

THE STATE ROLE IN ENTREPRENEURSHIP AND ECONOMIC DEVELOPMENT: GOVERNANCE, OVERSIGHT, AND PUBLIC UNIVERSITY START-UP INNOVATION[☆]

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INTRODUCTION

In many states, legislators have serious concerns about American competitiveness in the global economy. Based on Thomas Friedman's *The World Is Flat* – perhaps the most highly read book in policy communities over the past decade – legislators are aware the United States is falling behind other countries on many indicators of educational attainment. Although the United States was once a leader in higher education access, with 60 percent of its population attending at least some college, nine countries now exceed

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Measuring the Social Value of Innovation: A Link in the University Technology Transfer and Entrepreneurship Equation

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this level of participation (Wagner, 2006). Our educational attainment is predicted to increase in the future, not because of increasing participation rates, but because of the expanding college-going population. In production of bachelor's degrees, the United States is now merely average among the 20 most prosperous countries. On a per capita basis, one could argue that the United States no longer has the best higher education system in the world.

This is particularly true in science and engineering, the so-called STEM fields. The United States ranks 16th in the proportion of students pursuing degrees in science and engineering, and this proportion is declining, despite the fact that jobs in these areas are increasing at about 5 percent per year (National Science Board, 2006). In contrast, twice as many students in Europe, and three times as many students in Asia, earn degrees in these fields every year. For example, 60 percent of all degrees earned in China are in science and engineering. On these elements, the United States is saved by two important factors, namely the sheer numbers of high-quality world-class graduate programs in STEM, and the immigration of large numbers of foreign students into the United States to study in them. However, both of these factors are under threat to some degree. State appropriations and federal research funding have both decreased in recent years. The immigration of foreign students has also declined, due to disincentives produced by visa and registration requirements imposed after 9/11, the increasing quality and incentives for students to remain in their home countries, particularly within Asia, and the improving quality of life and job market opportunities in home countries.

Although knowledgeable legislators are aware of these issues, they see an estrangement between public higher education and state economic development. Legislators want higher education to act as an "engine of economic development," to increase general educational attainment in the state and to prepare a highly skilled, highly paid labor force (Ruppert, 2001). But many also question the ability of public higher education to fulfill this mission. They are skeptical of the responsiveness of higher education to state needs; they are concerned that higher education may not be able to remediate the deficiencies of the K-12 sector; and they are worried that higher education may not be accommodating state access needs, particularly for rural, urban, and minority students.

Public university's efforts to communicate their contribution to state economic development have been somewhat ham-handed where legislators are concerned. Early attempts to produce economic impact reports often failed due to the claims made by universities, which a recent article has labeled "preposterous" (Siegfried, Sanderson, & McHenry, 2007, p. 546).

From an economic perspective, the assumptions underlying these studies often strain credulity, so much so that even legislators, who are relatively untutored outsiders, see the claims as transparently ludicrous. (A notorious assumption of some of these studies is that a single dollar of public investment yields 32 dollars in local economic impact.) Once that trust was broken, subsequent reports on economic development often have been greeted with substantial skepticism.

In recent years, hope for state economic development has resided in the ability of public universities to promote innovation by creating start-up companies based on university research endeavors (Feldman, Feller, Bercovitz, & Burton, 2002). Compared to patents and licenses, which merely represent the potential for future economic returns, start-up companies are a tangible representation of university-driven businesses that lead to future job growth in the high-paying, knowledge-intensive industries that legislators love to promote. And unlike economic impact studies, start-up companies provide a clear link between the actions of public universities and a specific contribution to local economies; while patents and licenses are relatively abstract and ambiguous, start-ups are specific, measurable, and accountable. Public universities can thus document their role in invigorating entrepreneurship, and thus legislative skepticism can be converted into strong support for public universities.

This paper reviews three emerging partnerships to support state and regional economic development through start-up innovation. Due to the relatively new nature of these efforts, no single model exists for promoting start-up innovation, and there has been a proliferation of strategies and governance arrangements. The publicly funded venture capital partnerships described here, in Georgia, Maryland, and New York, represent three different approaches, yet they have common implications for the governance, oversight, and state action. After a review of these cases and their implications, we discuss a more comprehensive research agenda to be pursued regarding these emerging arrangements.

BACKGROUND CONTEXT AND DATA

Research universities have long been recognized as important actors in stimulating economic development, representing a critical source of academic knowledge, technological innovation, and skilled workers for American business and industry. In recent decades, universities' long-standing relationships with companies (e.g., publishing, consulting, and the hiring of students and faculty) have been expanded by more formal policies

and legal arrangements. The passage of the Bayh–Dole Act in 1980, which allowed universities to retain the property rights to inventions derived from federally funded research, altered incentive structures shaping the external environment of research universities (Powell & Owen-Smith, 1998). In response, universities created technology transfer offices to secure their intellectual property rights, and to license those rights to for-profit companies (Feldman, 2003). Universities have thus been commercialized, in the words of one National Science Foundation official, as “creators and retailers of intellectual property” (Powell & Owen-Smith, 1998).

As the locus of research universities’ intellectual property “retail” endeavors, technology transfer offices assume an important role in evaluating the commercial potential of university research and technology. When a faculty member or researcher generates new technology with commercial potential, the discoverer typically files an invention disclosure with the university’s technology transfer office, which begins the formal technology transfer process. The technology transfer office then establishes the university’s intellectual property rights in the form of patents, copyrights, or trademarks (Feldman, 2003). According to the Association of University Technology Managers (AUTM, 2006), in FY 2005, 151 research universities received 14,828 invention disclosures, an increase of 39 percent compared with 10,701 disclosures from 141 institutions in 2000. Among public research universities, 111 institutions received 10,153 invention disclosures in FY 2005, an increase of 49 percent compared with 6,799 disclosures from 99 institutions in 2000 (AUTM, 2006).

After identifying research and technology that may have commercial value, universities employ a variety of formal and informal mechanisms to transfer research and technology to business and industry. Informal mechanisms – faculty consulting, companies hiring students and faculty, and knowledge exchange among personal networks – contribute to the transfer of university research and technology (Feldman, 2003). More important formal technology transfer mechanisms include companies sponsoring university research, licensing university intellectual property in the form of patents, and promoting the formation of spin-off companies by providing business incubators, equity investments, and funding incentives to faculty (Feldman, 2003; Markman, Phan, Balkin, & Gianiodis, 2005). Since technology transfer remains a relatively new activity for many universities, there has been experimentation in the use of these mechanisms and the terms of agreements with companies (Feldman, 2003).

Of these technology transfer mechanisms, licensing university research to companies is the most common method. Licenses are contractual

agreements that provide companies with the rights to use a university's intellectual property. In exchange, the licensing company typically pays the university at the time of signing the agreement and at certain product milestones; in addition, licensing agreements often include provisions for royalty payments to the university if the ultimate product reaches the commercial market, potentially providing the university a steady revenue source (Feldman, 2003). By establishing active licensing programs, universities demonstrate capabilities that can help stimulate economic growth at the local, state, and national level, as well as recruit and retain top research faculty who consider universities a "congenial home" to their prospective entrepreneurial activities (Feldman et al., 2002).

In recent years, research universities have increased their licensing activity. As highlighted in Fig. A1 (appendix), in FY 2001, research universities executed 3,298 licenses to companies, but completed 4,053 licenses in FY 2005, an increase of 23 percent (AUTM, 2006). This overall increase primarily reflects an increase in the number of licensing agreements executed by public research universities; between FY 2001 and FY 2005, public institutions executed 35 percent more licenses to companies (AUTM, 2006). In addition to the volume of licensing activity, research universities are increasingly generating revenues from licensing their research and technology (reference Fig. A2 in appendix). In FY 2001, research universities executed 7,714 licensing agreements generating revenue, but completed 9,794 agreements yielding income in FY 2005, an increase of 27 percent (AUTM, 2006).

Despite the potential of licensing university-based research, licensing has yet to yield significant financial returns for most universities. First, licensed research and technology requires significant developmental work and ongoing cooperation by faculty to achieve commercial success. Thursby, Jensen, and Thursby (2001) find that only 12 percent of licensed university technology is ready for commercialization. Second, not all invention disclosures generate *any* intellectual property for universities, let alone intellectual property that may have commercial potential. Blake (1993) estimates that for every 100 invention disclosures, universities generate 10 patents and only 1 commercially successful product.

In addition, the distribution of licensing revenue among research universities is highly skewed with only a small number of universities generating financial returns on their intellectual property. Of the \$1,599,628,527 generated from licensing revenue in FY 2005 by research universities, 25 research universities accounted for 85 percent of these revenues and 10 universities accounted for 69 percent of these revenues (AUTM, 2006).

Moreover, many technology transfer offices generate operating losses in which their licensing revenues are insufficient to cover the costs of filing and maintaining patents, and other administrative costs (Feldman, 2003).

Companies partnering with technology transfer offices also perceive some shortcomings in licensing university-based research. In one study, nearly two-thirds of companies did not license intellectual property from universities; a major hesitation in collaborating with universities was the belief that university research is often at too early a stage of development (Thursby & Thursby, 2000). Universities may also overestimate the potential commercial value of their research or may move too slowly in negotiating licensing agreements (Feldman, 2003).

Based on these mixed experiences with licensing, research universities are experimenting with different mechanisms for commercializing their intellectual property. Some universities have begun assuming equity interests in partnering companies as payment for the use of university intellectual property instead of negotiating licensing fees. This practice originated with poor start-up companies that had little to offer universities other than equity in their companies (Feldman et al., 2002).

The practice of assuming equity positions in companies may be more effective than alternative technology transfer mechanisms such as licenses and patents (Feldman et al., 2002). Equity deals offer universities an opportunity to share in the fortunes of a whole company rather than only in the revenues of a single invention or technology that may contribute to the development of a company, but may not directly generate a commercial product. While licensing agreements detail the rights for using a particular patent, equity deals allow universities to share in a partnering company's success – even if little, or no, licensing revenue accrues from the original technology. As equity holdings yield a portfolio that comprises a broad range of potential revenue options, this mechanism for technology transfer may prove less risky than licensing for universities.

In addition, equity deals align the interests of the university and the partnering company toward the common goal of commercializing research more than conventional licensing arrangements. In particular, three aspects facilitate a closer alignment of the mutual objective of commercializing university research: common goals related to appreciating the value of the company and commercializing the technology; the relative ease of initial contract negotiations; and provisions for the ongoing adjustment of initial agreements based on the development of the commercial product.

According to technology transfer administrators, equity deals may also serve a certification function in which the arrangements provide legitimacy and prestige for both universities and partnering companies. For a university, assuming equity positions in partnering companies demonstrates its entrepreneurial orientation to peer institutions. For the partnering company, an equity deal may signal to other investors that the company has received a valuable technology from a university, and that the university is confident in the potential value of the technology and the company. As a result, this relationship with a research university may enhance the company's ability to attract additional funding from private investors.

Given these potential advantages, universities are unsurprisingly negotiating agreements with partnering companies that include equity. In FY 2005, 85 of 145 universities (or 57 percent) executed at least one licensing agreement in which universities acquired an ownership interest in a partnering company, as compared with two-thirds of institutions in FY 2000 and 37 percent institutions in FY 1996 (AUTM, 2006). In addition, as referenced in Fig. A3 (appendix), the number of licensing agreements executed by research universities involving equity increased by 140 percent between FY 1996 and FY 2005 (AUTM, 2006). However, a relatively small number of research universities account for most equity deals: in FY 2005, 10 institutions accounted for 33 percent of equity deals among research universities and 40 institutions accounted for 77 percent of equity deals (AUTM, 2006).

Similar trends exist among public research universities. The number of licensing agreements executed by public universities involving equity increased by 227 percent between FY 1996 and FY 2005 (AUTM, 2006). Moreover, in FY 2005, just over half of public universities executed at least one licensing agreement in which they acquired an ownership interest in a partnering company (AUTM, 2006). As observed among all research universities, a relatively small number of public universities account for most equity deals: in FY 2005, 12 institutions accounted for 51 percent of equity deals among public research universities and 23 institutions accounted for 74 percent of equity deals (AUTM, 2006).

In addition to experimenting with equity deals, universities have begun forming start-up companies that "spin off" university research and technology as an alternative method of technology transfer. The potential financial rewards of starting a company – and the increasing competition for university budgetary revenues and research funding – have created incentives for universities to engage in this kind of entrepreneurial activity (Powell & Owen-Smith, 1998). Feldman (2003) argues that spin-offs are an

increasingly important mechanism for commercializing university research, because researchers who actually develop the technology are best suited to continue developing the research toward commercialization and it is difficult to accurately evaluate the financial potential of university intellectual property. Creating start-up companies also offers opportunities for universities to assume a more prominent role in economic development (Shane, 2005).

Over the past decade, research universities have increasingly founded start-up companies to commercialize intellectual property (reference Fig. A4 in the appendix). In FY 1996, 129 research universities reported generating 184 start-up companies, while 147 institutions reported establishing 404 start-up companies in FY 2005 (AUTM, 2006). Furthermore, in FY 2005, 73 percent of universities report developing at least one start-up company that was dependent upon licensing the institution's research for its creation, as compared with 65 percent of universities in FY 2000 (AUTM, 2006). In addition to creating start-up companies, the total number of licensing agreements between research universities and start-up companies formed to commercialize university research increased by 159 percent between FY 1996 and FY 2005, and by 9 percent between FY 2001 and FY 2005 (appendix, Fig. A5).

Yet a relatively small number of research universities accounts for the generation of most start-ups. In FY 2005, 8 (of 147) institutions accounted for 25 percent of start-up creation and 45 institutions accounted for 72 percent of start-up companies (AUTM, 2006). Among public research universities, in FY 2005, 69 percent founded at least one start-up company that was dependent upon licensing the institution's research and technology for creation (AUTM, 2006). As observed among all research universities, a relatively small number of public universities account for most start-up creation: in FY 2005, 9 (of 107) institutions accounted for 33 percent of start-up creation and 45 institutions accounted for 72 percent of start-ups (AUTM, 2006). Unfortunately, the Association of University Technology Managers does not publish data that examines whether these start-up companies generate revenue for universities.

STATE ECONOMIC DEVELOPMENT INITIATIVES AND UNIVERSITIES

State leaders and policymakers have become increasingly interested in leveraging the presence of research universities to promote economic

development. State leaders are responding to pressures to promote economic development by investing in research and development activities, including those at local universities. States confront a strategic economic dilemma between accelerating innovation through the commercialization of research and development or “risk becoming economic backwaters” (National Governors Association, 2007). Given this economic and political context, state governments have established an array of programs that attempt to stimulate economic development through entrepreneurship and innovation by encouraging partnerships between research universities and industry (NGA, 2007). For example, some states have developed programs that help small start-up firms by subsidizing space in incubator facilities and providing assistance in new venture formation and business planning (Feldman, 2003).

One emerging program concept is to create state-supported venture capital funds that help finance the development of start-up companies aiming to commercialize university research. Although venture capital investors typically want to finance companies that already possess a clearly defined product concept, start-ups trying to commercialize university research require seed funding to spur the development of nascent ideas and technologies into potential products. In response, state-funded venture programs can fill this “financing gap,” supporting start-ups in their efforts to develop university technology by reducing the level of risk assumed by private venture capital investors and the cost of funding initial development (Shane, 2005).

This paper provides descriptive case studies of three different variations on public venture capital programs: the Georgia Research Alliance’s VentureLab program, which helps faculty researchers develop their research and technology into commercially viable products through grants and other support; Excell Partners in Rochester, NY, which helps to finance start-up companies in the Upstate New York region; and the Maryland Technology Development Corporation’s University Technology Development Fund (UTDF) and Maryland Technology Transfer Fund (MTTF), which encourage collaboration between university researchers and private entrepreneurs in support of commercializing university research and technology.

Georgia

The Georgia Research Alliance is Georgia’s primary mechanism for promoting economic development by commercializing university-based

research and technology. The Alliance, formed in 1990 to develop a technology-driven economy, represents a partnership of the state's six research universities, leading businesses, and government. The Alliance is a private, nonprofit corporation governed by a board of trustees comprised of 27 business and academic leaders in the state, including the presidents of Emory University, Georgia Institute of Technology, and the University of Georgia, as well as the chairman and CEO of the Southern Company, the executive chairman of Sun Trust Banks, and the former chairman and CEO of UPS.

The investments made through the Alliance's programs – \$26,823,000 in FY 2006 – are funded through the budget of Office of the Governor and are approved by the Georgia Legislature; its operations are funded through grants from private foundations and businesses. The Alliance focuses its resources in three key areas to stimulate economic development: attracting top or "eminent" faculty to Georgia's research universities (\$7,400,000 in FY 2006); creating centers of research excellence (\$14,085,000 in FY 2006); and commercializing university research into products and services (\$5,338,000 in FY 2006). Since its founding in 1990, the Alliance's programs have generated approximately \$2 billion in new federal and private funds into the Georgia economy, which equals a return on investment of \$5 for every \$1 invested by the program.

The Alliance encourages the commercialization of university research through three different initiatives. First, the Alliance supports technology incubators to help transfer technologies developed in university laboratories to industry. These incubators allow emerging companies to use the research and development resources of host universities to help refine the commercial potential of technologies under development. Nearly 125 companies have graduated from Georgia's university-based technology incubators, creating more than 4,000 high-tech jobs in the state. Second, through its Technology Partnership Fund, the Alliance fosters partnerships between Georgia companies and Alliance-affiliated universities to develop technologies that could stimulate economic growth. Grants awarded through this fund support technology development projects in three areas: advanced computing and communications, bioscience, and nanotechnology and advanced materials. Finally, the Alliance's VentureLab attempts to accelerate the process of creating new technology-based enterprises from university research. The VentureLab program operates at the Alliance's partner universities, examining university-based research, assessing the commercial potential of research discoveries, and providing grants to form new companies.

The VentureLab program awards seed grants to universities and early-stage companies through two different grants. The VentureLab offers “technology validation” grants of up to \$50,000 to assess market demand for a product or service and determine interest from potential customers. The funding from technology validation grants is used to engage prospective customers in order to validate market demand for the products based on the technology; create preliminary product specifications; and formulate an initial business plan that describes the value proposition of the technology and corresponding products, environmental forces affecting adoption of the technology and products, and the potential scale of the business. In addition, the VentureLab offers “prototype creation” grants of up to \$100,000 to help faculty develop a working prototype of a business. This funding is used to create a business plan suitable for raising venture capital, obtain seed funding from angel venture capital investors and federal government funds (e.g., the Small Business Innovation Research program), actively pursue customers, address issues of scaling the technology or product, and transfer the technology into a new company.

The VentureLab program has helped accelerate the process of creating new technology companies generated from research developed at Georgia’s universities. Piloted at Georgia Tech starting in September 2001, the VentureLab program has reviewed more than 120 technologies at the institution, resulting in the commercialization of 10 technologies; two companies have been created and eight ventures are being formed from these technologies. In fall 2002, VentureLab was expanded to the University of Georgia. During its first year, the program reviewed 38 technologies, resulting in the creation of three companies that are being managed in UGA’s business incubator.

The Georgia Research Alliance has gained national recognition for bringing business, research universities, and state government together to stimulate economic development. In 2007, the State Science and Technology Institute (SSTI) awarded its excellence in technology-based economic development awards to the Alliance for its VentureLab and Georgia Research Alliance Eminent Scholars programs. In addition to receiving national recognition, the VentureLab program might be receiving additional funds to help commercialize research generated at Georgia’s universities. In January 2008, Georgia Governor Sonny Perdue announced the creation of a \$40 million Georgia Research Alliance Venture Capital Fund (2008). The fund would provide early-stage financing to start-up companies commercializing university research, exclusively investing in companies participating in the VentureLab program that focus on technology and life

sciences. The proposal includes investments of \$10 million from the State of Georgia and of \$30 million from the private sector.

New York

Established in 2005, Excell Partners Inc. represents a unique regional economic development partnership between the University of Rochester and the State of New York. Due to the high risks of investing in the early stages of a company, few venture capital funds make seed investments, particularly in Upstate New York. However, at universities such as Cornell, Rochester, and the Rochester Institute of Technology, the region possesses strong research capabilities that generate technologies of potential commercial value. Excell Partners attempts to accelerate the creation of start-up companies based on university research by identifying promising technologies, offering mentoring services, and managing a modest venture capital fund that provides pre-seed and seed-stage financing to start-up companies in the region.

Although it is a nonprofit organization, Excell strives to operate like a private venture capital fund by structuring each investment with convertible debt and equity returns, with the goal of becoming self-sustaining, or evergreen, overtime. Since its founding, Excell has received funds totaling \$3,840,000 – \$3 million in state appropriations lobbied for by Jay Stein, the former CEO of the University of Rochester’s medical center; and \$840,000 allocated by the legislature in 2007 (Adams, 2007a). Despite receiving its funding from the State of New York, Excell is officially a subsidiary of the University of Rochester, and receives strategic direction from a seven member board of directors that includes officials from the region’s research universities and regional county executives. In addition, Excell maintains a technical advisory board and a network of researchers, as well as business and community professionals, throughout the region that provide due diligence and mentoring services to start-up companies seeking venture financing.

Excell frequently leads the round of seed investment and actively seeks coinvestors such as angel investors, seed investors, or economic development agencies to generate a level of financing that positions start-up companies for their first significant round of private venture funding (i.e., Round A financing). Although Excell’s seed investments extend up to \$250,000, its typical contribution is about \$100,000 in a raise totaling

between \$250,000 and 500,000. In addition to its seed investments, Excell also considers making pre-seed stage investments of up to \$50,000.

In making its investments, Excell calculates that one in 10 companies will successfully commercialize technology, resulting in a \$100 or 200 million acquisition – and thus, a significant return on Excell’s initial investment (Albers, 2008). In contrast, Excell predicts that four or five of 10 investments will fail to generate a commercial product (and any return on investment), while another four or five investments will generate modest financial returns. Excell’s agreements are typically “tranching,” meaning that it disburses its investment over time subject to the start-up company achieving key valuation milestones.

Excell’s current portfolio includes 18 companies, of which 11 companies are located in the Rochester area (Adams, 2007b). In 2005, Excell provided 11 start-up companies \$775,000 in seed and pre-seed financing, while in 2006, Excell provided 7 companies a total of \$745,000 in financing (Deckert, 2006; Johnson School, 2007).

Maryland

The Maryland Technology Development Corporation (TEDCO) was created by the Maryland General Assembly in 1998 to promote the commercialization of scientific research conducted by the state’s colleges and universities, and developed in the private sector (TEDCO, 2005). TEDCO receives annual appropriations from the State’s General Fund, which totaled 14,622,000 in FY 2007 (TEDCO, 2005). In 2004, TEDCO initiated a new strategic direction focused on promoting entrepreneurship by applying its experience as a technology transfer and development organization to becoming Maryland’s leading source of seed capital and commercialization assistance for technology-related companies (TEDCO, 2005).

TEDCO is governed by a 15-member board of directors representing the nonprofit research sector, venture capital financing, technology-based businesses, the general public, colleges or universities, and the Secretary of Business and Economic Development, as well as Maryland’s major geographic regions (TEDCO, 2005). Current directors include the Secretary of Maryland’s Department of Business and Economic Development, the Vice President of Research at Johns Hopkins University, and a founding partner of a venture capital firm. In addition to its board of directors, two technical advisory committees comprised of experts representing the private

sector, university and research institutions, and federal agencies provide policy recommendations and program oversight.

TEDCO provides seed capital and entrepreneurial business assistance for technology transfer and development through several programs. Through its UTDF, TEDCO offers resources to all universities in Maryland to support the commercialization of university intellectual property. With the assistance of university technology transfer offices, faculty researchers apply for UTDF grants by providing a plan for the commercialization of research, including a budget and a timeline with specific milestones. UTDF grants are usually limited to \$50,000 and are typically for one year; funds may be used for salaries and benefits, supplies, equipment, 10 percent of direct costs for overhead expenses, and up to \$5,000 in patent expenses.

In exchange for this funding, universities are required to share revenues with TEDCO on intellectual property created or developed with a UTDF grant. Universities pay TEDCO 25 percent of all revenues received from intellectual property developed with UTDF funding until they have repaid two times the amount of the UTDF grant. For example, a university receiving a \$50,000 grant would pay TEDCO 25 percent of the annual revenues from this intellectual property until it had paid \$100,000. TEDCO does not control any of the terms of a license or exact any royalty of its own from a licensed technology.

In addition to funding the commercialization of university research, TEDCO's MTF provides seed funding to Maryland companies that want to develop technology-based products and services in collaboration with universities or federal laboratories in Maryland. To be eligible for a MTF grant, a company must collaborate with a federal laboratory or Maryland university and meet the following two criteria: have fewer than 16 employees or be a university spin-off that has been in business for less than five years. By receiving a grant, companies receive both access to research and technology generated at universities or federal laboratories in Maryland and funding up to \$75,000 to help defray the cost of developing early-stage technology. MTF funds may be used to conduct feasibility testing on early-stage technologies in hopes of obtaining additional funding for commercial development.

In exchange for these resources, beginning five quarters after the end of the funding period, a company is required to pay TEDCO (annually) the lesser of either 3 percent of revenue or 40 percent of the award amount over a period of five years. The maximum repayment amount for a company is two times the value of the MTF award. TEDCO does not require companies to repay their awards unless, or until, the company generates

revenue. MTF awards are nonequity investments; TEDCO does not assume any ownership over companies or their intellectual property, nor does TEDCO retain rights to control aspects of commercializing the subject technology.

Since its founding, the MTF program has invested a total of nearly \$4.8 million in 78 firms, including investments of \$1.95 million to seven firms in 2007 (Buckelew, 2007). TEDCO reports that these 78 companies have generated \$162.8 million in subsequent financing from venture capital firms, angel investors, and public programs; or for every dollar MTF expends, partnering start-up companies generate \$35.56 in additional investment (Buckelew, 2007).

DISCUSSION AND FUTURE RESEARCH

Start-up companies provide a vehicle for balancing the risk and rewards of entrepreneurial activity. Universities are in a strong position to judge the quality of both research and business innovations by faculty and students. For most public institutions, however, investing significant funds in private enterprises would be perceived as an irresponsible use of funds. The fiscal environment for public universities has been seriously constrained due to demands for funding by K-12 education, medicaid, and criminal justice (Kane & Orszag, 2003). In addition, start-up investments are high risk, with only a few of these investments breaking even, much less providing steady revenue streams to support university activities.

Nonetheless, it is precisely these sort of entrepreneurial activities that will lead to future job creation. As a result, states may have an incentive to invest even in high-risk ventures if there is the potential for an overall return on that investment over the long term. In addition, states have the financial capacity to support these innovations, and economic development is a legitimate category of state funding. Yet state agencies are in a poor position to judge the quality of innovations generated by university faculty and students, and need the expertise of public universities to make these judgments.

Thus, the hybrid organizations described here offer a structural solution to the conflict in university mission, priorities, and expertise. Although start-up creation presents clear benefits to states, universities have strong incentives to cooperate. Legislators increasingly demand evidence of university activities that support state economic development – and they are holding public universities accountable to these demands through

budgetary and other political pressures. Depending on the arrangements, universities have the potential to benefit financially from state-funded venture funds. Organizations like Excell Partners seek to remain “ever-green” by balancing risk and reward through private equity stakes. Shockingly, public universities often fail to demand *any* future financial return on their investments in the name of the university’s public service mission. In the future, it seems likely that public universities will seek to create self-sufficient governance structures to support their economic development activities.

These new governance structures have the potential to support companies that produce substantial social benefits that serve the university mission. The start-up companies funded through state public-private partnerships are heavily focused on technological and health care innovations that have the potential to improve the overall quality of life in society and around the world. In addition, the financial benefits that accrue to public universities could be reinvested in student learning and further research collaboration among faculty and students. As states and universities expand their economic development activities, there is also the potential for universities to invest in faculty and student nonprofit start-ups, and to expand conceptions of social entrepreneurship that contributes equally with private innovators (Mars, Rhoades, & Slaughter, 2008).

Nonetheless, public university presidents report substantial concerns with these emerging governance arrangements. In a recent qualitative study of presidential perspectives on governance, they reported worries about the lack of trustee oversight over research parks, technology transfer, entrepreneurship institutes, private equity positions, and other economic development initiatives (Bastedo, forthcoming). As one president said, “In the area of economic development, you have private developers, faculty and technology transfer. This has gone from a minor function to a major function, and we’ve got a lot more vulnerability on the economic development function than we are dealing with.” There are also indications that economic development activities are increasing the potential for trustee conflicts of interest and making effective governance more complicated for presidents, both within the board and in relationships with external actors. “We need to look at the increasing interlocking nature of these public boards and other boards,” one president said. “We have trustees that sit on the foundation board, the hospital board, the public radio board, the technical college board, the radio board. I don’t know if we’ve tried as a field to analyze what that means.”

These concerns suggest the need for a substantial research agenda around the governance relationships among economic development entities, public

university boards, and state government. Our examination of these arrangements led to conclude that there was often ignorance of the appropriate role for state governments to ensure accountability for state taxpayer funds. There was also a lack of clarity about what would constitute a conflict of interest among university governance interests, and whether there was adequate oversight by university boards of trustees or state agencies. Further research would help to clarify existing relationships, identify potential conflicts of interest, and provide an understanding of best practices to support the oversight of hybrid governance structures.

This research has potential benefits for both innovators and government officials who seek to promote economic development. The economic and social gains produced by private start-up companies are both high risk and highly ambiguous. The resulting lack of accountability and financial assurance may lead legislators to invest slowly, or not at all, even when they support the overall objectives. For innovators, clarity about governance arrangements would provide stability about the expectations universities and governments attach to their investments, and they would benefit from the increased funding resulting from clarified accountability mechanisms. Finally, university concerns about the lack of overall oversight, potential legal liability and public relations disasters, and the potential intervention of state legislators or auditors in these activities would be relieved, facilitating further investment and engagement by public university leaders.

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APPENDIX

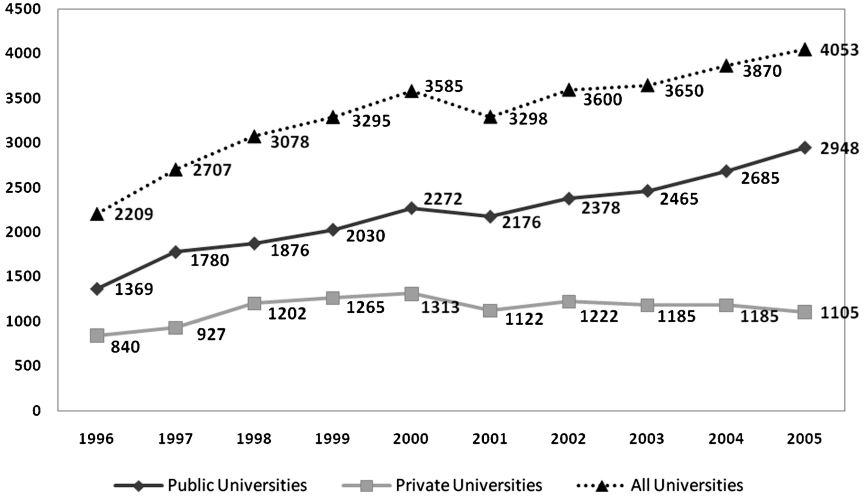


Fig. A1. The Number of License Agreements Executed by US Research Universities, FY 1996–FY 2005.

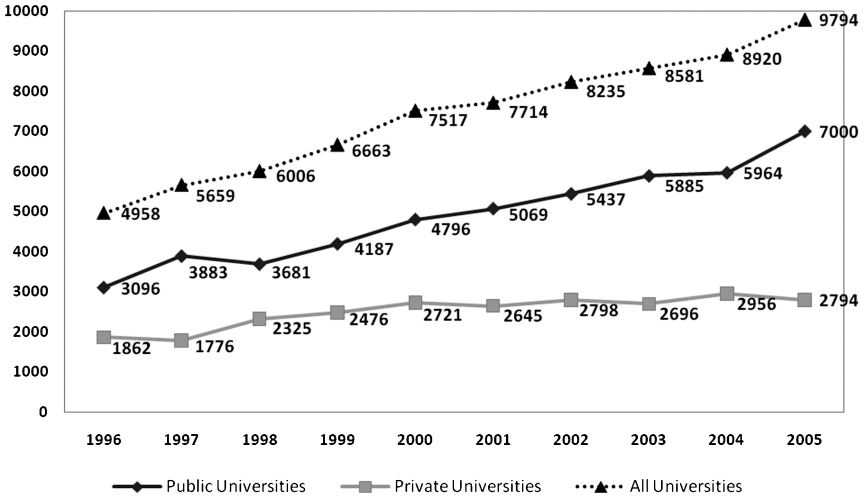


Fig. A2. The Number of License Agreements Yielding Income for US Research Universities, FY 1996–FY 2005.

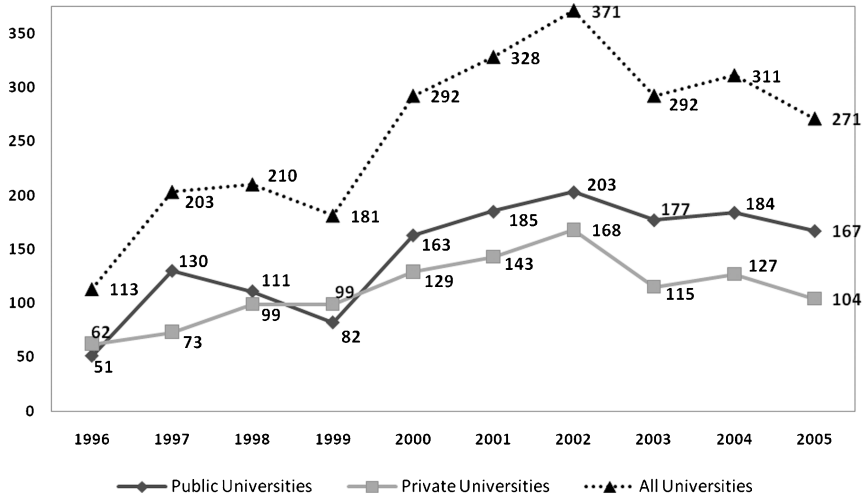


Fig. A3. The Number of License Agreements Executed by US Research Universities That Included Equity, FY 1996–FY 2005.

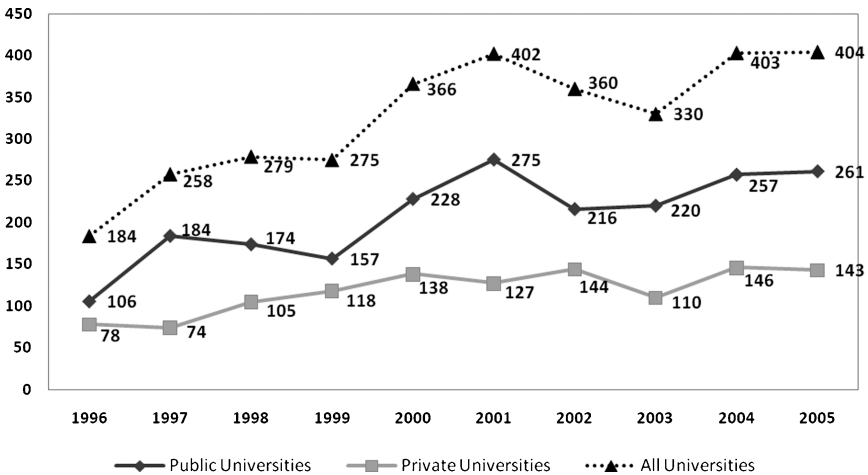


Fig. A4. The Number of Start-Up Companies Generated from Technology Developed at US Research Universities, FY 1996–FY 2005.

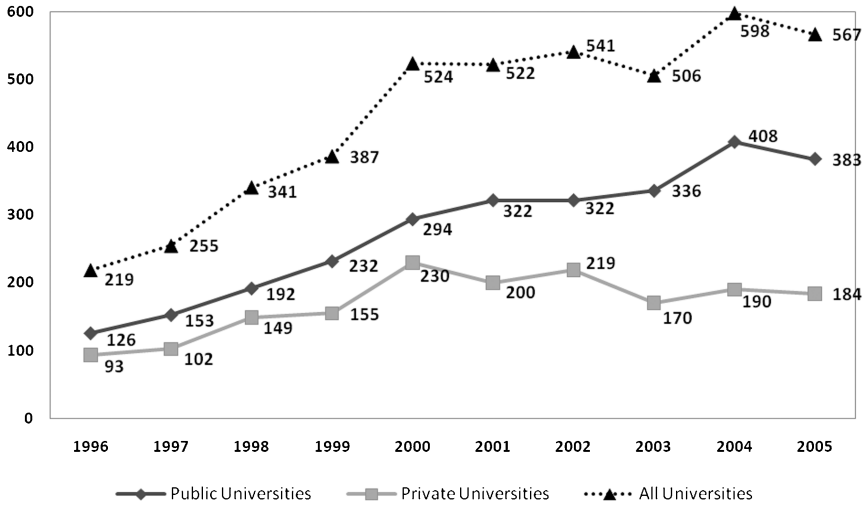


Fig. A5. The Number of License Agreements Executed by US Research Universities to Start-Up Companies, FY 1996–FY 2005.