Enhancing Economic Growth? University Technology Commercialization

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1. INTRODUCTION

Local and national governments are putting universities under constant pressure to promote economic growth. Commercialization of technology has been identified as the main mechanism by which universities can do this. Existing studies attempt to find one silver bullet that will work for all universities. However, universities are located in specific geographic environments with their own history, which inevitably affects their ability to commercialize technology. Most studies on commercialization of technology do not take those specific conditions into consideration.

Traditionally, universities have the two roles of teaching and research, so it is important to understand how they became involved in and implemented technology commercialization, in what has become their third role. Adding commercialization to the university’s roles began in the nineteenth century. A catalyst in this process was the development of important products and services and the reliance on research in two world wars. The importance of universities’ research during that period shifted the view on universities to one as a tool for social change.

In addition, the role of the university has come to include a responsibility for training the work force and working on applied research. The job training aspect was a direct result of changes in modern society. Modern industrial economic growth required highly trained work force, something universities were in a position to provide (Scott, 1977). Adding to this pressure was the extent of government funding that the universities receives (Russell, 1993). Training a qualified labor force is typically an expensive endeavor, it requires increasingly greater investment. However, no individual company can support such an investment, and even more so, individual companies are not likely to make such an investment, especially if the output benefits other corporations (Kenney, 1986). Hence, governments became the main source of university research funding. As a result of becoming s benefactors of public funding, universities were pressured to make a return to society.

As part of “paying back the community,” universities make contributions through research and development (R&D), collaborations, and technology transfer to industry (Minshall et al., 2004). In this way, universities become engines of local economic growth through the commercialization of research. The outcome of these efforts can be seen in an analysis of universities’ ability to commercialize technology. The many studies on technology
commercialization and best practices indicate that this new role of technology commercialization is not performed equally at all universities nor is it equally rewarding everywhere.

This paper takes the view that there is no silver-bullet method suitable for university technology transfer everywhere and therefore adds the important elements of history and environment in analyzing a critical case study of commercialization of technology at one university: the Georgia Institute of Technology. This university represents a critical case study of a research university that is rapidly growing and developing and a prime example of a university where previous findings regarding best practices for technology transfer should work. We find that to best serve its state as a public university, this relative newcomer to technology commercialization designed and organized its technology transfer activities around its local environment and historical strengths, unlike other universities that tried to follow a general trend in technology commercialization.

2. WHAT AFFECTS COMMERCIALIZATION AT UNIVERSITIES?

Studies on university technology commercialization best practices found conflicting information (Rothaermel et al., 2007). They mostly overlook the fact that each university operates in a different legislative, financial, and cultural setting and therefore needs to allocate different resources to become successful at commercialization.

External University Factors

External factors that influence the commercialization process are found in the economy and legislation at both national and regional levels (Rahm et al., 2000, O'shea et al., 2005, Lawton Smith, 2006). Among federal legislation and regulations in the United States, the Bayh-Dole Act of 1990 has had a marked effect on the relationship between university and industry (Mowery and Sampat, 2001b). The law requires faculty members who conduct research using federal grants to disclose inventions created as a result of that research to the Technology Transfer Office (TTO). European countries, seeing the impact of the Bayh-Dole Act, especially in regions like Silicon Valley, have tried to replicate this success by creating incentives and a welcoming climate for technology transfer (Lawton Smith, 2006).

The relationship between industry and universities is important in studies of successful technology transfer and commercialization. By viewing these relationships in the context of
national and regional innovation systems and the triple-helix theories, the environment in which universities operate and the relationship between firms and institutions emerge as important factors in influencing their ability to innovate and bring products to market (Nelson, 1993, Etzkowitz, 1995).

In addition to being obliged to contribute to the national economy, universities also feel the same push at a local level. As a result, these innovation systems are also found at the regional level. Cooke (2002) presents a correlation between the two:

Clearly, by no means all innovation interaction can or even should occur locally, but the rise of the entrepreneurial university and promotion of the so-called “triple-helix” of interaction between industry, government and universities as a key feature of the knowledge economy testifies to the practical evolution of interactive innovation process. (p. 136)

Some regions with innovative organizations that are connected through joint research programs, policies, and social networks “combine learning with upstream and downstream innovation capability” (Cooke and Morgan, 1998, p.71). These regions are especially important in that firms have easier access to knowledge and ideas. These systems, in which the university is able to operate, have a significant, but not sole, impact on the university’s ability to transfer knowledge and ideas to the private market (Morgan, 1997).

**Internal University Factors**

In addition to the importance of the effect of external factors on the university’s ability to commercialize technology, there are internal university factors that can also have an effect. Various studies indicate that the three most important factors are the university’s entrepreneurial activity, technology-transfer policy, and technology-transfer organization (Clark, 1998, Etzkowitz, 1998, Bercovitz et al., 2001, Shane, 2004, Link and Scott, 2005, O'shea et al., 2005, Breznitz, 2011).

Several studies identify university culture as an integral component of technology commercialization. Clark (1998) highlights the importance of the cultural climate of the entire university and asserts that all departments and research centers, not just the leadership, play a vital role in promoting entrepreneurial activity. Moreover, Kenney and Goe (2004) found that the culture within the scientist’s department, including individual colleagues, has an effect on his/her entrepreneurial spirit. Moreover, the scientist’s university of residence can also direct his or her
“professional entrepreneurship and corporate involvement” (Kenney and Goe, 2004, p. 204) and influence his or her ability to innovate and commercialize technologies (Bercovitz and Feldman, 2007). Bercovitz and Feldman (2007) argue that the likelihood that the scientist will participate in commercialization and technology transfer activities and file inventions will be greater in an atmosphere in which entrepreneurship is encouraged and supported—that is, the department chair and peers within that culture also file inventions. Further studies found that the mission statement of a university in many cases offers a window into the commercialization culture and organization of the institute. For technology commercialization especially, mission statements indicate an institution’s commitment to economic development in general and technology and research commercialization in particular (Breznitz, 2011).

Another factor that affects technology transfer and output is the physical organization and management of the university—in particular, the university’s Technology Transfer Office (TTO) or in some universities the Technology Licensing Office (TLO). Moreover, studies indicate that the characteristics of the university TTO influence the level of spinout activity for that institution (Bercovitz et al., 2001, Owen-Smith and Powell, 2001, Shane, 2004, Chapple et al., 2005, Lockett and Wright, 2005, O’shea et al., 2005). O’Shea et al. (2005) found that historical background and past technology transfer success predict a university’s future capability and options with regard to spinout formation. The quality and number of personnel at a TTO, which reflect its resources, influence the flexibility and trust of the university. If a TTO has a highly credentialed and knowledgeable staff, inventors and investors will be more willing to work with it (Shane, 2004, Lockett and Wright, 2005, O’shea et al., 2005). Studies by Clarysse et al. (2005) and Lockett and Wright (2005) found that the TTO’s business development capabilities have a positive influence on startup formation. The use of outside lawyers can also affect output. Siegel et al. (2003) found that resources dedicated to outside counsel reduce the number of licensing agreements but increase revenues from the agreements made. Breznitz (2011) found that the concentration of commercialization activities in one unit within the university, policy clarity, and professional staff are important factors that promote prompt and productive technology commercialization.

Several studies have explored the importance of academic policies that affect the relationship between universities and industry. In particular, they have examined the effects of intellectual property rights (IPR) with regard to patents, licenses, and spinout companies and
how they influence the effect of technology transfer on that relationship. IPR policies at universities refer to copyright on academic publications, such as journals and books, or to patents filed by the university for inventions that were created as a result of research there. Ownership of these inventions shapes the analysis of IPR policies in general, not only because the definitions change from one university to another but also because of the differences between TTOs in culture, history, and organization. For instance, one university might wholly own inventions while at another ownership is determined by the source of funding (Siegal and Phan, 2005). One factor that encourages and enhances technology licensing is assigning a higher share of royalties to the inventor. According to Link and Seigel (2005), “Universities that seek to enhance licensing should allocate a higher share of royalties to faculty members” (p. 179). Another important policy influence on technology transfer and commercialization is the university’s willingness to contribute equity for patenting and licensing expenses. Di Gregorio and Shane (2003) state that universities that are willing to take on this expense have a higher rate of spinning out companies than universities that are not. Further studies by Shane (2004) indicate that a university’s policies have a marked influence on its spinouts. He finds that the following factors are important in determining the rate of creating spinout companies: allowing exclusive licensing, allowing a leave of absence, permitting the use of university resources, the size of the share of royalties allocated to inventors, and providing access to pre-seed-stage capital.

3. METHODS

This is an empirical case study of the factors that affect commercialization of technology at a university. The specific case examined here is the Georgia Institute of Technology (Georgia Tech) and the steps it took as a university that was new to commercialization, yet became one of the top ten commercializing universities in the United States.¹ Data for this study was collected through two sources that support such data: The Patent Board and the Association of University Technology Managers (AUTM). First, the selection of the case study and comparable institutes was based on the patent scorecard for 2009. The Patent Board, which is a private business, provides information regarding the technology and patent strengths of each university.²

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¹ According to the 2009 patent scorecard.
² The score for each institution is based on five categories (Patent Board, 2009):
Technology Strength™: Indicates overall strength of the company’s patent portfolio holdings with a combined measure of quality and quantity.
Industry Impact™: Indicates the extent to which other institutions are building upon a portfolio of issued U.S. utility patents, compared with a
Second, the authors used the Association of University Technology Managers (AUTM) licensing surveys, which provided information regarding public and private investment, spinout companies, and licenses for each of the institutions (Association of University Technology Managers (Autm), 2009, Association of University Technology Managers (Autm), 2005). In particular, the authors used the 2009 survey to compare the data to the patent scorecard of 2009. The 2005 licensing survey was added to allow an historical perspective. Third, universities’ web sites revealed information regarding their technology commercialization policies and organization. Fourth, the researchers conducted interviews with Georgia Tech administrators, including directors and managers. These interviews provided an in-depth look into the operations and organization of technology commercialization at the university and how commercialization was achieved using various university resources.

This study compares Georgia Tech to the other institutions listed in the top ten (in a ranking of 124 institutions)³ “University Leaders in Innovation” by the Patent Board (2009): California Institute of Technology, Cornell University, Massachusetts Institute of Technology, Stanford University, University of Michigan, University of North Carolina–Chapel Hill, University of Texas–Austin, and University of Wisconsin–Madison. These universities made the list because of the “relative strengths of their patent portfolios” in terms of both overall quantity and quality.

4. THE CASE OF GEORGIA TECH

This section analyzes and compares Georgia Tech by using the factors identified in the literature review. We start by examining the historical and environmental factors in which the university operates. The following section reviews internal university factors: culture, organization, and policy to commercialize technology and Georgia Tech.

External University Factors at Georgia Tech

The Georgia Institute of Technology was established in 1885 as the Georgia School of Technology as part of an attempt to reconstruct the South and create the “New (Industrial)
The Georgia School of Technology, which was built on land donated by the state, originally trained students by using model factories to help develop agricultural technologies (O'mara, 2005). Initial conversations regarding the pursuits of the school focused on whether its curriculum would use a practical approach, based on that of the Worcester Free Institute, or a more academic approach, similar to the model used by the Massachusetts Institute of Technology. The school’s formation committee, which was created by Georgia’s state legislature and headed by two former Confederate soldiers, decided that the institute would combine both approaches and provide a well-rounded education in a post–Civil War South. The state of Georgia appropriated $65,000 for buildings, land, and other costs associated with operating the school for one year (Georgia Tech).

Georgia’s congressional representation played a heavy role in contributing to Atlanta’s industrial growth, especially in the 1950s and 1960s, during the cold war era. Because two Georgians played influential roles on the House Armed Services Committee during that critical period, Georgia was the recipient of many military contracts, and its industrial capacity grew exponentially. By 1960, the state was home to fifteen new military installations (O'mara, 2005). Georgia Tech benefited from these contracts in the form of not only increased federal R&D grants for military objectives but also new relationships with the private sector. These interactions created the need for a university liaison to foster beneficial relationships between the various entities, and, to that end, the Engineering Experiment Station (EES) created the “Industrial Associate Program.” By paying a standard fee of $15,000 every three years, corporations could fund research at EES and help direct how the money was used, and, in turn, EES would offer the services of its research staff to those firms (O'mara, 2005, 1988).

By 1969, a survey of Atlanta firms indicated that Georgia Tech and its resources were responsible for creating 29 companies, which generated over $23 million in sales and employed 1,400 workers (O'mara, 2005, 1988). The promise of such growth spurred discussions by city officials regarding the creation of a science park. In the early 1960s, Paul Duke, a prominent alumnus, offered a large swath of land in the northern part of the city. Though the land is located more than 10 miles away from the main campus, city officials thought that it was a prime location for the skilled workers it was hoping to attract (O'mara, 2005). That is, the location

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4 It was renamed the Georgia Institute of Technology in 1948.
5 EES, which later became GTRI. More about GTRI can be found in the section on internal university factors.
offered insulation from the racial and economic residents that surrounded Georgia Tech’s campus. Following its institution’s mission statement, the Georgia Tech administration, under the leadership of President Edward Harrison, thought that university-related development should be focused on urban renewal projects in areas proximate to the campus, and it withdrew support of the park development. Technology park development went ahead without any university partnership. In 1982, it was home to 40 companies, which employed more than 2,500 people (O’marra, 2005).

The state of Georgia developed a series of programs to help elevate its status as a destination for firms related to high technology industry. In 1990, the Georgia Research Alliance (GRA) was created as a collaborative partnership among the six research universities in the state. These universities, Clark Atlanta University, Emory University, Georgia Tech, Georgia State University, Georgia Health Sciences University, and the University of Georgia, were brought together to help foster economic development through their research capabilities (Georgia Research Alliance, 2011). The GRA has leveraged $225 million in state funding to generate more than $2.5 billion in federal and private investment in its first twenty years. By promoting partnerships between business, government, and the universities, the alliance’s primary aim was to build a technology-driven economy (Georgia Research Alliance, 2011).

In 2002 the GRA created the Georgia Research Alliance Venture Fund. The fund invests in the six research universities to allow inventions to leave the lab and develop into a commercial product. The fund’s investors are the state of Georgia, private individuals, corporations, and foundations. Research enterprises can go through four stages of investment. Phase I and II provide commercialization grants for a university lab totaling $150,000. Firms that receive the funds are required to go through the GRA VentureLab education program, which at Georgia Tech is managed by the ATDC. Researchers are expected to collaborate with the ATDC and apply to the GRA for funding. The proposal is then considered by a committee made of representatives from the six universities. In Phase III, the company can apply for a loan up to $250,000. The request is then considered by the GRA committee as well as an outside committee made up of lawyers, venture capitalists, and entrepreneurs. The loan has favorable terms, with 4% APR up to seven years. In Phase IV, as limited partnerships, firms that have completed the

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6 The funding goes directly to the university while the faculty involved must participate in the training.
VentureLab program can apply for up to $1 million from the fund. The application is considered at the investor level only. There is no university involvement.

By helping universities attract intellectual talent, invest in infrastructure, and provide funding to advance commercialization of the new technology, the GRA aimed to fulfill its mission of creating economic opportunity through university-based innovation (Georgia Research Alliance, 2011). Though the GRA was funded primarily through grants from private foundations and industries, investments were part of the state budget and were approved by the legislature (Georgia Research Alliance, 2011). Current economic conditions have threatened the funding of the organization – the current governor, Nathan Deal, proposed cutting the organization’s annual funding from $17 million to less than $4 million for fiscal year 2012 (Stuart, 2011).

In addition to the GRA, Georgia’s Traditional Industries Program (TIP) was created in 1994 as a partnership among the state government, the University System of Georgia, and the state’s three traditional industries – paper, food processing, and textiles. Since its beginnings, TIP has conducted more than 200 R&D projects in these three areas across the state. More than $80 million has been invested in R&D since the program’s inception to help close the gap between research and practice and to increase these sectors’ competitiveness within the state and beyond (Economic Development Institute).

At the federal level, the Bayh-Dole Act of 1990 has been influential in incentivizing cooperation between industries and institutions. By allowing the institution to elect to retain title to inventions related to federally funded work, this law has allowed universities to market inventions and benefit from their inventions and innovations (Association of University Technology Managers (Autm), 2011). The Office of Technology Licensing has stated that, as a result of the Bayh-Dole Act, Georgia Tech secured 786 patents and 592 active licenses by 2011. In addition, the university has been able to increase its sponsored funding and recruit top faculty and researchers, and in 2010, it secured a record $557 million in awards (Georgia Tech, 2011).

The varied technology commercialization history and environment, especially at the state level, have shaped Georgia Tech’s view and ability to transfer knowledge and commercialize technology. Inconsistent support at the state level, coupled with the original mission of the university to create jobs for the state, had a significant impact on building up the industrial infrastructure of the university. Moreover, public-private partnerships gained importance with
the increase in federal funding. Though the state’s financial contribution to the university decreased in the second half of the twentieth century, it provided support through the creation of programs that encouraged public-private partnerships. These programs helped facilitate intra-university collaborations and helped partner industry with firms. These collaborations, which were further strengthened by the discriminatory development plans implemented by city officials in the 1960s, allowed the university to optimally employ the support from the federal and state government, strengthen its ties with private industry, and build up its commercialization services.

**Internal University Factors**

Existing studies show that internal university factors strongly affect the ability of a university to commercialize its technology. In particular, studies refer to a university’s culture, policy, and technology commercialization organizational structure. This section examines internal university factors at Georgia Tech and finds that Georgia Tech’s commercialization is based on its creation as a public university with a goal of contributing to the local economy. Hence, knowledge transfer and technology policy focuses on industrial collaboration and university spinout companies.

**University Commercialization Culture at Georgia Tech**

Georgia Tech’s mission statement focuses on the state of Georgia as the main beneficiary of its innovation and teaching. In particular, the university’s mission is “to provide the state of Georgia with the scientific and technological base, innovation, and workforce it needs to shape a prosperous and sustainable future and quality of life for its citizens” (Georgia Tech, 2010c). Though Georgia Tech was not established as a land grant university, the university’s early years were dedicated to workforce development and training. As Atlanta strived to move beyond recovering from the Civil War, the school sought to abandon the model factories in favor of technology research and engineering projects around the state. This desire to shift direction had little support from state officials, and the school continued to promote the regional economy by providing technological training through the end of the nineteenth century (O'mara, 2005).

Another indicator of a university’s entrepreneurial culture is its close ties with industry. Historically, industrial research at Georgia Tech was conducted mainly through the Georgia
The establishment of the EES in 1919, which was authorized by the state assembly, was a response to the school’s frustrations regarding expansion of its academic program. However, it was mostly a symbolic move; in its early years the state neglected to fund the program. Sixteen years after its inception, the state finally allocated $5,000 toward programs that addressed engineering problems with a stated connection to Georgia’s economic interests (Gtri, 2009c, O'mara, 2005). This effort, coupled with “Forward Atlanta,” a 1920s economic development campaign that rebranded Atlanta as a regional business center (O'mara, 2005), marked a new era of using the school, its resources, and Atlanta’s location to attract out-of-state firms and corporations. The “Forward Atlanta” initiative and the EES contributed to a strong business community that heavily influenced the growth and direction of Atlanta’s economy.

In the 1950s, innovators at the EES wanted to capitalize on the technologies and inventions that emerged from the work performed there. This resulted in the creation of Scientific Atlanta, a firm that produced telecommunications products based on technologies developed at the EES. This move was not supported by members of Georgia Tech’s administration, who feared the possibility of conflicts of interest that could interfere with the work of the EES. In addition, they thought that contracts that would normally be awarded to the EES were being assigned to Scientific Atlanta (Gtri, 2009d). Scientific Atlanta was a major producer of telecommunication products that was acquired by Cisco in 2006 (Cisco, 2011). As the cold war came to an end, defense research spending in the federal budget decreased, markedly so during the administration of Bill Clinton. Georgia Tech adapted to this change by adapting the GTRI’s mission, strengthening its industrial partnerships, especially in the areas of transportation, medical technology, and modeling, simulating, and testing (Gtri, 2009b). In 1984, on its fiftieth anniversary, the EES officially became the Georgia Tech Research Institute (GTRI) (Gtri, 2009a).

Compared to other top research universities, Georgia Tech has established relatively strong connections with industry. This is especially evident in the amount of funding the university receives from private industry and also in terms of the number of patents it holds. The university has received, on average, $45 million from private industry every year. Though it does not fare as well as peer institutions (see Table 1) in terms of both government and overall

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7 Read more about GTRI/EES in the section on Georgia Tech external factors.
research expenditures, Georgia Tech has won more awards from industry. Moreover, the patent scorecard reveals that Georgia Tech’s patented innovations are more likely to be built upon than those of most institutions.8

<table>
<thead>
<tr>
<th>University</th>
<th>Industrial Expenditure</th>
<th>Industrial Impact*</th>
</tr>
</thead>
<tbody>
<tr>
<td>MIT</td>
<td>$79,783,825.00</td>
<td>1.94</td>
</tr>
<tr>
<td>Cal Tech</td>
<td>$21,362,988.00</td>
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<tr>
<td>Georgia Tech</td>
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</tr>
<tr>
<td>Stanford</td>
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<tr>
<td>UNC–Chapel Hill</td>
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<tr>
<td>UW–Madison</td>
<td>$3,118,440.00</td>
<td>0.83</td>
</tr>
</tbody>
</table>

*Based on the Patent Board’s 2009 patent scorecard.

Table 1 –Georgia Tech’s industrial relationship strength.

In addition to the university’s strong relationship with industry, Georgia Tech encourages innovation among its students. The InventurePrize@GeorgiaTech, a competition created by the faculty and aimed at undergraduate students at Georgia Tech, is a high-profile event that seeks to create an entrepreneurial and innovative climate at the university using a bottom-up approach:

The goal … is to encourage an interest in invention, innovation, and entrepreneurial lifestyle amongst GT students and create an infrastructure, culture, and focus that galvanizes, captures, and highlights student inventiveness and inventorship. (Georgia Tech, 2010d)

This competition contributes to the entrepreneurial culture of Georgia Tech by fostering innovation and technological advancement at the undergraduate level. Contest entries are judged on their innovation, marketability, size of the market for the innovation, probability of success of

8 The reference to patents that are “more likely to be built upon” is based on the patent scorecard factor “Industry Impact”. As indicated in the method section, Industry Impact™: Indicates the extent to which other institutions are building upon a portfolio of issued U.S. utility patents as compared with a total set of patents.
the business idea, and drive of the inventor. The winner is awarded a $15,000 cash prize and is offered patent counsel through the GTRC, and, if applicable, the GTRC will file a patent on the winner’s behalf and assume any associated costs (Georgia Tech, 2010b). Additional benefits include having access to business counsel and other resources that could help increase the marketability of the invention and opportunities for raising capital to support the idea (Georgia Tech, 2010b).

The Business Plan Competition, which was started in 2001, is a similar program administered by the College of Management and aimed at both Georgia Tech students and alumni. The competition has been credited with building up the local community and economy:

The Business Plan Competition is an important contributor to the expansion of entrepreneurship locally, regionally, nationally, and internationally. Each year, the competition draws from 60 to 70 leading venture capitalists, entrepreneurs, and business people to participate as judges and workshop presenters. (Georgia Tech, 2010a)

The competition guidelines state that entrants must develop a business plan that is both viable and sustainable and built on the idea that the technology or service has a viable market. There are both cash and service prizes awarded to the top winners in the competition (Georgia Tech, 2010a).

**University Commercialization Organization at Georgia Tech**

There are two pathways to commercialize technology transfer at Georgia Tech. The first is through the GTRC, which contains the Office of Technology Licensing (OTL), and the second is through the EII, which contains the ATDC. The GTRC is primarily concerned with patents and licensing. The EII in general and the ATDC in particular are responsible for incubating firms and spinning out companies that promote the technologies being developed on campus. That said, all contracts for spinout companies must go though the OTL and the GTRC. Moreover, the EII supports technology partnerships and economic development and connects companies to R&D, education, and other resources at Georgia Tech.9

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9 [http://innovate.Georgia Tech.edu/about-us/a-message-from-the-vice-provost/]
Figure A - Technology commercialization at Georgia Tech. Technology transfer is based in two parts of the institute: at the Enterprise Innovation Institute and at the Georgia Tech Research Corporation. Marked in circles are all the units involved with technology commercialization. Source: Georgia Tech organizational chart (Gatech, 2011)

The GTRC, established in 1937 as the Industrial Development Council, was created to “stimulate industrial development, to promote the fullest utilization of natural resources, and to foster research invention and discovery so as to provide a constantly improving technique in that behalf.”\(^{10}\) The organization is primarily concerned with applying the technological innovations developed at Georgia Tech through technology transfer and fostering relationships with public and private sectors.\(^ {11}\) The GTRC is the body through which funding from different funding agencies is channeled into Georgia Tech.

GTRC serves as the contracting entity for the academic colleges of Georgia Tech while its subsidiary. GTRC supports and promotes research through its stewardship of the funds for sponsored research and the financial support of research activities. GTRC is the owner of intellectual property created at Georgia

\(^{10}\) [http://www.gtrc.Georgia Tech.edu/history/](http://www.gtrc.Georgia Tech.edu/history/)

Tech, and its Office of Technology Licensing (OTL) is responsible for the protection, licensing, and management of the intellectual property portfolio. The E-Commerce and Training Division within OSP is responsible for implementation and administration of electronic proposal submission systems, sponsored programs data, and the administration of electronic commerce functions. The Office of Research Compliance promotes the responsible conduct of research and manages regulatory requirements for human subjects, the use of animal models, the application of export controls, compliance with the conflicts of interest policy, and administration of recombinant DNA regulations. (Gtrc, 2011)

The GTRC provides administrative support to faculty, staff, and students with regard to research administration, contracting, and intellectual property management. The technology commercialization is handled by two units at the GTRC: (1) the OTL, which was founded in 1990 after passage of the Bayh-Dole Act, is responsible for university licensing and tracking of expenses and royalties; it owns all intellectual property that results from research activities and works closely with industry and government to sponsor research at the university; (2) the EII, which provides support for startups and spinout companies.

Studies show that the size and quality of OTL employees, the use of outside attorneys, and past success are indicators of the office’s commercialization ability of the office. The OTL at Georgia Tech has ten full-time employees (seven professionals and three support staff). The seven professionals in this office are focused in the biological and physical sciences and all have at least a secondary-school education. In fact, all have advanced degrees (MBA, MS, JD, etc.). Moreover, two out of the seven professionals are attorneys. The office uses outside attorneys mostly for patenting. However, outside counsel is used as needed for other contractual and transactional needs. Georgia Tech has not earned revenues in the hundreds of millions of dollars. However, the office does receive about $500,000 a year in some deals. Excluding the deals in biomedical fields, Georgia Tech compares favorably with Stanford in terms of the level of royalties.

The second avenue through which technology commercialization occurs is in several units within the EII. Spinout and startup activity is encouraged through the Startup Services Unit, where we find the ATDC. The Strategic Partners Unit provides industrial liaison for large corporations seeking to collaborate with Georgia Tech researchers. The Innovation Partners Unit at the EII provides economic development services to Georgia’s communities, technology-transfer consulting to smaller universities in the region, collaboration with the National
Aeronautics and Space Administration (NASA), and Small Business Innovation Research (SBIR) assistance. Funding for university spinouts and startup companies is managed mainly through the office of the vice president and director of the EII, Stephen Fleming.

In 2011 three new programs were created to foster entrepreneurship and innovation at Georgia Tech. GT:IPS provides an expedited license from the OTL and a support system from the ATDC in particular and across campus in general. To receive these benefits, firm founders are required to go through an education program regarding conflict of interest, legal affairs, licensing, and patenting procedures. The second organization is Flashpoint at Georgia Tech. This program, together with the Flashpoint venture capital fund, will invest and provide assistance to firms leaders while they take a semester to learn more about how to build and run their firm. The third program is the Bio-impact Commercialization Team (BCT). This program works closely with faculty members to commercialize translational research in biomedicine.

The organizational structure at Georgia Tech historically supported technology commercialization. Until 2010, both the ATDC and the OTL reported to the vice provost, who reported to the provost, who reported to the president of the university. In 2010, with a structural change at the university, Georgia Tech continued to show its commitment to technology commercialization by eliminating one reporting level. As of 2011, both the ATDC and the OTL report to their directors, who report to the executive vice president of research. This organizational structure demonstrates support for these programs by allowing both units direct access to top-level administration.

**University Commercialization Policies at Georgia Tech**

Existing studies show that intellectual property ownership, royalty share, equity, and exclusive licensing all have an impact on a university’s commercialization ability.

**IPR Policy**

Georgia Tech retains all rights to intellectual property developed under federally funded research. Until recently, the GTRC afforded the same right to private sponsors; however, this severely limited the marketability of the innovation. As a result, the GTRC now retains title to the invention and also gives the industrial sponsor the right of first refusal in licensing the technology. Also, when Georgia Tech releases the title to intellectual property, there is usually a
stipulation that allows it to continue to use or practice the property for academic or research purposes.\textsuperscript{12}

All full or part-time faculty and staff shall, as a condition of employment with the Institute, execute an Assignment of Rights Form, assigning all rights, title and interest, to the extent prescribed in this policy, in any Intellectual Property to the Georgia Tech Research Corporation. Students shall not be required to execute an Assignment of Rights Form except in the cases where they are employees of the Institute. This policy shall, however, be applicable to them and shall be set forth in the General Catalog and Student Handbook. (Gtrc, 2011)

Georgia Tech’s OTL provides exclusive licensing and, even more important, nonexclusive royalty-free licenses, especially for industry-sponsored research deals. These deals are a major part of the reason for the large proportion of Georgia Tech’s industrial expenditures (see Figure B). Royalty shares at Georgia Tech favor the university (Table 2).\textsuperscript{13} Georgia Tech frequently takes equity in firms, a factor that studies indicate has a positive impact on spinout creation.

Table 2 summarizes the breakdown of distribution after the initial payment.

\begin{table}[h]
\centering
\begin{tabular}{|c|c|c|c|}
\hline
 & Next $500k & $501,000–$1 million & >$1 million \\
\hline Creator & 33\% & 33\% & 33\% \\
\hline Unit & 17\% & 27\% & 33\% \\
\hline GTRC & 50\% & 40\% & 34\% \\
\hline
\end{tabular}
\caption{Distribution of net licensing income. Source: (Office of Faculty Career Development Services, 2008).}
\end{table}

\textbf{Spinout Policy}

The ATDC, an organization within the EII, provides startup services. It is a startup accelerator that seeks to launch tech entrepreneurs and create successful businesses. The ATDC has helped launch more than 120 companies since its inception in 1980. Companies at the ATDC are divided into four categories: Stage I, Concept; Stage II, Prototype; Stage III, Production; and

\textsuperscript{12} \url{http://www.osp.Georgia Tech.edu/intellectual-property/}
\textsuperscript{13} \url{http://www.academic.Georgia Tech.edu/handbook/Georgia_Institute_of_Technology_ -Faculty_Handbook_Sep2008.pdf}
Stage IV, Expansion. The ATDC provides assistance to firms in writing a business plan, designing a financing strategy (VC, angels, SBIR), and recruiting employees.

The ATDC also provides incubator and accelerator services. As of 2011, out of 400 firms served by the ATDC serves, 40 were in the ATDC’s incubator. Georgia Tech provides incubator space at three locations: two on Georgia Tech’s campus in Atlanta and one in Savannah. Recently, the ATDC merged with the VentureLab program and the SBIR assistance program\(^\text{14}\) and expanded its services to companies across the development spectrum – from the conception stage to well-established firms.\(^\text{15}\) Because the ATDC is fully funded by the state of Georgia, it offers these services to all Georgia firms.

In addition to the GRA venture fund, funding for university spinouts and for local startups is provided at Georgia Tech through the following funds and programs:

a. ATDC seed fund. The ATDC seed fund was created in 1999 by the state of Georgia and is managed by EII director Stephen Fleming. Because the purpose of the fund was to enhance the creation of jobs in Georgia, the fund invests in startups located in or moving to the state. The maximum funding per company is $1 million. However, the ATDC is restricted in its ability to invest in companies. The fund can invest only $1 for every $3 in private investment. Moreover, the state has not made a contribution to the fund in the past three years.\(^\text{16}\)

\(^\text{14}\) "About SBIR Assistance Program of Georgia"

"The state of Georgia has one of the nation's leading SBIR/STTR assistance programs which, since being established in 2005, has educated and helped hundreds of Georgia entrepreneurs access these sources of federal funds. With the program's direct assistance, 150 companies have submitted one or more proposals resulting in more than $30 million in federal awards. By merging into ATDC, the program will be able to interact with more entrepreneurs across the state, including those who may have never considered applying for federal grants, and bring more of these awards into Georgia's startup ecosystem."

"About VentureLab"

In 2001, Georgia Tech became a founding member of VentureLab, a program of the Georgia Research Alliance (GRA). VentureLab helps build spinout companies around cutting-edge university research. With its emphasis on technologically-grounded business analysis, access to early-stage funds, and recruitment of experienced management, Georgia Tech's VentureLab has launched more than two dozen successful companies and serves as a model for other universities seeking to commercialize their discoveries. GRA's VentureLab Program now extends to four other research universities in Georgia; with an investment of some $13 million from GRA, more than 150 Georgia-based startups have been created around university intellectual property in the state. GRA also recently launched a new venture fund to make equity investments into these spinout companies" (Fleming, S. 2009. VentureLab merges with ATDC [Online]. Available: http://blog.gtventurelab.com/ [Accessed].

\(^\text{15}\) http://atdc.org/about

\(^\text{16}\) The state actually removed $5 million in 2010.
b. Georgia Tech Edison Fund. This fund, created in 2008, invests in Georgia Tech-related companies.\textsuperscript{17} Managed directly by Stephen Fleming, the fund was created from private donations, including the Charles Edison Fund in New Jersey. The fund invests $10,000–$25,000 in each firm.

c. Flashpoint at Georgia Tech. In 2011 following a change in leadership at Georgia Tech, the university launched Flashpoint at Georgia Tech. The program’s mission is to identify early-stage companies with Georgia Tech connections. Like the GRA venture fund, the program is based on a venture fund and an education program. Based in Atlanta, the venture fund is a new private firm called Flashpoint Investments, and it is headed by Sig Mosely, president of Imlay Investment. Flashpoint Investments will invest in selected startups that go through the Flashpoint at Georgia Tech educational program. Nina Sawczuk, the general manager of the ATDC, and Merrick Furst, from the College of Computing, will manage the education program at Georgia Tech. The program will last one semester.

5. DISCUSSION: HOW DOES GEORGIA TECH COMPARE?

At Georgia Tech commercialization of technology might not exactly follow what studies call “best practices,” but that accentuates its success in bringing technologies to market. Georgia Tech’s ability to commercialize its technology successfully is especially apparent when the results there are compared with those at other peer institutions. Georgia Tech’s TTO has one of the shortest histories but it still very competitive with other, more established TTOs. Figure B illustrates a comparison of the commercialization performance of Georgia Tech and other universities in terms of the age of their TTOs.

\textsuperscript{17} Georgia Tech-related companies are companies with strong relationships to tech developed at the university. They include both spinouts and local companies that hire tech students, faculty, and alums from the university.
Figure B: Of the universities on the patent scorecard, MIT leads in terms of commercialization ability. Georgia Tech performs well in terms of the number of spinouts and industry impact, considering the age of the technology licensing office and its research expenditure. Source: Patent Board, patent scorecard (2009).

**University Commercialization Culture**

Working with industry is extremely important at Georgia Tech. Thus, as with the MIT Lincoln Laboratory and SRI International (originally called Stanford Research Institute), with state support the university has created a separate unit, the GTRI, dedicated to industrial research and collaboration with local and national businesses. Its commercialization culture is also reflected in its student invention competitions. Students’ invention competitions at Georgia Tech, like those at the universities with the most spinouts, such as MIT and Stanford, show that the culture at Georgia Tech is oriented toward applied research and inventions. Students can compete at both the undergraduate and the graduate level and promote their inventions with the goal of commercialization. Moreover, the students receive the full support of the institute to patent and commercialize their technologies.
Georgia Tech is one of the leading universities in its positive and supportive attitude and culture toward commercialization. In 2011 alone the university developed three new programs to support technology commercialization. In many ways Georgia Tech is at the cutting edge of the industry university spectrum, working very closely with industry, a situation that has both advantages and disadvantages.18

**University Commercialization Organization**

Georgia Tech has two main units that work on technology commercialization: The ATDC under the EII and the OTL under the GTRC. Six of the nine universities on the patent scorecard have only one office dedicated to technology commercialization. Georgia Tech is competitive with these universities in terms of the number of spinouts and licenses, which might imply that the number of units does not matter.

<table>
<thead>
<tr>
<th>University</th>
<th>Number of Technology Commercialization–Related Offices</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cal Tech</td>
<td>1</td>
</tr>
<tr>
<td>Cornell</td>
<td>1</td>
</tr>
<tr>
<td>MIT</td>
<td>1</td>
</tr>
<tr>
<td>Stanford</td>
<td>1</td>
</tr>
<tr>
<td>UNC–Chapel Hill</td>
<td>1</td>
</tr>
<tr>
<td>UW–Madison</td>
<td>1</td>
</tr>
<tr>
<td><strong>Georgia Tech</strong></td>
<td><strong>2</strong></td>
</tr>
<tr>
<td>Michigan</td>
<td>3</td>
</tr>
<tr>
<td>UT–Austin</td>
<td>3</td>
</tr>
</tbody>
</table>

Table 3: Universities ranking by number of technology transfer offices. Georgia Tech is one of three universities in the patent scorecard that has more than one unit working on technology commercialization.

While its OTL is comparatively young and has a smaller number of employees than other TTOs, Georgia Tech does well in terms of the number of patents and licenses (Association of University Technology Managers (Autm), 2009).19 Comparing Georgia Tech’s commercial output with that of the other universities on the Patent Scorecard, we find a positive correlation

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18 Many studies reflect on the negative impact on universities by working “too close” to industry (Russell, C., 1993. Academic Freedom. Routledge. London. However, this paper does not focus on these aspects.

19 See Table 4.
between the number of employees in a TTO and the university’s income from licenses. This implies that the size of a TTO matters. Previous studies found contradictory results regarding the size of the TTO. However, studies agree that the professionalism of a TTO affects its ability to transfer technology. Data on the professionalism of the employees in the universities studied in addition to Georgia Tech were not available. Large offices might have more funding, employ more experienced employees, use outside lawyers, and be better able to evaluate technologies. As a result, larger TTOs commercialize technology that brings in more revenue.

Table 4

<table>
<thead>
<tr>
<th>University</th>
<th>Number of Employees</th>
<th>Age of TTO (2009)</th>
<th>Number of Licenses</th>
<th>Income from Licensing (in millions)</th>
<th>Presence of Medical School</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cal Tech</td>
<td>5</td>
<td>31</td>
<td>26</td>
<td>47</td>
<td>NO</td>
</tr>
<tr>
<td>UNC–Chapel Hill</td>
<td>6</td>
<td>39</td>
<td>72</td>
<td>3</td>
<td>YES</td>
</tr>
<tr>
<td>Georgia Tech</td>
<td>7</td>
<td>19</td>
<td>59</td>
<td>2.4</td>
<td>NO</td>
</tr>
<tr>
<td>Michigan</td>
<td>9</td>
<td>27</td>
<td>22</td>
<td>18</td>
<td>YES</td>
</tr>
<tr>
<td>Cornell</td>
<td>11</td>
<td>30</td>
<td>64</td>
<td>5.1</td>
<td>YES</td>
</tr>
<tr>
<td>Stanford</td>
<td>16</td>
<td>40</td>
<td>62</td>
<td>65</td>
<td>YES</td>
</tr>
<tr>
<td>MIT</td>
<td>20</td>
<td>59</td>
<td>71</td>
<td>66.4</td>
<td>NO</td>
</tr>
<tr>
<td>UW–Madison</td>
<td>26</td>
<td>84</td>
<td>40</td>
<td>56</td>
<td>YES</td>
</tr>
</tbody>
</table>

Table 4: Universities’ TTOs ranking by number of employees. This table indicates that smaller offices perform just as well in the number of licenses compared with larger offices but do not perform as well in evaluating licensing income. Source: AUTM (2009).

Comparing the scorecard universities using the AUTM data from 2005 and 2009 (Table 4), we find different results with regard to the number of employees versus the number and income from licenses. Cal Tech, UNC–Chapel Hill and Georgia Tech have the fewest full-time employees dedicated to licensing technology—from five to seven. However, UNC has the highest number of licenses issued, and Georgia Tech ranks in the top half of the universities being analyzed. In contrast, the income received from the licenses tells a different story—UNC and Georgia Tech ranked lowest in terms of the level of income received, which corresponds to the number of employees dedicated to licensing. However, this is not the case with Cal Tech. The
University of Wisconsin, MIT, and Stanford all earn the highest licensing income and have some of the largest TTOs (with 26, 20, and 16 employees, respectively).

The comparatively low income from licenses at Georgia Tech might have several explanations, but most are related to the university’s mission, which is geared toward relations between university and industry and the commercialization of technology. The majority of big successes in technology commercialization are related to medical research. The scorecard indicates that Georgia Tech is one of the few that does not have a medical school. Moreover, commercialization of nonmedical technology is usually based on royalty stacking.20 Most products require more than one patent; hence, the royalty per patent is low. Also, inventions in nonmedical fields tend to be product or process improvements, which also have lower returns. Moreover, Georgia Tech has a proportionately high number of nonexclusive royalty-free licenses. As mentioned above, these licenses do not earn any revenue for the university yet it views such licenses as an important component of a positive relationship with industry.

**University Commercialization Policies**

IPR policy at Georgia Tech is similar to that of other universities in that the university retains rights to faculty and staff inventions (Breznitz and Feldman, 2010). Moreover, Georgia Tech’s division of royalties favors the university, which, as with other universities on the scorecard, has a positive effect on its ability to spin out companies.

<table>
<thead>
<tr>
<th>University</th>
<th>Royalty Share for Inventor</th>
<th>Average Number of Spinoffs</th>
</tr>
</thead>
<tbody>
<tr>
<td>UNC–Chapel Hill</td>
<td>40 percent for tangible property and 70 percent for copyright21</td>
<td>2.60</td>
</tr>
<tr>
<td>Cornell</td>
<td>1/3 of royalty22</td>
<td>4.20</td>
</tr>
<tr>
<td>Wisconsin–Madison</td>
<td>For patents and non-copyrightable inventions—20 percent</td>
<td>4.80</td>
</tr>
<tr>
<td>UT–Austin</td>
<td>50 percent23</td>
<td>6.00</td>
</tr>
<tr>
<td>Michigan</td>
<td>50 percent up to $200,000 and 30 percent after that amount24</td>
<td>8.80</td>
</tr>
<tr>
<td>Stanford</td>
<td>1/3 of royalty25</td>
<td>7.75</td>
</tr>
</tbody>
</table>

20 In royalty stacking a product is based on more than one patent.
21 [http://intranet.northcarolina.edu/docs/legal/policymanual/500.2.pdf](http://intranet.northcarolina.edu/docs/legal/policymanual/500.2.pdf)
Table 5: universities’ royalty shares policies and average spinouts. Conflicting results regarding the impact of royalty share on the ability to license technology and spin out companies. Source: Individual university web sites; AUTM (2005, 2009).

<table>
<thead>
<tr>
<th>University</th>
<th>Royalty Share</th>
<th>Average Spinouts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Georgia Tech</td>
<td>1/3 of royalty</td>
<td>8.80</td>
</tr>
<tr>
<td>Cal Tech</td>
<td>25% of royalty</td>
<td>14.2</td>
</tr>
<tr>
<td>MIT</td>
<td>1/3 of royalty</td>
<td>21.0</td>
</tr>
</tbody>
</table>

It is difficult to compare universities’ policies regarding the creation of spinouts. These usually involve case-by-case studies. However, studies show that Georgia Tech’s spinout policies are similar to those of MIT, Stanford, and Yale. These studies show that a supporting infrastructure in the form of business education, assistance with business plans, employee recruitment, and funding for university spinouts encourages innovation and leads to an increase in university-related firms (Breznitz, 2007, Breznitz, 2011, Breznitz et al., 2008, Saxenian, 1994, Shane, 2002).

6. DISCUSSION AND CONCLUSIONS

Studies on university commercialization culture highlight the importance of the university’s mission statement, the research and commercialization of peer employees, and the administration’s attitude toward commercialization. An examination of Georgia Tech finds a university that, from its inception, took its role as a public university as a guide in its focus on technology commercialization. This culture is evident in the extent in which the university collaborates with industry, works on applied research, and encourages faculty and students to innovate. Georgia Tech’s commercialization policy is similar to that of many highly ranked universities. The university owns the intellectual property, has a royalty share in support of spinout creation, and provides assistance for technology licensing and spinout creation.

Studies on the organization of TTOs stress the importance of focusing university efforts through one office that has had success in commercializing technology (i.e., had an innovation go through the process of commercialization and earn royalties). Moreover, studies view the size of the office and the use of an outside legal team as harbingers of success. At Georgia Tech, several units deal with technology commercialization. However, most of the work is done at two units: startup services (ATDC) and the OTL. The ATDC focuses specifically on the creation of

25 http://otl.stanford.edu/inventors/inventors_policies.html?headerbar=1#royalty
26 https://www.ogc.caltech.edu/forms/documents/patentpolicy
27 http://web.mit.edu/tlo/www/community/guide4.html#4.8
startup firms, and decision making regarding patenting and licensing is based at the OTL. The university has not had a big success in its licensing income compared to Yale with Zerit™ or Stanford and UCSF with Recombinant DNA. The university has a relatively small technology licensing office and does not use outside lawyers. These facts alone, according to existing studies, should have impaired the university’s ability to commercialize technology; however, the results of this study show the opposite.

Georgia Tech has had notable success in technology commercialization. The university ranks among top universities in terms of the number of patents and licenses. In the past decade, Georgia Tech has been consistently rated as one of the top ten public universities in the United States by US News & World Report. Considering the pressure that public universities are facing to make a contribution to the economy, Forbes magazine named Georgia Tech one of the best incubators and accelerators of technology firms. Moreover, in view of the size and age of the institution, the amount of its industry-sponsored research and industry collaboration is unprecedented. Because of a clear university mission statement and strong support from its administration, Georgia Tech has been able to make a substantial contribution to Georgia’s economy. Georgia Tech’s policies, culture, and organization are focused on this goal, allowing the university to create an educated workforce, provide an incubator for new firms, and foster industrial collaboration. In the words of one of our interviewees:

If you want to know what I think [is the reason for Georgia Tech’s success] it is three things: The fact that we have no med school and all the expenses related to it; the fact that we lost the Civil War, which created an agenda to build factories and create jobs; and the fact that we are well aware that we are not Silicon Valley, and that is why we have to do more than other places do.

This paper reinforces studies regarding university culture and policy. Policies regarding intellectual property rights, royalties, and spinout companies, as well as a strong entrepreneurial university culture have positive impacts on university technology commercialization. However, the case of Georgia Tech does not conform to studies on university TTOs and organization. In this way, the paper supports former studies that contravene the existence of “one formula” or “the right sauce” to achieve knowledge transfer and technology commercialization. Every university must consider its own historical and environmental context as well as its own resources and capacity.
7. ACKNOWLEDGEMENTS

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