University Knowledge Hubs and Economic Growth

Gregory T. Owen, PhD.

Introduction

There is a recent growing body of literature that demonstrates and advocates for the increasing role that higher education institutions have assumed in economic growth. Many studies advocate similar assertions that, "Increasingly, the university system will be the locus of fundamental discoveries. And industry will need to work with universities to transfer those discoveries into innovative products, commercialized through appropriate business models."[2] In 2002 the Southern Technology Council (STC) released the results of a seven-year project devoted to public policy analysis and the report recognized twelve higher education institutions as "doing a particularly good job of building alliances with industry and playing active roles in economic development in their regions." Project results advocated that we have entered an "era of the engaged university, and the policies, practices, and visions of these exemplary institutions should show the way."[3]

The purpose of this article is to answer the STC 2002 project's "next steps" challenge to "advocate, educate, champion, and harangue the larger academic community to pay more deliberate and more informed attention" to the successes of some of the institutions identified in their study. As noted by the researchers in their final report, they "firmly believe that the leadership of the institutions spotlighted in this book—and their government and industry partners—have themselves a powerful story to tell."

First, this paper will highlight three key points that are important to the future success of higher education and its role in contributing to economic growth. These key points include (1) the shift from closed innovation to open innovation, (2) the delicate campus conditions that rarely exist for successful technology-related economic impact, and (3) the importance of recognizing strategies that move higher education communities beyond their traditional roles. Second, this article discusses some important reminders for policy makers regarding the entrepreneurial process as well as higher education's propensity to rely on imitation as its primary evolutionary tool. Third, this paper utilizes the Georgia Institute of Technology (Georgia Tech) to demonstrate how deliberate partnerships between higher education and the business community can have a positive economic impact. Finally, this paper concludes with a list of relevant resources for further understanding on how higher education can contribute more broadly to local, regional, state, and national economic growth.

> "The basic reality, for the university, is the widespread recognition that new knowledge is the most important factor in economic and social growth. We are just now perceiving that the university's invisible product, knowledge, may be the most powerful single element in our culture, affecting the rise and fall of professions and even social classes, of regions, and even nations."[1]
>
> – Kerr, Clark (2001) *The Uses of the University*

Key Points

1.) Open Innovation is now the rule and not just the shifting norm-a clear advantage for universities.

In his seminal book *Open Innovation*, Henry Chesbrough highlights that universities have a lot to gain from the shifting paradigm of Closed Innovation to Open Innovation. In order to understand the Closed Innovation model, the approach that was the norm for most of the twentieth century, it's important to be aware of the motivation behind it. One of the main drivers of this "internally focused logic" was to closely guard the Intellectual Property (IP) that arose from a company's Research and Development (R&D). Closely guarding IP through the practice of Closed Innovation provides a barrier, preventing others from exploiting ideas for their own profit. The basic premise was "If you want something done right, you've got to do it yourself." For a long time this mind-set was "tacitly held to be self-evident as the right way to innovate." Some of the implicit rules of Closed Innovation include (1) we should hire the best and brightest people, so that the smartest people in our industry work for us; (2) in order to bring new products and services to the market, we must discover and develop them ourselves; (3) if we discover it ourselves, we will get it to market first; (4) we should control our intellectual property, so that our competitors don't profit from our ideas.[4]

Several factors have contributed to a recent shift away from the Closed Innovation model. Some of the key societal and economic changes include (1) the demise of the barren knowledge landscape, (2) rapid growth of venture capital supporting new start-ups, and (3) a growing propensity of talented people choosing to leave Closed Innovation style companies.

First, academic journals, scientific databases, and a plethora of various professional journals have moved online, reducing the cost and access barriers common in the twentieth century. In the age of the Internet, "leading scholars from around the world have created a global community" more willing and able to share and distribute their ideas and discoveries. This has created an "end of knowledge monopolies" common in centralized R&D organizations.

Second, prior to 1980 there was very little Venture Capital (VC) in the United States. New startups failed early and often due to an inability to fund their endeavors. Closed Innovation environments before 1980 also had an enormous amount of R&D that just "sat on a shelf" as firms prioritized which ideas to pursue further. As VC grew in the 1980s and early 1990s, new startup stock-option packages got better, but more importantly these startups offered an atmosphere of innovation simply not possible within closed innovation. Gradually talented researchers were increasingly lured away from established firms to join startups that could move their ideas off the shelf and into the market.[5]

The Open Innovation model, in contrast to the old closed approach, "assumes that firms can and should use external ideas as well as internal ideas, and internal and external paths to market, as the firms look to advance their technology." Some basic Open Innovation principles include, (1) not all the smart people work for us so we need to work with smart people inside and outside our company; (2) we don't have to originate the research to profit from it; (3) building a better business model is better than getting to market first; (4) we should profit from others' use of our IP, and we should buy others' IP whenever it advances our own business model.

Universities are ideally situated in Open Innovation environments as firms aim to bring to market new technologies through R&D partnerships. In the wake of decreasing government funding for basic research, faculty have increasingly become more astute at securing funding for their work from industry partners. These partnerships place universities at the forefront in their potential to contribute to regional, state, and national economic development. As Chesbrough concludes, "Increasingly, the university system will be the locus of fundamental discoveries. And industry will need to work with universities to transfer those discoveries into innovative products, commercialized through appropriate business models."[6]

2.) The Campus Conditions for Successful Technology-Related Economic Impact are Delicate and Rarely Exist

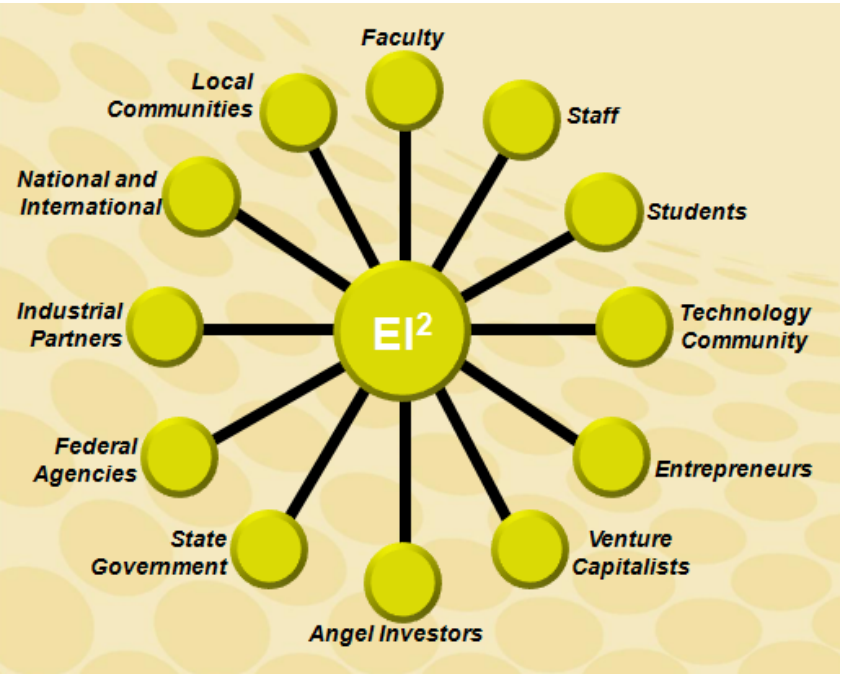
In a very recent (2012) study, Helen Smith and Sharmistha Bagchi-Sen "explore the conditions under which research universities become more than latent assets in their regional economies." Smith and Sharmistha attempt to offer an understanding of how universities can impact regional economic development and they offer several "propositions" that are important to consider. First, the way in which a university can contribute economically highly depends on its internal characteristics. In more specific terms, a university must become more connected with the ethos of entrepreneurism. Motivation toward this goal can come from external influences such as national legislation and public policy; however, campus leaders can achieve this cultural shift internally through interweaving entrepreneurial impact goals into the institutional strategic plan. In either case, internal or external forces, both "can result in new opportunities, creation of incentives and rewards for technology transfer, and increased industrial funding." Applying a business-like style of technology transfer is recognized as a crucial pre-requisite for successful commercialization of university IP. More specifically, what is needed is a "formulation of a selective incubation strategy for spin-offs and the development of relationships among academics, technology-transfer office (TTO) personnel, and investors." Unfortunately, "these ideal circumstances, however rarely exist."[7]

Second, typically the only higher education institutions able to succeed in these ventures are established, research-focused universities with a very robust funding base and diversified revenue sources. As demonstrated by Lendel (2010), "The impact of research universities is very strong during the expansion stages of business cycles, but only the top research universities have positive impacts on regional economies in periods of economic decline." In order to support steady performance, higher education institutions need "consistently high levels of research income, stable flows of students, and high academic salaries."[8]

Finally, there must be a "match between the assets of the university and regional conditions," and this is "contingent on factors such as diversity of university-regions and type of academic research." Several suggested main regional conditions include (1) a "local absorptive capacity" or the presence of firms able and willing to engage with university research; (2) a "nascent or competitive infrastructure" around the university; and (3) a surrounding labor market that is technical and professional in nature. Finally, (4) this labor market must be ripe with entrepreneurial activity and culture that melds well with the university's entrepreneurial goals.[9]

3.) Institutions of higher education that are able to evolve beyond traditional university roles and construct an innovation-promoting knowledge hub have a stronger opportunity for creating positive economic impact.

As I have mentioned previously, there is a recent growth in the number of publications devoted (or related) to university efforts in building technology partnerships in support of economic growth. Of particular interest is a report that uses the Georgia Institute of Technology (Georgia Tech) as a case study on how universities can evolve into an "innovation-promoting knowledge hub."[10] One of the hallmarks of a knowledge hub is that it serves as a "boundary-spanning organization" that accumulates mediating functions for the exchange of tacit, as well as codified, knowledge. This exchange typically occurs between academia, local businesses, and financial communities. According to this particular case study, universities must move beyond their roles as factories and storehouses of knowledge. Traditionally, higher education institutions in the United States have been very capable in developing, acquiring, and using codified knowledge. However, evolving institutions have learned how to effectively advance, distribute, and recombine tacit knowledge as well. This increased focus on tacit knowledge involves "the engagement of relational knowledge enablers that seek out tacit knowledge and link it with other individuals and organizations to exploit it, thus integrating the university with new relationships that foster innovation." The Enterprise Innovation Institute (EI^2) at Georgia Tech has evolved into this role and serves as a strong example of an innovation-promoting knowledge hub. The diagram below highlights the people and organizations EI^2 interacts with to promote tacit knowledge exchange. This tacit knowledge exchange has created significant positive economic impacts for the local, regional, and statewide communities in, and around, Atlanta, GA. Some of these impacts include incubation of successful startup companies, creation and/or retention of jobs in Georgia, and assisting established businesses with increasing top-line growth and reducing bottom-line costs.



Ideas for Getting Started

Think Innovate, Not Imitate

Clayton Christensen and Henry Eyring (2011) believe that the traditional model of higher education in the United States is under pressure from what they call the "theory of disruptive innovation." This theory is based on the assumption that there are two types of innovation. The first, "sustaining innovation" is basically an advancement that "makes something bigger or better." Examples cited by Christenson and Eyring include airplanes that fly farther, computers that process faster, or universities with more college majors and better activity centers. The competition for sustaining innovation is often dominated by industry leaders for two main reasons. Industry leaders usually have the financial resources to stay ahead and when this is combined with their traditional expertise advantage, competitors rarely stand a chance in the race for bigger and better.

A disruptive innovation, however, is the introduction of a product or service that "is not as good as the best traditional offerings, but it is more affordable and easier to use," thus disrupting the bigger and better cycle. Online learning is an example of disruptive innovation to traditional higher education face-to-face classrooms. This innovation started out slow. However, as Internet speeds grew and improvements were introduced, interest expanded. Through adding improvements such as video conferencing, online tutorials, and discussion forums (that traditional face-to-face doesn't provide), online learning has gradually increased its market share to include even traditional students. Another example of higher education disruptive innovation is the well-known University of Phoenix model. Their approach focuses nearly all its efforts and financial resources on delivering faster education rather than research efforts or building bigger and better athletics or student services facilities.

Traditional universities in the United States have thrived and grown in the past two centuries by following the imitation path to success. Smaller institutions experienced growth through emulating an elite group of highly successful research institutions. As new smaller higher education institutions sprouted, they expanded by hiring researchers, adding additional subjects of study, and offering more advanced degrees. Under the pressure of disruptive innovation, however, higher education will need to let go of its traditional imitation mode of progress and begin to "define themselves in individual terms rather than emulating others."[11]

Reminders to Help Policymakers Understand the Entrepreneurial Process

Josh Lerner (2009) provides us with several insightful warnings for policymakers who want to facilitate entrepreneurship. In his book *Boulevard of Broken Dreams* he purports that "in many, many cases, the failure by governments to promote venture and entrepreneurial activity was completely predictable." A great deal of these failures "shared a set of flaws in their design, which doomed them from the start."[12] While Lerner's analysis focuses on governmental efforts, high-potential new ventures, and the policies that enhance them, his guidelines serve as important reminders for higher education economic development programs (especially those supported by state funding). Guidelines most relevant for higher education policy makers include:

- Remember that entrepreneurial activity does not exist in a vacuum: building an environment where new ventures can thrive is a critical first step.
- Be sure to let the market provide direction when providing subsidies.
- Recognize the long lead time these initiatives require.
- Avoid programs that are too small to make a noticeable difference or too big for the market.
- Understand the need for, and actively encourage, strong interconnections with entrepreneurs overseas, rather than focus only on domestic activity.
- Programs to promote entrepreneurship need creativity and flexibility; sometimes they must be refined or killed off.
- Recognize that "agency problems" – when individuals and organizations act to benefit themselves, rather than the broader social good – are universal, and take steps to minimize their danger.
- Make education part of the initiative, including that of overseas investors, local entrepreneurs, and the public sector.

Example

Georgia Institute of Technology

The Southern Technology Council (STC) "reputation analysis" discussed in the introduction of this report named Georgia Tech as a leading institution among the 12 identified in their study. As specifically stated in the 2002 STC report, Georgia Tech "can be considered as the most advanced in the economic development activities studied." Georgia Tech has successfully created entrepreneurship and technology-based economic development supporting efforts that provide a potential framework for other institutions considering same or similar initiatives. Georgia Tech's success can be understood through an analysis of the Enterprise Innovation Institute (EI^2). The EI^2 program brings the majority of Georgia Tech's economic development efforts under one umbrella. As Georgia Tech's primary business outreach/extension organization, EI^2 is the nation's largest and most comprehensive university-based economic development program focusing on business and industry assistance, entrepreneurship, and technology commercialization. The core mission of EI^2 is to positively affect the economy by helping enterprises improve their competitiveness through the application of science, technology, and innovation. EI^2 provides connections to Georgia Tech's vast resources, including world-class research, state-of-the-art facilities, internationally recognized experts, and upper-echelon students. EI^2 is located in the Georgia Tech Midtown-Atlanta Technology Square, a campus gateway community that is home to academic, commercial, residential, and retail tenants. The facilities provide commercial leasing opportunities and a variety of conference room options to technology entrepreneurs, investors, non-profits, and Georgia Tech corporate strategic partners. The primary EI^2 programs with the

highest levels of economic impact are the Advanced Technology Development Center (ATDC), VentureLab, and the Georgia Manufacturing Extension Partnership (GaMEP).

The **Advanced Technology Development Center (ATDC)** is a startup incubator at Georgia Tech that helps technology entrepreneurs in Georgia launch and build successful companies. Founded in 1980, ATDC is the oldest university-based technology incubator in the country. ATDC was featured in a 2013 Forbes magazine article as one of the top 12 technology incubators changing the world. ATDC was recognized by Inc. and Business Week as one of the nation's top incubators, and has won several awards for the expert services it provides. Member companies receive coaching, connections, and a community to foster their development. Companies that have graduated from the ATDC incubation program include Mindspring (now part of EarthLink), Trans Nexus, Blinq Media, Pindrop Security, Suniva, and CardioMEMS. In FY2013 ATDC serviced over 400 member companies and helped create more than 7,300 new technology jobs. Revenues of all ATDC companies (current and graduated businesses still active in the economy) equal more than $1.8 billion.

VentureLab is a service open to all Georgia Tech faculty, research staff, and students who have an interest in forming startup companies based on their research. Founded in 2002, as a complement to ATDC, VentureLab was created to curate and translate Georgia Tech research into startups. As Georgia Tech's comprehensive center for technology commercialization, VentureLab transforms innovations into companies by (1) Developing engaging business models; (2) Connecting clients with experienced entrepreneurs; (3) Locating sources of early-stage financing; and (4) Preparing new companies for global markets. In 2013 VentureLab was ranked second in the world according to a Stockholm-based benchmarking study of 150 university-based incubators in 22 countries.[13] VentureLab also manages Innovation Corps (I-Corps), a National Science Foundation (NSF) funded program that helps scientific and engineering discoveries move from universities into the marketplace. In FY2013, VentureLab evaluated 200 technologies and attracted over $52M in investment capital. Through these FY2013 efforts, VentureLab created more than 675 new jobs in the state of Georgia. Since its inception, VentureLab has helped launch more than 150 new companies, which have attracted more than $700 million in outside funding.

The **Georgia Manufacturing Extension Partnership (GaMEP)** helps manufacturers throughout Georgia increase top-line growth and reduce bottom-line costs. Equipped with nine dedicated regional offices throughout the state, GaMEP employs project managers specializing in multiple areas of business improvement expertise. Each GaMEP project manager has spent multiple years working in industry, including many who have owned or operated their own manufacturing companies. GaMEP also offers numerous open-enrollment professional-education training courses as well as custom training for manufacturing companies nationwide. Adhering to rigorous metrics-based success measurements created and overseen by the federal government, GaMEP offers solution-based business improvement approaches through coaching, implementation, and training, including:

- **Strategic Planning** – includes developing and incorporating organization-wide strategies into overall business plans and day-to-day operational tactics. Services also include management and family-business coaching.
- **Innovation Management** – focuses on creating and sustaining a process to grow businesses and to feed an ideation pipeline.
- **Process Improvement** – includes applying continuous improvement solutions in lean (5S, value stream mapping, kanban, kaizen events, and more) to both manufacturing plant and front-end processes.
- **ISO Standards** – focuses on implementing and modifying quality- (ISO 9001), environmental- (ISO 14001), and energy-management (ISO 50001) systems.
- **Sustainability** – includes incorporating sustainable environmental and safety solutions into manufacturing plants.
- **Energy** – focuses on integrating best practices in energy efficiency and management.

As part of both a larger, national network of MEP centers and of Georgia Tech, GaMEP is able to provide connections to vast resources to ensure that manufacturing companies meet their individual goals. In FY2013, the GaMEP worked with over 1,300 companies resulting in over $27 million in reduced operating costs. These efforts contributed to over 1500 jobs created or retained in the state of Georgia.

Specific Georgia Tech Success Stories

University Knowledge Hubs can be formed and funded on campuses all over the United States, however without the correct formula fitted to the culture and markets within a specific region many are destined to fail. The elements of the Georgia Tech approach have

been in place for decades and there are several examples of successful ventures and business-university partnerships. These examples can potentially serve as idea promoting catalysts for other higher education institutions considering same, or similar, initiatives.

Pindrop Security is a startup company based on technology developed by Georgia Tech researchers. In summary, Pindrop's technology provides telephone network security to help stem the tide of phone fraud. For example, financial services companies rely on caller ID and other services to help ensure callers are who they claim to be (particularly important for activating credits cards over the phone). The creation of technologies that imitate or spoof caller IDs has been costing the financial industry billions of dollars per year. Pindrop's security solutions are especially attractive, because their technical solutions do not require changes to existing phone networks. Pindrop's success has relied on much more than the brilliance behind its technology. According to Stephen Fleming, Vice President and Executive Director of the Georgia Tech Enterprise Innovation Institute, "Pindrop is a textbook example of how all the components of Georgia Tech's commercialization infrastructure can work together to support researchers developing technology that has commercial potential."[14] In his July 28th, 2013 blog post, Fleming articulates the history behind Pindrop's success in securing a recent $11 million investment from top-tier national venture capital firms. Over an approximate three-year period Georgia Tech and other partnering economic development resources assisted Georgia Tech graduate student, and now Ph.D., Vijay Balasubramanian (designer of the technology behind Pindrop's success). This assistance helped Balasubramanian and his associates overcome the multiple hurdles of bringing a discovery out of the lab and into the market. In his blog, Fleming provides a chronological account of over thirty key events that gradually brought Pindrop to its current level of success. This "textbook example" serves as a potential roadmap for other same or similar initiatives.[15]

CardioMEMS, in 2012, was presented the prestigious Intel Innovation award, one of many awards the company has received over the past several years. Similar to Pindrop Security, CardioMEMS's success has deep roots within Georgia Tech research. Co-founded by Georgia Tech Electrical and Computer Engineering professor Mark Allen, CardioMEMS is an Atlanta-based medical technology company. Its inception came through commercializing proprietary wireless sensing and communication technologies for the human body. The company is a graduate of Georgia Tech's ATDC startup accelerator, and their primary product is a paperclip-sized implantable monitoring device for heart patients.[16] CardioMEMS developed this technology based on the belief that frequent, on demand, real-time health condition, monitoring enables proactive patient management, which holds the promise of reducing hospitalizations, improving a patients quality of life, and delivering more efficient and cost effective healthcare. Before the Intel award, CardioMEMS had received a long list of other awards and investment funding. For example, in 2011 the company was honored with the Phoenix *Most Promising New Product Award*. Also, at the 2011 Georgia Technology Summit, CardioMEMS was chosen as one of the Top 10 Innovative Technology Companies by the Technology Association of Georgia (TAG). Financial achievements by CardioMEMS include a 2010 $60 million equity investment and purchase option from St. Jude Medical Inc., a large medical device company based in St. Paul Minn. For a complete list of CardioMEMS achievements and awards see CardioMEMS's News and Articles site on their company website.[17]

Technology Square: As noted earlier, Josh Lerner advocates that entrepreneurial activity does not exist in a vacuum: building an environment where new ventures can thrive is a critical first step. Georgia Tech's response to creating this environment was the creation of "Technology Square," a large mixed-use research park community adjacent to the east side of campus. Early in its inception, Technology Square received the 2004 Award of Excellence presented by the Urban Land Institute (ULI).[18] Celebrating its 10 year anniversary in 2013, the Technology Square project has reestablished Georgia Tech's connection with Midtown Atlanta by turning 13 abandoned acres of property into 1.1 million square feet of research, education, and commercial collaboration. Serving as a visable technology corridor for Atlanta, the facility serves as a focal point for Georgia Tech's econmic outreach activities and also houses the newly named Scheller College of Business. The area is central to Georgia Tech's efforts to promote new collabrations with business and industry. For example, Georgia Tech played a signifigant role in the decision-making process to move Fortune 500 Company NCR to Georgia.[19] Also, in 2011 Governor Nathan Deal announced Georgia Tech's partnership with GE Energy for creation of The Smart Grid Technolgy Center of Excellence.[20] Other recent partnership successes include Panasonic's new R&D center and the opening of the AT&T Foundry.[21-22] These two initiatives, specifically located in Technology Square, help closely connect AT&T and Panasonic to Georgia Tech faculty, students, research programs, and multiple early-stage tehnology companies being incubated in ATDC, VentureLab, and Flashpoint.

Concluding Remarks

This article takes up the challenge offered by Southern Technology Council to "advocate, educate, champion, and harangue the larger academic community to pay more deliberate and more informed attention" to the successes of some of the higher education institutions identified in their 2002 study. Using the Georgia Institute of Technology as a key example, this article demonstrated how a higher education institution has successfully responded to three recent and very important technological, economic, and cultural changes. These include the shift from closed innovation to open innovation, identification of the delicate campus conditions for successful technology-related economic impact, and the importance of higher education moving past imitation as its primary evolutionary tool.

This article provided details about three programs within the Georgia Tech Enterprise Innovation Institute (EI^2), including ATDC, VentureLab, and GaMEP. Additionally, specific examples were provided regarding new ventures and partnerships that owe much of their success to the services provided by EI^2. The state of Georgia continues to experience a significant ROI through its investment in EI^2 programs. In FY2013 alone, Georgia contributed just over $7.1 million to the EI^2 annual budget. In the same FY, ATDC, VentureLab, and GaMEP combined with all other programs within EI^2 have had a total positive economic impact over $1.4 billion. This overall FY2013 economic impact came through EI^2 serving over 9,000 enterprises and/or stakeholders, and saving or creating over 25,000 jobs in the state of Georgia.

Resources

Books, Articles, & Other Written Resources:

Abramo, G., D'Angelo, C. A., & Di Costa, F. (2011). University-Industry Research Collaboration: A model to assess university capability. *Higher Education 62*, 163-181.
http://link.springer.com/article/10.1007/s10734-010-9372-0#page-1

Bathelta, H., Koglerc, D. F., & Munrod, A. K. (2010). A knowledge-based typology of university spin-offs in the context of regional economic development. *Technovation, 30*(9), 519-532.
http://www.sciencedirect.com/science/article/pii/S0166497210000519

Bertrand, W. E. (2010). Higher Education and Technology Transfer: The Effects of "Techno-sclerosis" on Development. *Journal of International Affairs, 64*(1), 101-119.

Breznitz, S. M., O'Shea, R., & Allen, T. J. (2008). University Commercialization Strategies in the Development of Regional Bioclusters. *Journal of Product Innovation Management, 25*, 129-142.

Christensen, C. M., & Eyring, H. J. (2011). *The Innovative University: Changing the DNA of Higher Education from the Inside Out* (1st ed.). San Francisco: Jossey-Bass. http://www.theinnovativeuniversity.com/

Doron, S. (2011). Seeing the Future: Technology and Innovation.
Seeing the Future - Resource Guides. Research Triangle Park, NC: Southern Growth Policies Board.
http://www.southerngrowth.com/pubs/pubs_pdfs/SFModule_technology&innovation.pdf

Drucker, J., & Goldstein, H. (2007). Assessing the Regional Economic Development Impacts of Universities: A Review of Current Approaches. *International Regional Science Review, 30*(1), 20-46.
http://irx.sagepub.com/content/30/1/20.full.pdf+html

Falconer, J. (2007). The Economic Impact of Universities in Non-Metropolitan Areas of the Great Plains, USA.
Industry and Higher Education, 21(3), 185-194.

Feldman, M., & Desrochers, P. (2003). Research Universities and Local Economic Development: Lessons from the history of Johns Hopkins University. *Industry and Innovation, 10*(1), 5-24.
http://www.tandfonline.com/doi/abs/10.1080/1366271032000068078#preview

Ferguson, W. (2011). Commercialization of University Research for Technology-Based Economic Development. *Industry and Higher Education, 25*(3), 161-172. http://www.ingentaconnect.com/content/ip/ihe/2011/00000025/00000003/art00003

Fraser, J. (2010). Academic Technology Transfer: Tracking, Measuring and Enhancing Its Impact. *Industry and Higher Education, 24*(5), 311-317.

Friedman, D. (2009). An Extraordinary Partnership Between Arizona State University and the City of Phoenix. *Journal of Higher Education Outreach and Engagement, 13*(3), 89-100.

Goldstein, H., & Drucker, J. (2006). The Economic Development Impacts of Universities on Regions: Do Size and Distance Matter? *Economic Development Quarterly, 20*(1), 22-43. http://edq.sagepub.com/content/20/1/22.full.pdf+html

Hoke, L. (2011). Seeing the Future: Entrepreneurship. *Seeing the Future - Resource Guides* Research Triangle Park, NC: Southern Growth Policies Board. http://www.southerngrowth.com/pubs/pubs_pdfs/SFModule_entrepreneurship.pdf

Holly, K. (2009). Venture Capital–University Interface: Best Practices to Make Maximum Impact. *Tomorrow's Technology Transfer, 1*(2), 35-42.

Lendel, I. (2010). The Impact of Research Universities on Regional Economies: The Concept of University Products. *Economic Development Quarterly, 24*(3), 210-230. http://edq.sagepub.com/content/24/3/210.full.pdf+html

Lerner, J. (2009). *Boulevard of Broken Dreams: Why public efforts to boost entrepreneurship and venture capital have failed and what to do about it*. Princeton: Princeton University Press.

Maxwell, A., & Levesque, M. (2011). Technology Incubators: Facilitating Technology Transfer or Creating Regional Wealth? *International Journal of Entrepreneurship and Innovation Management, 13*(2), 122-142.

Mille, M. (2004). The University, Knowledge Spillovers, and Local Development: The Experience of a New University. *Higher Education Management and Policy, 16*(3), 77-100. http://ideas.repec.org/a/oec/edukaa/5lgxzjd15b8s.html

Nelles, J., & Vorley, T. (2010). Entrepreneurial by Design: Theorizing the Entrepreneurial Transformation of Contemporary Universities. *Industry and Higher Education, 24*(3), 157-164. http://www.ingentaconnect.com/content/ip/ihe/2010/00000024/00000003/art00003

Roberts, E. B., & Eesley, C. E. (2011). *Entrepreneurial Impact: The Role of MIT-An Updated Report*. Cambridge, MA.: Massachusetts Institute of Technology. http://entrepreneurship.mit.edu/impact

Roessner, D., Bond, J., Okubo, S., & Planting, M. (2013). The economic impact of licensed commercialized inventions originating in university research. *Research Policy, 42*, 23-34.

Rothaermel, F. T., Agung, S. D., & Jiang, L. (2007). University Entrepreneurship: A Taxonomy of the Literature. *Industrial and Corporate Change, 16*(4), 691-791. http://icc.oxfordjournals.org

Shaffer, D. & Wright, D. (2010). *A New Paradigm for Economic Development, How Higher Education Institutions are Working to Revitalize their Regional and State Economies*. Albany, NY: Nelson A. Rockefeller Institute of Government http://www.rockinst.org/pdf/education/2010-03-18-A_New_Paradigm.pdf (full report access, March-2010)

Simha, O. R. (2005). The Economic Impact of Eight Research Universities on the Boston Region. *Tertiary Education and Management, 11*, 269-278. http://link.springer.com/article/10.1007/s11233-005-5113-9

http://www.news.harvard.edu/gazette/2003/03.13/photos/EconomicReport-full.pdf (expanded report access)

Smith, H., & Bagchi-Sen, S. (2012). The Research University, Entrepreneurship and Regional Development: Research Propositions and Current Evidence. *Entrepreneurship & Regional Development, 24*(5-6).
http://www.tandfonline.com/doi/abs/10.1080/08985626.2011.592547#preview

Smutz, W., & Weidemann, C. (2008). Economic Development in Challenging Times: The Penn State Outreach Response. *Continuing Higher Education Review, 72*, 44-56.
http://www.eric.ed.gov/PDFS/EJ903436.pdf

Tornatzky, L. G., Waugaman, P., & Gray, D. (2002). *Innovation U.: New University Roles in a Knowledge Economy*. Durham, N.C.: Southern Growth Technology Council & Southern Growth Policies Board.
http://www.southerngrowth.com/pubs/pubsindex.html

Wang, J., & Shapira, P. (2012). Partnering with Universities: A Good Choice for Nanotechnology Start-Up Firms? *Small Business Economics, 38*(2), 197-215.
http://www.springerlink.com/link.asp?id=100338

Youtie, J., & Shapira, P. (2008). Building an Innovation Hub: A case study of the transformation of university roles in regional technological and economic development. *Research Policy, 37*(8), 1188-1204.
http://dx.doi.org/10.1016/j.respol.2008.04.012

Yusuf, S., & Nabeshima, K. (2007). *How Universities Promote Economic Growth*. Washington, D.C.: World Bank.
http://elibrary.worldbank.org/content/book/9780821367513

Endnotes

1.) Kerr, C. (2001). *The Uses of the University* (5th ed.). Cambridge, Mass.: Harvard University Press. p. xii
Clark Kerr's career in higher education was extensive and included appointments as the twelfth president of the University of California and also the first Chancellor of the California University System. He delivered his first Godkin Lecture at Harvard in 1963 and introduced his vision of the "multiversity." The Godkin Lectures and his many follow-up essays (1972, 1982, 1995, and 2001), are chronicled in his 2001 book *The Uses of the University*. In its early years, according to Kerr, the American university started simply as "a single community—a community of masters and students." This early version of the American university, for a long time, followed the European university oligarchy style framework of the eighteenth century which often "stood like castles without windows, profoundly introverted." Kerr's 1963 concept of the multiversity was inspired by his belief that universities in the United States, at the time, were "at a hinge of history" and were poised to contribute so much more to society. Designed to illustrate and assess some of the significant new developments in American higher education, Kerr's Godkin Lectures advocated that "higher education is being scrutinized in all its aspects" and "this reflects the increasing recognition of its uses in economic growth." See pages ix, 1, & 8.

2.) Chesbrough, H. W. (2006). *Open Innovation: The new imperative for creating and profiting from technology*. Boston, Mass.: Harvard Business School Press. See discussion "*Harnessing University Research*," pp. 188-190 and "*Public Policy and Open Innovation*," pp. 191-194.

3.) Tornatzky, L. G., Waugaman, P., & Gray, D. (2002). *Innovation U.: New University Roles in a Knowledge Economy*. Durham, N.C.: Southern Growth Technology Council & Southern Growth Policies Board.
http://www.southerngrowth.com/pubs/pubs.html#tech.
Specific areas of study about these 12 institutions included: (1) Industry research partnerships; (2) Technology transfer; (3) Industrial extension and technical assistance; (4) Entrepreneurial development; (5) Industrial education and training partnerships; (6) Career services and placement; (7) Formal partnerships with economic development organizations; (8) Industry/university advisory boards and councils; (9) Faculty culture and rewards; and (10) Leadership/structures, policies, and institutionalization.
Ordering the case studies in what seemed to the researchers "to be a logical unfolding, first is Georgia Tech, which, by the votes received from our panel judges, can be considered as the most advanced in the activities studied" (p. 22). The other 11 universities, in alphabetic order of the land grant institutions included North Carolina State University, Ohio State University, Pennsylvania State University, Purdue University, Texas A&M University, the University of Wisconsin, and Virginia Polytechnic Institute and State

University. Public non-land grant universities included the University of California at San Diego and the University of Utah. Finally, two private institutions recognized in the study were Carnegie-Mellon University and Stanford University.

4.) Chesbrough, H. W. (2006). *Open Innovation: The new imperative for creating and profiting from technology*. Boston, Mass.: Harvard Business School Press. Also, for a more recent Open Innovation discussion and an examination of how this model impacts state public policy, "particularly the practice of technology-based economic development in weak R&D states," see:
Mayer, H. (2010). Catching Up: The Role of State Science and Technology Policy in Open Innovation.
Economic Development Quarterly, 24(3), 195-209.
http://edq.sagepub.com/content/early/2010/05/13/0891242410366563.abstract

5.) See: Saxenian, A. (1994). *Regional Advantage: Culture and Competition in Silicon Valley and Route 128*. Cambridge, Mass.: Harvard University Press. In this book AnnaLee Saxenian discusses how a wave of talented technology industry professionals moved to the decentralized co-operative industry style culture of the Silicon Valley region. She highlights how Silicon Valley, and its relationship with Stanford University, developed in comparison to the very similar development (however, with very a different outcome) of the Boston, MA. - M.I.T. areas (commonly known as route 128). Silicon Valley is often cited as economically developed around an Open Innovation culture in contrast to the Boston area Closed Innovation way of life.

6.) Chesbrough, H. W. (2006). *Open Innovation: The new imperative for creating and profiting from technology*. Boston, Mass.: Harvard Business School Press. See discussion "*Harnessing University Research*," pp. 188-190 and "*Public Policy and Open Innovation*," pp. 191-194.

7.) Smith, H., & Bagchi-Sen, S. (2012). The Research University, Entrepreneurship and Regional Development: Research Propositions and Current Evidence. *Entrepreneurship & Regional Development, 24*(5-6). See pages 385-391.

8.) Lendel, I. (2010). The Impact of Research Universities on Regional Economies: The Concept of University Products.
Economic Development Quarterly, 24(3), 210-230.

9.) Smith, H., & Bagchi-Sen, S. (2012). The Research University, Entrepreneurship and Regional Development: Research Propositions and Current Evidence. *Entrepreneurship & Regional Development, 24*(5-6). See pages 385-391.

10.) Youtie, J., & Shapira, P. (2008). Building an Innovation Hub: A case study of the transformation of university roles in regional technological and economic development. *Research Policy, 37*(8), 1188-1204.

11.) Christensen, C. M., & Eyring, H. J. (2011). *The Innovative University: Changing the DNA of Higher Education from the Inside Out* (1st ed.). San Francisco: Jossey-Bass.

12.) Lerner, J. (2009). *Boulevard of Broken Dreams: Why public efforts to boost entrepreneurship and venture capital have failed and what to do about it*. Princeton: Princeton University Press. See pages 16-17.

13.) Toon, J. (2013). Georgia Tech's VentureLab Ranks Second Among University-Based Incubators Worldwide. Georgia Tech Online News Release, July 15th, 2013. http://www.gatech.edu/newsroom/release.html?nid=222991

14.) Toon, J. (2012). Pindrop Security: Georgia Tech Spinoff Secures Silicon Valley Funding for Phone Security Technology. Georgia Tech Research News, January 12th, 2012. http://www.gtresearchnews.gatech.edu/pindrop-security/

15.) Fleming, Stephen. 2013. "Pindrop Security Shoots for the Moon" *Academic VC, Stephen Fleming's blog about academia, venture capital, and spaceships*, July 28. http://academicvc.com/2013/06/24/pindrop-security/

16.) Georgia Tech, College of Engineering News Release. (2012). *Georgia Tech Company CardioMEMS wins Intel Innovation Award*
http://coe.gatech.edu/content/georgia-tech-company-cardiomems-wins-2012-intel-innovation-award

17.) CardioMEMS News Releases Available at: http://www.cardiomems.com/content.asp?display=news

18.) Terraso, D. (2004). Technology Square Receives International Award for Excellence in Land Use. Georgia Tech Online News Release, November 15th, 2004. http://www.whistle.gatech.edu/archives/04/nov/15/uliaward.shtml

19.) Toon, J. (2009). Georgia Tech Played a Key Role in NCR\'s Relocation to Georgia. Georgia Tech Online News Release, June 11th, 2009. http://www.gatech.edu/newsroom/release.html?nid=46299

20.) Cardin, E. (2011). Tech, GE Partners for Smart Grid Center. Georgia Tech Online News Release, January 27th, 2011. http://nique.net/news/2011/01/27/tech-ge-partner-for-smart-grid-center/

21.) Georgia Tech, Office of the President (2012). Georgia Tech 2012 Annual Report: The Power of Strategic Partnerships. http://www.gatech.edu/president/ar2012/helping-economies-thrive

22.) Toon, J. (2013). Innovation Ecosystem Draws AT&T, other Corporations to Georgia Tech and Midtown Atlanta. Georgia Tech Online News Release, August 27th, 2013. http://www.gatech.edu/research/news/innovation-ecosystem-draws-att-other-corporations-georgia-tech-and-midtown-atlanta

Author Note

As of the publication of this article (2014), Gregory T. Owen serves as Director of Human Resources, and a member of the senior management team, for the Georgia Tech Enterprise Innovation Institute (EI^2) in Atlanta, GA. He completed his graduate studies at Georgia State University with a PhD. in Educational Policy and an MS in Educational Psychology. He has over 13 years experience working in higher education and in the field of human resources. His research interests include policy and organizational development, change management, and qualitative research design.

Correspondence regarding this article can be addressed to: Gregory T. Owen, EI^2 Technology Square, 75 Fifth Street NW (Suite 380), Atlanta, GA. 30308. Phone: 404-385-3290 & Email: gowen@gatech.edu