelligence, cutting-edge technology solutions, and as a way to engage better with entrepreneurs and startups.

In addition, many universities are hopeful that recent guidance provided by the U.S. Department of Treasury about Program Related Investments (PRI),¹⁸ could greatly increase the amount of philanthropic investment in their student entrepreneurs. The guidance put forth by Treasury makes it easier for philanthropic entities, such as foundations and trusts, to directly invest in for-profit entities that share their mission. This will greatly expand access to philanthropic funds, in addition to traditional investor capital, to advance socially beneficial technologies in food, energy, and health.

¹⁷ U.S. Department of Energy, National Clean Energy Business Plan Competition, see <http://techportal.eere.energy.gov/commercialization/natlbizplan.html>.

¹⁸ U.S. Department of the Treasury, proposed regulations for program-related investments by private foundations, see <http://www.irs.gov/Charities-&-Non-Profits/Examples-of-Program-Related-Investments-by-Private-Foundations-%E2%80%93-Proposed-Regulations>.

Entrepreneurial and innovation collaboration spaces

Entrepreneurial and innovation “living spaces” are a unique trend in motivating student involvement outside the classroom setting. These spaces use the power of proximity to promote student engagement in developing innovative ideas and starting businesses (Box 2.4). Some universities are embracing the entrepreneurial dorm, whereas others are expanding this concept to promote entrepreneurial clusters, within the university and sometimes stretching into local communities. Entrepreneurial spaces facilitate student access to learning and networking opportunities with local entrepreneurs and innovators. These spaces also host a variety of student entrepreneur clubs that serve as a premier resource for aspiring student entrepreneurs and foster a community of like-minded peers. These clubs are geared toward building financial literacy and leadership skills, as well as encouraging students to pursue commercialization opportunities for innovative ideas and technologies.

Box 2.4

Examples of Living and Learning Spaces

University of Florida’s Inspiration Hall is a new, state-of-the-art live-and-learn community located within Innovation Square, only two blocks from the University of Florida and the Florida Innovation Hub. By living and learning within the Innovation Square environment, undergraduate students can interact throughout their academic program with other like-minded people: fellow students, researchers, faculty, business professionals and entrepreneurs.

Purdue University has an Entrepreneurship and Innovation Learning Community (ELC) that is made up of students interested in new business ventures that live together in Harrison Hall, many of whom also participate in the entrepreneurship certificate program.

Community college entrepreneurship

As part of the Startup America Initiative, 170 community colleges across the United States have launched entrepreneurship programs. These programs are often taking the same shape as those at larger research universities. Institutions, such as Lorain Community College, OH, offers incubators and shared facilities for their students and regional entrepreneurs and Middlesex Community College, MA, provides seed funding for their students to launch entrepreneurial ventures. Community colleges are embracing entrepreneurship for the same reasons as their colleagues in research universities. It reflects their student desires, the changing nature of their local economies, and a change in their role in workforce training with larger companies. Many of them have expressed the desire to see entrepreneurship become a career pathway for their students similar to other career fields.

III. Encouraging Faculty Innovation and Entrepreneurship

A new generation of faculty on America's campuses is striving to conduct world-class research, while working to identify the relevance of their research for solving real-world problems. To address this issue, these institutions are fostering faculty entrepreneurship through educational opportunities, acknowledging technology development, increasing transfer and commercialization achievements, and facilitating collaborative efforts. This commitment to promoting innovation pushes faculty to identify and employ available networks and resources to pursue innovation and entrepreneurship opportunities. New faculty orientations, boot-camps, and seminar events focusing on innovation and entrepreneurship are examples of some of the educational opportunities offered to faculty. Campuses are actively connecting faculty to networks of recognized entrepreneurs and industry partners, to promote cross-disciplinary efforts. Faculty tenure considerations and other rewards are on the rise, incorporating faculty contributions in innovation and technology transfer efforts, while providing the incentives to engage in R&D, technology development, and business start-up efforts.

The changing innovation culture

On trend is a shift in the hiring and retention culture across many universities. Today, institutions hire faculty who are interested not only in the advancement of their academic areas but also in pursuing commercial applications for their technologies, or engage in entrepreneurial activities that correlate with their academic disciplines. New faculty orientations often include workshops and training to help faculty navigate technology transfer offices and find the resources available to them on campus. Universities also offer faculty training in areas such as professional mentoring, prototype development, business planning, and market testing (Box 3.1). An evolving university innovation culture provides faculty with the essential information and incentives to move from a narrowly-focused scientific research tradition to a more forward-looking, comprehensive innovative process that incorporates technology development and commercialization efforts.

Box 3.1

The University of Pittsburgh Offers a Business of Innovation Commercialization Course

The Office of Technology Management and the Office of the Provost hosts an annual, seven-week course aimed at educating and motivating both student and faculty researchers in innovation development, commercialization, and entrepreneurship. The course takes participants through each step of the innovation and commercialization process, from idea conception to intellectual property protection and licensing, and all the way to early-stage market research and networking strategies. Private, individualized workshops are also offered where students can explore their own innovation ideas in a team setting.

Rewarding faculty innovation and entrepreneurship

Universities and colleges are celebrating faculty achievements in innovation and entrepreneurship. These acknowledgements include campus-wide prizes and award ceremonies that bring the faculty community together to recognize and learn about the accomplishments of their peers across academic disciplines (Box 3.2). Awards such as "Innovator of the Year" and "Faculty Entrepreneur of the Year" are popular as they reward faculty for achievements that reach beyond traditional research and teaching accomplishments. Universities and colleges are updating tenure and sabbatical leave guidelines to encourage faculty to pursue collaborative and entrepreneurial endeavors, such as launching a start-up company (Box 3.3). Some programs allow faculty time off to engage in innovation and entrepreneurial activities, without incurring any penalty towards tenure and promotion. Providing leave to pursue entrepreneurial activities increases the potential for the successful technology development and commercialization of research, while adding to faculty's understanding of the commercialization process, enabling them to incorporate new material into student instruction. This flexibility also improves the focus of R&D efforts and facilitates public engagement by encouraging faculty to commercialize their research.

Box 3.2

University of Southern California

The university promotes faculty entrepreneurship and innovation by supporting, rewarding, and funding the work of faculty members. The Lloyd Greif Center for Entrepreneurial Studies presents three faculty members with research grants totaling \$11,000 as part of annual Faculty Research Awards. The Center also rewards entrepreneurial-minded faculty with the annual Greif Research Impact Award, which is given to the faculty member who has written an article that has the most effect on the area of entrepreneurship.

Box 3.3

University of Virginia

In 2010, UVA's School of Medicine was among the first to include innovation and entrepreneurship activities among its promotion and tenure criteria. Candidates for promotion and tenure are asked to provide a report on their inventions and the patent status of those inventions; registered copyright materials; license agreements involving their technologies; and any other contributions to technology transfer-related activities, including entrepreneurship and economic development impact.

Finding the appropriate rewards and policies to promote faculty innovation is complex. Internal policies for faculty innovation performance usually are evaluated at the discretion of individual departments. For these programs to be successful in spurring innovation out of the higher educational system, universities and colleges need increased flexibility in developing faculty tenure, leave regulations, and other faculty-based policies that facilitate innovation and entrepreneurship.

Supporting collaboration

As faculty become more interested in commercialization activities, universities are providing additional resources to encourage collaboration with local communities and industries. A few universities have hired individuals, or created teams, to connect faculty with similar interests and research goals—often reaching across academic departments—to share information and experience on creating startups, licensing technology, and collaborating with industry. This cross-disciplinary effort helps share information on best practices and spurs new ideas for developing and commercializing new products.

Universities and colleges are also inviting community leaders and local entrepreneurs to become more involved in the development of technology and startup companies (Box 3.4). A few universities have developed programs to link experienced entrepreneurs with faculty to assist in the startup process, development, and longevity. In most cases, faculty returns to teach and continue research, allowing the non-university collaborative partners to take over the leadership role and continue to develop and expand the companies. Entrepreneurs also serve in a mentoring role, helping faculty to identify and further develop commercialization opportunities.

Box 3.4

The University of Cincinnati Research Institute (UCRI)

The University's non-profit allows local, national, and international industries to partner with expert faculty and students performing sponsored research. These partnerships not only connect university experts with industry, but also facilitate the commercialization of research, and enhance cooperative and experiential learning experiences and opportunities. With the creation of the foundation outside the university, professors and other state employees remain in compliance with state restrictions on equity and revenues streams, while allowing them to be compensated for their work through income from licensing revenues and other shares.

To capitalize on the expertise of seasoned entrepreneurs, many universities are building entrepreneur-in-residence (EIR) programs. The EIRs work with university researchers, students, faculty, and staff in the development of early stage start-up companies to provide guidance and advice. EIRs help interested faculty members better understand entrepreneurship, evaluate technology for licensing, expand their network of resources, and guide them on how to start the commercialization process (Box 3.5). EIRs usually have a focus area that meets faculty needs, often have a good working knowledge of current intellectual property laws and can assist faculty in finding those ideas in their research programs that are worth commercializing. The EIR program provides mentorship opportunities that help stimulate innovative and entrepreneurial activity throughout campus.

Box 3.5

University of Nebraska Medical Center- Entrepreneur in Residence

The EIR works with licensing staff and researchers at the University of Nebraska Medical Center to help identify, evaluate, develop, and support the creation of business plans and new companies based on technology developed at UNMC. The EIR is an industry expert with scientific, entrepreneurial, managerial, and financial experience who works side by side with UNMC scientists to identify, evaluate, and support the development of new start-up companies based on technology license agreements from UNeMed.

Engaging with industry

Faculty is engaging more with industry to obtain research and technology development ideas, capital, and other types of support. Many universities host events to bring faculty, industry, angel investors, and venture capitalists together for networking opportunities (Box 3.6). These events give industry an early look at R&D activities on campus, while providing faculty with networking and funding possibilities. Examples of such events include lunch-and-learn series, rapid-fire networking programs, seminars, and workshops.

Box 3.6

California Institute of Technology

The university runs a comprehensive "tech review" process for faculty, in which Caltech researchers have the opportunity to give a short presentation on a new and promising technology for commercialization to an audience of angel investors, venture capitalists, and entrepreneurial alumni. A roundtable discussion then takes place where investors provide feedback and advice on commercial development potential of the technology.

A common theme developing across campuses large and small is the importance of creating connections between faculty and the outside world. Programs, such as proof-of-concept, are meant to connect faculty research topics to market relevance, while externships and leave of absence policies are designed to provide faculty with the time they need to understand the latest trends and technologies in industry in their fields of science. Although the NACIE-led letter prioritized these sorts of programs, they haven't grown as quickly as expected due to a combination of budgetary issues and faculty interests.

As universities provide faculty with increased educational opportunities, celebrate their innovative achievements, and enable collaboration with experienced entrepreneurs and business communities, an entrepreneurial culture is developed throughout the educational system. Students also can benefit from the on-going education and experiences of faculty. Through dedicated institutional support, faculties across academic disciplines are able to work together with each other, community entrepreneurs, and businesses to develop new technology and create start-up companies.

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IV. Actively Supporting Technology Transfer

Effectively transforming research and ideas into marketable products and services is often a lengthy and complex process requiring substantial resources. The university and college systems are one of the most important sources of the nation's R&D output. The goal of a Technology Transfer Office (TTO) at a college or university is to protect and promote the research developed by its faculty and students through commercialization and patents. Once the research is protected, the technology and information can be released, providing social and economic benefits.

Reducing technology transfer barriers

A high priority for the nation's university and college system is to streamline the technology transfer process, to more effectively identify research with market potential, and to move it from the lab to the marketplace. Universities are broadening their technology transfer functions to meet the growing demand of their services while working to minimize the costs and risks of commercializing research. They are accomplishing this by expanding TTO facilities, hiring skilled staff, improving technical support to researchers, and increasing access to capital for researchers.

The success of these heightened technology transfer efforts at universities is evident by an increase in licensing and startup activity.¹⁹ According to a licensing survey by the Association of University Technology Managers (AUTM), the number of licenses executed in fiscal year (FY) 2011 rose 14 percent compared to (FY) 2010, and the number of startups formed was up three percent during the same time period.

Reducing these barriers while also developing common standards is critical to the TTOs seeking to add societal benefit and impact to their missions. As entrepreneurs today move towards a greater focus on the triple bottom line, TTOs are being asked about the process for patenting low-cost innovations and which investors may be interested in microfinance models. TTO's are developing processes for these sectors in the model of their traditional work.

Expanding TTOs level of support

TTOs are hiring more skilled professional staff with experience in areas such as intellectual property law, licensing, and in developing and managing university-industry partnerships. In addition, a university's TTO often taps into institutional resources such as law and business graduate students and faculty. Examples of other skills sought by TTOs include marketing, accounting, and regulatory compliance (Box 4.1). Acquiring experienced staff and in-house assistance not only leverages internal resources but also reduces the costs and time associated with filing patent applications and negotiating technology licenses. TTOs are also integrating accomplished entrepreneurs to consult with students and faculty about building startup companies to foster their technologies.

Box 4.1

Utah State University

The university's Intellectual Property (IP) Services unit within Commercial Enterprises helps USU faculty and staff manage and protect intellectual property. IP service managers work and assist USU and USURF researchers to identify, disclose, protect, and commercialize USU intellectual property. IP Services includes two IP attorneys, one registered patent agent, one paralegal and one docket manager.

An emerging trend in technology transfer is the establishment of "one-stop-shops" that provide assistance, mentorship, and information on patenting and licensing processes to faculty and student inventors. These "shops" streamline the technology disclosure process and integrate all technology transfer functions into one facility. Interested faculty and students can explore the start-up potential for their inventions and can obtain assistance during the technology development and marketing. TTOs are also expanding beyond their traditional areas of focus, namely the hard sciences

¹⁹ Association of University Technology Managers, "AUTM U.S. Licensing Activity Survey: Highlights," http://www.autm.net/AM/Template.cfm?Section=FY_2011_Licensing_Activity_Survey&Template=/CM/ContentDisplay.cfm&ContentID=8731

and engineering. Today, many TTOs provide guidance in navigating licensing processes and commercialization opportunities for innovative work in areas such as education, criminology, organizational structure, music, dance, and the fine arts. NACIE's letter to the Secretary of Commerce recommended the importance of building a common platform to connect similar efforts – so that institutions know what research, intellectual property development, and programming their peers are involved with.

The fastest growing trend in this space is the rise of Proof of Concept Centers, such as the MIT Deshpande Center for Technological Innovation and the Von Liebig Center at the University of California San Diego. These centers have a variety of programs that collectively achieve three goals: increase the volume and diversity of entrepreneurship on campus, improve the quality of startups and entrepreneurs on campus, and be increasingly engaged with local investors and entrepreneurs so that the university's startups stay local.

Box 4.2

University of Toledo

The “Lab-to-Launch” initiative partners UT's technology transfer team with Rocket Ventures LLC, a pre-seed fund, to accelerate the transfer of research to the market. The team works closely with research faculty to identify and promote high-potential platform technologies and expedite the transfer of university research into commercial products and services, with particular emphasis on regional economic development.

TTOs are also hiring undergraduate and graduate students both as interns and employees (Box 4.3). These students acquire experience working on commercialization projects and the associated challenges, such as the patenting and licensing process, and how access to funding. Some students sort through faculty R&D submissions and help identify university research with technical viability and commercial value. Other students, in particular law and business school students, help file patent applications, share information on intellectual property rights, consult on internal strategy, and provide business development coaching. A few TTOs offer lecture series to faculty and students on technology transfer topics to attract more interest and educate on commercial viability.

Box 4.3

Examples of Educational Hands on Learning and Workshops

University of North Carolina Chapel Hill's Office of Technology Development (OTD) internship program is an eight-month position for graduate students or post-doctoral fellows who wish to learn more about intellectual property protection and technology commercialization. The internship runs during the academic year and requires 8 to 12 hours a week, during which the interns participate in a formal training series covering the basics of technology transfer, market assessments, and direct marketing for select technologies. Interns also gain exposure to ongoing negotiations between the OTD and industry partners.

University of Rochester's F.I.R.E. Series is a regular lecture series designed to educate the university community about the many aspects of technology transfer, what it means to be an inventor, what every researcher should know in order to protect potential intellectual property rights, and the complexities of starting a business. This lecture series is run out of the University of Rochester Medical Center Office of Technology Transfer.

Cornell University IP&Pizza™ and IP&Pasta™ host outreach activities to Cornell faculty, research staff, and students. The goal of these activities is to increase appreciation of the importance of making university research results useful to society, providing a basic knowledge and understanding of intellectual property issues, and creating an awareness of capturing and protecting valuable intellectual property and its importance to entice potential industry partners. This and other similar programs are run through Cornell's Center for Technology and Enterprise and Commercialization.

Protecting intellectual property

Universities have created a variety of strategies to protect their intellectual property, which has raised the demand for intellectual property services and staff with knowledge of intellectual property laws and procedures. One reason for the increased demand is that many TTOs are now connecting with faculty early in the R&D process to encourage them to file patent applications prior to publicly releasing their results. One institution files a provisional patent application for every invention disclosure submitted by university researchers, while others are more selective and file a combination of provisional and utility (or regular) patent applications on technologies that appear to have the greatest licensing potential (Box 4.4). To provide faculty, students, and staff with incentives to protect intellectual property and pursue commercialization of research, universities are increasingly rewarding them by offering them a greater share of licensing royalties and other commercialization income.

Box 4.4

California Institute of Technology

Caltech files a provisional patent application for every single invention disclosure that goes through their TTO. Over the first year following the filing of the provisional patent application, the TTO evaluates the technical and business merits of the invention to determine whether it is worth filing a regular patent application on the invention.

Shrinking the funding gap

Universities are working with their TTOs to provide and increase access to funding opportunities in order to help bridge the transition between basic research and technology development, commonly referred to as the "Valley of Death" (Box 4.5). Universities use a variety of funding mechanisms to bridge the Valley of Death. Many universities have created venture-, proof-of-concept-, and growth-funds to assist in the development of technology and startups resulting from university research. Additionally, universities have sought local community and alumni support to help TTOs meet the growing demand for venture funds and grants for seed funding. Convertible debt loans are used by some universities to ease commercialization, with faculty paying back a predetermined percent of start-up costs.

Box 4.5

Bridging the Funding Gap

University of Wisconsin's Wisconsin Alumni Research Foundation (WARF) is a nonprofit organization that started as a funding center from alumni contributions. Today, WARF raises funds through licensing university research and technologies to companies for commercialization. The funds generated are used to fund research, build facilities, purchase equipment, and support faculty and student fellowships.

University of Oklahoma's Growth Fund provides money to researchers on each OU campus to help them develop prototypes and conduct additional research to keep research programs viable through the Valley of Death.

Temple University's Office of Technology Development and Commercialization has provided more than \$130 million in funding to support advanced research commercialization at the university.

University of Colorado System's TTO Proof of Concept (POC) programs are supported by income generated from the commercialization of CU intellectual property. The CU TTO has created, and supports, POC funding opportunities for university research and business development. To date, TTO's POC programs have involved over 110 projects and more than \$13 million in total funding.

University of Michigan's Gap Fund program was developed from the proceeds of the UM Tech Transfer central administration revenues, with matched funding from the State.

University of Minnesota's Internal Business Units (IBUs) program has developed an incubator space to help mature and launch early-stage technologies. IBUs address a small number of technologies that are nearly market ready but need some limited investment and early sales in order to be more attractive as startup opportunities. IBUs are an effective way to incubate those technologies in a business setting where they receive support from the university through seed funding and resources. IBUs are not a mechanism for bridging a broad "valley of death," or incubating technologies that will require a long period of development or significant seed funding, but rather represent an innovative strategy for new company development.

Emory University's Drug Innovation at Emory (DRIVE) is a non-profit drug development company separate from, but wholly owned by, the university. DRIVE expands the capabilities of traditional academic drug discovery by combining the expertise of Emory scientists with industry drug development experts.

University of Akron's Akron Regional Change Angel (ARCHAngel) Network is a regional forum for introducing investors to market-driven, technology-based investment opportunities. It brings together promising technology companies and angel investors with a particular focus on businesses that leverage the region's strengths in healthcare, information technologies, polymers, and other advanced materials.

Regional technology transfer centers

In various parts of the country, universities and non-profit research centers are already coming together to collaborate on the commercialization of research. According to a recent survey of its member's by the Association of Public Land Grant Universities (APLU), a large percentage of major public universities do not have separate technology transfer offices. In addition, students and alumni from smaller colleges often don't have an on-campus technology transfer office, and need

support from others in their regions. Regional tech transfer centers are filling that role, by providing the technology transfer function across large universities, regional state universities, non-profit research organizations and small colleges across a region (Box 4.6). Universities such as the University of Utah and Texas System have taken the lead in developing these centers in order to collaborate better with their regional partners.

Box 4.6

University of Texas South Texas Technology Management Center

South Texas Technology Management (STTM) is a regional technology transfer office affiliated with the University of Texas Health Science Center at San Antonio (UTHSCSA), and has collaborated with the research departments of the University of Texas San Antonio (UTSA), the University of Texas Pan American (UTPA), Texas State University (TXState), the University of Texas at Brownsville (UTB) and Stephen F. Austin University (SFA). It provides a host of services for regional institutions such as support on grant applications, patenting, and commercialization. Through the collaborative efforts STTM has built a portfolio of technologies and projects to take to push ideas to the next level. The Horizon fund provides \$10 million to spin off companies created using University of Texas technology.

Several universities indicated that they experienced funding challenges in this area. In particular, there are very few sources of funding for innovation infrastructure – i.e., support for the organizations that bring together researchers, entrepreneurs, investors, and professional services to help deliver ideas to the marketplace. Often, private philanthropy and corporate sponsors are not interested in broad-based infrastructure support, but rather on programmatic funding for specific sectors. To help fill this void, the federal government recently released new grant challenge such as EDA's i6 Challenge and NSF's Innovation Corps, to provide flexible funding to support innovation infrastructure.

Presidential Memorandum on Accelerating Technology Transfer and Commercialization of Federal Research

In 2011, President Obama posted a Presidential Memorandum entitled "Accelerating Technology Transfer and Commercialization of Federal Research in Support of High-Growth Businesses." This Memorandum requires federal agencies highly involved in R&D and entrepreneurship to develop plans to greatly increase the commercialization of federally-funded R&D over the next several years. There are several proposed programs to guide technology transfer efforts in the federal government, but many of the agency decisions will also have an impact on universities.

The Interagency Working Group on Technology Transfer, managed by the National Institutes for Standards and Technology, has released its preliminary report on the implementation of the Presidential Memorandum. The various agency reports outline the unique programs and emerging best practices among federal agencies for partnering with outside R&D organizations such as universities and private industry, funding the commercialization of research, and assisting startup companies. In addition, federal agencies will put into place more robust metrics to measure the success of technology transfer and commercialization of federally-supported R&D. These metrics will help federal agencies identify the commercial impact of their in-house R&D, as well as that done with partners, such as universities.

v. Facilitating University-Industry Collaboration

University-industry partnerships are essential for further developing ideas and technologies derived from university research. These partnerships are crucial for directing investment toward commercially promising research, and helping to bridge funding gaps that often exist at the technology development and marketing stages. Universities and industry have found that working together is mutually beneficial because knowledge and resources are shared to achieve common goals. Industry benefits from greater and earlier access to scientific expertise, intellectual property, and commercial opportunities, while universities benefit from enhanced educational opportunities for faculty and students, revenues from successful licensing agreements and ventures, and local and regional development.

Sharing resources and knowledge

As federal resources become limited, universities are seeking broader channels of support for technology development and commercialization efforts, particularly from the business community. Several universities are creating “front-door policies” to easily engage private industry. Universities have a wealth of resources available to them, including human and intellectual capital, and R&D infrastructure. So the front-door policies, web-portals and easy to navigate licensing policies all expedite the ability of private industry and startups to identify university R&D with commercial potential earlier and open up opportunities for companies to easily commence strategic partnerships with universities. Companies of all ages, sizes, and geographic proximity are benefiting from this invigorated support from universities. And better use of the universities physical infrastructure, such as lab space utilization with industry reduces risks and provides valuable research opportunities to their faculty and students. By collaborating with universities and colleges, companies are able to take advantage of their well-equipped labs and breadth of skills.

Universities with specific strengths in the areas of manufacturing or energy research have established long-term partnerships with large corporations, such as BMW[®], FedEx[®], Johnson Controls[®], IBM[®], Cisco[®], Proctor & Gamble[®], and Minova[®] (Box 5.1). These relationships allow students and faculty to engage in cutting-edge research while helping solve industry problems. There is, however, some concern among a few universities that partnerships with large companies may limit a university’s research options to only those areas of interest to industry. Tulane University, as an example, works to establish partnerships with smaller local companies not only to support the university’s research but also to engage with the local community in a mutually beneficial way.

Box 5.1

Clemson University’s International Center for Automotive Research (CU-ICAR)

CU-ICAR is an advanced-technology research campus where university, industry, and government organizations collaborate. In the university’s labs and testing facilities, automotive, motorsports, aerospace, and mobility experts work together on R&D. The Center’s focus on applied education and direct engagement with industry leaders includes cutting-edge curriculum development and research capabilities focused on current trends and related issues in the automotive industry. Partners, such as BMW[®], Michelin[®], and Koyo[®] work, with students and faculty to focus on systems engineering through automotive R&D.

Additionally, universities are doing a better job making their facilities, lab space and infrastructure available to private industry. This has taken many forms, from contract research and licensing agreements to Entrepreneur-In-Residence programs where investors and corporate send their brightest minds into academia for a time to understand the latest research and assess the business model and economic implications of the latest technologies.

Regardless of whether universities opt to partner with large or small businesses, collaborative efforts between universities and the private sector capitalize on the variety of resources available to both, and efforts range from individual projects to broader engagement across disciplines. Companies reap benefits from sharing laboratory and incubator space that pull together the combined intellectual capital of industry and academic experts (Box 5.2). In the later stages of technology

development and commercialization, universities benefit from industry experience in areas such as market research and public relations. Furthermore, university-industry partnerships create a direct connection that facilitates job placement and talent recruitment.

Box 5.2

Examples of University-Industry Partnerships

University of Minnesota's IPrime (Industrial Partnership for Research in Interfacial and Materials Engineering) was created in 2000 and is a university/industry partnership based on two-way knowledge transfer. The partnership is a consortium of more than 40 companies supporting fundamental collaborative research on materials. Participation in IPrime affords companies the chance to scan a wide range of scientific and technological developments and delve into the fundamental science that undergirds their products. A principal goal of IPrime is the engagement of industrial scientists and engineers in a pre-competitive, non-proprietary and collaborative environment that promotes hands-on participation by visiting industrial scientists with IPrime faculty, students, and post-doctoral associates.

Northeastern University is leveraging its strong relationship with 3,600 companies through cooperative education and work programs, as well as with the privately-endowed Center for Research Innovation and Business School, to create a robust pipeline of innovation going from lab to market at startups and large companies around the world.

Universities, as regional hubs of innovation and entrepreneurship, are developing creative ways to draw industry partners to campus (Box 5.3). Emerging trends to increase industry presence on campus and facilitate conversations on new ideas and technology include web portals that provide industry with access to university resources, networking events, such as breakfast forums and casual roundtable discussions, and structured/intensive student and faculty internships in the private sector. Industry speaker series are another popular tool for engaging university and industry scientists in discussions of commercialization opportunities available in the private sector. On some campuses, students and faculty members participate in semester-long internships with industry to learn and solve scientific and technology development challenges (Box 5.4). While these “experiential” learning opportunities for university researchers are often geared toward industry interests in areas such as medicine, natural gas drilling, green energy, pharmaceuticals, and aerospace engineering, they provide technology assistance, workforce training, and education on current market trends.

Box 5.3

University of Delaware's Office of Economic Innovation & Partnership (OEIP)

OEIP has established partnerships with The College of Engineering and the Lerner College of Business to establish a program entitled Spin In™. The program works with local entrepreneurs who ‘spin in’ a technology, patent, or product that needs further development. OEIP then recruits an interdisciplinary team of undergraduate students from the business and engineering colleges to further develop the product. At the end of a pre-determined period of time, the intent is to spin the product back out to the entrepreneur for potential commercialization. OEIP also offers undergraduate and graduate student internships in the areas of technology transfer and business development.

Box 5.4

University of Minnesota's Medical Device Center's Innovation Fellows Program

This program offers a full immersion educational and product development program for medical device creation. Annual cross-functional teams are created with participants having degrees in engineering, medicine, and/or biosciences along with a demonstrated evidence of innovation and product development. Team members, or fellows, are immersed in an intense training program with access to first-class lab facilities in engineering and medical research across campus. The fellows interface daily with faculty, medical professionals, industry collaborators, and the university's technology transfer office to develop, test, patent, and license new medical devices with the goal to improve health care worldwide.

An emerging trend is the use of targeted websites and social media around current research project information and patent licensing opportunities through online databases, and the creation of network banks of past campus-wide efforts and partnerships. Some universities have implemented an external-facing portal, or an open web-based database, that provides content on innovation and commercialization processes to self-registered users and business partners. Others, such as the University of Missouri have developed tools like Source Link - online tools as tools to highlight educational resources on campus so that businesses can easily find university experts of interest to them. These portals house all relevant information in one location, which reduces search times and increases efficiency in identifying potential commercial opportunities. By increasing openness and transparency, industry can easily access university resources and information without having to search through multiple university records.

Box 5.5

University of Michigan's Business Engagement Center (BEC)

The BEC, affiliated with the Office of the Vice President for Research and the Office of University Development, provides companies with a one-stop gateway to the various research, technology, education, facilities, and talent resources at U-M. Founded in 2007, the BEC maintains relationships with more than 1,000 companies, and is contacted by about 200 new companies each year. BEC-facilitated relationships can range from individual research projects to broader engagements, depending on the business need. One of the functions of the BEC is to work with schools and departments to encourage industry sponsorship of research at U-M. Another BEC initiative specifically aims to spur innovation and economic development in partnership with industry and government. For example, Boeing maintains a long-standing partnership with U-M, recruits from seven different U-M programs, provides support for 50 students, regularly sponsors student projects, and conducts research with four different departments.

Accelerators

Another emerging trend is the development of "accelerators" and related initiatives, located in and around university campuses (Box 5.6). These accelerators are partnerships between universities and companies that are designed to fast-track the innovation and commercialization process by providing access to world-class scientific facilities, technical personnel, and testing and diagnostics equipment—resources not readily available to many startups. Some accelerators focus on helping companies in the post-incubation period such as meeting the technical needs of startups, and bridging funding gaps.

Box 5.6**Georgia Tech's– Flashpoint**

Flashpoint is a startup accelerator that offers entrepreneurial education and access to experienced mentors, experts, and investors in an immersive, shared-learning, and open workspace. The program, the first public-private partnership of its type in the country, brings together resources from the university, private sector, and startup leaders to accelerate innovation and growth. A \$1 million fund, created by an investment firm working with Atlanta angel investors, invests between \$15,000 and \$25,000 in startup funds a company. In January 2011, Flashpoint held its first “demo day” with 15 startups from the initial Flashpoint group that included Georgia Tech faculty and students.

Providing guidance on intellectual property rights and royalties

University partnerships often face issues in navigating intellectual property (IP) ownership of technology that is developed collaboratively with industry. However, most universities and companies are looking beyond these barriers and proactively addressing ownership issues. As more university researchers partner with industry for financial R&D support, negotiating a functional IP policy is becoming an important issue. To increase these partnerships, some universities have developed a standard policy and agreements that they use with all industry collaborators. A few universities have followed the Pennsylvania State University model, which uses a simple, flexible agreement that often leads to granting sole IP rights to the industry partner. The University of Minnesota has a unique approach in eliminating the need for protracted negotiations over IP by allowing the sponsoring company to pre-pay a fee and receive an exclusive worldwide license, and all associated royalties. By taking a flexible approach to negotiations, universities are trying to encourage more industry partnerships.

To increase transparency and encourage industry cooperation, universities are establishing unified and structured IP policies. These policies guide decisions on issues such as rights to IP and division of royalties. Some larger universities, for example, have established policies that waive a substantial portion of royalties—in some cases 25 to 35 percent—on disclosures to the sponsoring industry. Generally this has happened for industries that are quickly evolving in the global economy – where business model becomes more important than IP protection. Many universities also are creating standard forms that outline university and industry responsibilities and profit-sharing. These new IP strategies reduce uncertainty, alleviating the financial concerns that surround university-industry partnerships.

VI. Engaging with Regional and Local Economic Development Efforts

Universities are proven assets to regional economies, providing employment opportunities and skilled labor, and contributing to local demand for goods and services. Likewise, universities and colleges understand that investments in surrounding communities are of benefit to their institutions. Local communities with a higher living standard can offer a diversity of good economic, housing and recreational opportunities. This attracts faculty, students, and skilled workers to the university and maintains a healthy local economy. To improve this relationship, universities are broadening their relationships with regional and local governments, businesses, and workers, while improving access to university-based resources. Today, universities are often active partners in regional economic planning and revitalization efforts.²⁰

Universities have taken varied approaches to advance state, regional, and local economic development and growth objectives, including:

- Encouraging direct university participation in local businesses and communities;
- Collaborating with local governments, industry, and other stakeholders to develop comprehensive approaches for regional innovation and economic development; and
- Linking local communities with support networks that include federal and state governments, industry, venture capitalists, and other stakeholders.

State, regional, and local governments are also providing support to facilitate university and business interactions, such as designing regulations, laws, policies, and programs that promote responsible innovation and economic development goals.

Working directly with local businesses and communities

Universities and colleges are encouraging student and faculty education, innovation, and entrepreneurial pursuits that revitalize local businesses and address other local development needs (Box 6.1). Students and faculty are engaging directly with local businesses and communities more than ever. Universities are incorporating volunteer requirements into their curricula and encouraging students to shadow, or consult for, local businesses and non-profit organizations. Some universities are even acquiring local small businesses and allowing students to manage and operate them to hone their entrepreneurial skills. Such programs cut business costs, while providing students with hands-on learning experiences which make them more competitive in the job market.

²⁰ In fact, in a 2009 AUTM survey, more than half of technology transfer offices indicated that they “frequently” or “always” had economic development responsibilities. See AUTM, “FY2009 AUTM Transaction Survey: A Survey of Non-licensing Activity of Technology Transfer Offices,”

<http://www.autm.net/AM/Template.cfm?Section=Documents&Template=/CM/ContentDisplay.cfm&ContentID=5794>.

Box 6.1

Examples of Direct Student Engagement in Local Community Businesses and Projects

Tulane University's Social Innovation and Social Entrepreneurship Initiatives integrate the entire school with the surrounding economic and social ecosystem, contributing to local economic development. Partnering with all schools including the AB Freeman School of Business, School of Architecture, and School of Science and Engineering, the program has created many student-led organizations and social ventures that assist with moving students out of the classroom and into the New Orleans Community. Tulane has also created several university competitions including the Tulane Business Plan Competition, the Urban Innovation Challenge, PitchNOLA, and the NewDay Social Innovation Challenge to engage students and community partners with local problems while providing them with financial and technical support to create solutions. These programs offer students the opportunity to access over \$100,000 in funding annually.

Purdue University's Technical Assistance Projects bring faculty and graduate students together to provide cost-free consulting and assistance to local groups on business and technical issues.

University of Georgia's service-learning program offers enhanced courses at all of the University's schools and colleges to encourage students to provide service to the local community during their time at the university.

University of Kansas' RedTire initiative was developed to help link graduate students and alumni with struggling, local small/medium-sized businesses to prevent shuttering with ensuing loss of community services and tax base. Through this collaborative effort, businesses are able to receive support and mentorship to grow the business and employ more fellow Kansans.

The Merrimack Valley Sandbox's Campus Catalyst program provides small grants of up to \$500 for students of the University of Massachusetts Lowell, Merrimack College, Middlesex Community College, and Northern Essex Community College to start entrepreneurial projects off-campus and in their communities.

Faculty members also support local communities through teaching, mentoring, and initiatives to advance innovation and economic development goals. Many university programs are working to foster dialogue between faculty and the local community to tackle local challenges. As faculty engage in R&D, they increasingly collaborate with regional stakeholders to push technology development forward and open the door to viable market opportunities locally. These efforts have led to long-term partnerships with local communities.

Collaborative approaches for achieving regional economic development

Universities are engaging in long-term, dedicated innovation and entrepreneurship efforts that promote regional and local economic development. They are working closely with community stakeholders—government, companies, venture capitalists, entrepreneurs, and workers—to improve access to university-based assets and to implement regional innovation and economic strategies. Universities use a variety of collaborative models, including research parks, university corridors, startup accelerators, shared laboratory space, incubators, and innovation and manufacturing clusters. These venues bring together infrastructure and intellectual capital to address innovation and business challenges and to develop local economies. These efforts provide a cost-effective and productive means for conducting research, developing technology, and spurring new markets and businesses.

Universities are well positioned to contribute greatly to these efforts. The universities capitalize on the power of proximity, building research parks locally, which help to revitalize downtown areas or once-thriving communities. Research parks house technology transfer and strategic partnership offices, and incubator and accelerator spaces. They also host entrepreneurs-in-residence, provide mentoring opportunities, connect individuals with similar research interests, and assist with the licensing and commercialization processes.

Startup incubators and accelerators hosted by universities serve as powerful places for local community members to start new companies and solve pressing local and national innovation and commercialization challenges. Incubators focus on addressing local community issues such as supporting local startups by providing mentorship and technical support, thus contributing to local economies.

Universities also are encouraging economic development through the creation of research corridors. These corridors reside within and across regions and often have a particular technology focus, such as biotechnology, nanotechnology, health, energy and advanced materials. Corridors offer a resource pipeline for local communities, universities, and colleges that have similar research interests and challenges. They attract industry by providing technical support, access to capital, and a large network of experts. Some research corridors unite communities across state lines, which allow them address issues of regional importance, such as green technology, job training for the unemployed, and small business creation. Furthermore, corridors also produce regional economic analyses with information on regional economies, such as numbers on job growth, state income, and state startups. Job creation is also an important focus of many research corridors. Overall, universities are extending their influence and better serving their communities by participating in research corridors that connect them with other local universities, thereby leveraging the talent and resources of all of the participating institutions.

Box 6.2

Examples of Regional Corridors

University of California, Lawrence Berkeley's East BayGreen Corridor is a broad regional collaboration to support the emerging clean technology economy. It builds upon the region's existing strength as a center for emerging green technology, innovation, and entrepreneurship.

Pennsylvania State University I-99 Corridor Region has received funding from the NSF Partnership for Innovation program and the Commonwealth to leverage Penn State research and education strengths for job creation in nearby counties of Bedford, Blair, and Centre.

University of Michigan's University Research Corridor (URC) is an alliance between Michigan State University, the University of Michigan and Wayne State University to transform, strengthen and diversify the state's economy.

Iowa State University's Research Corridor stretches from Ames to De Moines and focuses on research and manufacturing in agriculture, metals, and other areas. ISU and technology companies such as DuPont® and Syngenta® contribute their expertise toward the effort.

Finally, universities are an excellent source of economic, regional, and business development data and analysis, ranging from tracking regional economic development and growth to providing data on university, federal and other resources available to local communities. Many universities are working together with faculty, staff, students, and community leaders to find, highlight, and solve regional issues. The U.S. Economic Development Administration's University Center's Program has supported centers in all fifty states to create this sort of data.

Regional technology transfer centers

As mentioned in Section V, several regions have created regional technology transfer centers in order to coordinate commercialization of R&D conducted at their universities, and in collaboration with other universities and labs. These regional centers were created for two reasons – for universities to assist each other in the commercialization of innovation that was done across institutions, and to keep innovative ideas in their respective regions. For example, the Massachusetts Technology Transfer Center is an initiative that provides technology transfer services to multiple colleges and universities in the area that are not research-driven. In addition, it has played an important role in keeping innovators and

entrepreneurs in the region – particularly those not affiliated with a large research university. Many regional economic development plans call for this type of collaboration to retain regional talent and innovation.

Linking local communities to support networks

Universities engaging more in developing and implementing regional economic strategies are undertaking a predominant role in linking local businesses and community leaders with national and regional support networks to expand the pool of available resources. Universities hold a unique position in local communities. They can provide a venue where all stakeholders, including researchers, venture capitalists, companies, entrepreneurs, consultants and regional authorities and organizations, can come together to tackle critical local issues, such as locating grant and other funding opportunities (Box 6.3). Universities are also a good source of intellectual capital.

Box 6.3

Missouri KC- Whiteboard to Boardroom

This bi-state (Missouri and Kansas) partnership of regional colleges, universities, community colleges, local businesses, and nonprofits seeks to discover and develop technology by pulling it out of the institutions and actively moving it along the development pathway. Through this program, students, faculty, and local community work to establish new business ventures, licensing opportunities, create jobs, and spur economic development through mentoring, job training, hands on learning opportunities, and access to capital funds. Through the collaborative effort, partnerships are expanded to form and encourage technology growth and business plan development for the local economy.

A number of university economic development efforts have targeted underserved communities, such as programs supporting women and minority entrepreneurs to help increase economic development opportunities across the region (Box 6.4).

Box 6.4

Examples of Reaching Underserved Communities

University of California, Berkeley has students from its Center for Young Entrepreneurs at Haas (YEAH) work in the community with underprivileged East Bay and Bay Area youth to share best practices in entrepreneurship, a passion for education, and to help high school students in the area pursue a college education.

Texas State's RampCorp program works to improve economic opportunities for women entrepreneurs in Texas. Women entrepreneurs receive coaching from experienced investors, entrepreneurs, inventors, and business leaders to learn about resources and opportunities. The RampCorp program includes both skills and knowledge training to provide guidance in starting, growing, and funding scalable companies.

Other efforts to provide incentives to promote an innovation economy

State and local governments help to provide resources and design laws, regulations, and initiatives that can promote innovation and regional economic development. Recent trends show that state and local governments are pairing up with universities to stimulate local economies through research and business investments, workforce development, and job creation. By joining forces, both parties maximize the use of their resources. For example, to stimulate local innovation,

state and local government offer regional grants that match funding that universities contribute. With these additional resources, advancements in green technology, health sciences, manufacturing, and infrastructure can be applied to solve local challenges while creating jobs. These collaborative efforts help align resources and support with state and local needs and strengths.

Many states have begun to incentivize regional innovation and economic development by expanding private sector investments in local communities through tax cuts and other benefits. State-sponsored angel networks and venture funds are taking a larger role in the commercialization of technology and the creation of startups. Some states fund their venture capital programs by auctioning tax credits. Targeted state-level innovation tax credits for local projects also encourage local investment to keep development of early-stage technology and companies within the region.

Many universities are also hoping that the recent guidance by the U.S. Department of Treasury about program related investing will entice a great number of foundations and charitable trusts to invest directly in entrepreneurs and in university programs that nurture startup creation. Charitable foundations often focus on regions or specific topical areas, and their ability to fund innovation and entrepreneurship to meet the needs could be a critical new source of funding for these efforts.

DRAFT

VII. Conclusion: Recognizing the Growing Number of Economically-engaged Universities

In addition to the five areas highlighted above, the NACIE-sponsored university presidents' letter had a sixth focus category – the recognition of exemplary economic engagement by universities. The letter suggested that more should be done to recognize those universities that are truly breaking new ground by supporting innovation and entrepreneurship in the realm of economic development. We hope that this report is the first step in an on-going recognition and celebration of university-based innovation and entrepreneurship.

While the letter itself had a profound impact on the higher education community, it also highlighted the need to understand the details of university-based innovation and entrepreneurship to assist in the development of future ideas and programs in this space. The goal of the letter was to lay out, programmatically, how major research universities were nurturing innovation and entrepreneurship – organized in the five focus categories of the letter. In addition, the letter identified some of the more common practices, such as business plan contests, as well as collaborative activities that universities should engage in, such as a database, mapping research and patent applications. This was important because most major research universities and colleges in the U.S. are not yet performing these activities. The letter has become a road map for aspiring universities and colleges around the country that are looking for a path forward for nurturing innovation and entrepreneurship.

The examples cited in this report, and the underlying discussion, underscored the diversity of approaches by higher education institutions across the United States for promoting innovation and entrepreneurship. This diversity reflects not only the history, research funding, location, and size of a particular institution, but also helps the reader understand what the role of outside actors, such as government, investors, and entrepreneurs should be in order to create more university- and college- sponsored spinoffs. The hope is that this report will serve as a source of ideas and encourage connections between peers with similar objectives and circumstances. In other words, as universities strategize about the next generation of innovation programs that they would like to launch, this report should help them identify peer institutions that have already implemented similar programs.

Finally, the university community is keen on expanding and improving its partnerships with the federal government. For every best practice or emerging trend in innovative programs that this report highlighted, there are a similar number of recommendations to improve public policy and federal funding programs to help universities commercialize more of their R&D and ideas. Furthermore, as the Presidential Memorandum on Technology Transfer is implemented, a discussion on synergies and challenges to align the goals, missions, and opportunities between federal agencies and universities is certain to arise. The results of those discussions will have a tremendously positive impact on the U.S. economy and prospects for job creation.

As innovation and entrepreneurship becomes an even greater force in economic growth, U.S. universities and colleges will be the vanguard in discovering that innovation and in nurturing the entrepreneurs that can create products, services, economic value, and high-quality jobs. While this report identifies a series of practices that are helping universities become better at this, there are many more examples that could have been highlighted. OIE looks forward to working with the higher education community to identify and promote those practices in future reports.