The Florida Senate

Interim Project Report 2002-123 *November 2001*

Committee on Commerce and Economic Opportunities Senator Alex Diaz de la Portilla, Chairman

TECHNOLOGY TRANSFER AND COMMERCIALIZATION

SUMMARY

"Technology transfer" is commonly used to refer to a complex commercialization process through which an entity that develops a new technology, but does not have the wherewithal or desire to bring it to market, transfers that raw technology to another entity that does. Many different types of donor-recipient pairings can engage in technology transfer, including university-to-business, business-to-business, and federal government-to-business. This report, however, focuses on university-to-business technology transfer.

University-industry technology transfer can be a key factor in building a high-skills, high-wage state economy. However, Florida universities, in general, do not appear to be performing as much technology transfer as many of their peer universities.

Although research indicates agreement among university and industry professionals with regard to the existence of certain broad state technology-transfer issues, there is a lack of consensus on how specifically to address a number of those topics. Furthermore, in order to ensure optimal implementation of future solutions, resolution of key issues must be agreeable to both parties in university-industry transactions. It is therefore recommended that the Legislature direct the Florida Board of Education to establish a process that will facilitate the regular meeting of university officials, industry professionals, and state economic development officials for the purposes of discussing state technology-transfer issues, such as those identified in this report; developing solutions to state technology-transfer problems; creating mechanisms by which informal university-industry interaction can be increased; and facilitating synergistic collaboration between state universities located in non-metropolitan areas and those residing in the state's larger cities.

BACKGROUND

"Technology Transfer" Defined and Described

> *The three most important ingredients in economic growth are: people, money and ideas. Ideas are worthless unless someone can make practical use of them. Technology that is locked up and inaccessible cannot grow. It is pretty straightforward that we must do everything possible to incentivize the sharing of creative ideas.*[1]

Research itself cannot generate new products and processes. Successful commercialization of technology also requires capital, production capacity, marketing, and ongoing development.[2] Often, an entity that develops a new technology does not have the wherewithal or desire to bring it to market and, therefore, must "transfer" that raw technology to another entity that does. The term "technology transfer" is commonly used to refer to this complex commercialization process, which is guided by formal procedures and nurtured by informal information exchange and industry partnerships.

Many different types of donor-recipient pairings can engage in technology transfer, including university-to-business, business-to-business, and federal government-to-business. This report, however, focuses on university-to-business technology transfer and identifies associated issues.

Technology transfer between a university and a business can occur in many different ways. The Council on Governmental Relations describes six major models of technology transfer:

[1] Dr. L.M. Wangberg, President/CEO, Enterprise Development Corporation of South Florida, in a letter to staff of the Senate Committee on Commerce and Economic Opportunities, August 15, 2001.

[2] Association of American Universities, *University Technology Transfer of Government-Funded Research Has Wide Public Benefits*, Internet, June 2, 1998.

- Sponsored Research: Typically, a corporation provides funding for a specified statement of work for a limited period of time.
- Collaborative Research: Collaborative research, especially when partially funded by government, enables participants to leverage limited resources in the achievement of mutually beneficial research objectives.
- Consortia: In a university-based research consortium, participating companies join forces and contribute resources, often in the form of an annual fee, to support research in a technical area of common interest.
- Technology Licensing: Consideration for a university license agreement is offered by a licensee to obtain commercialization rights in intellectual property owned by a university.
- Start-up Companies: New companies are established to commercialize a university technology, rights to which are obtained through a license agreement.
- Exchange of Research Materials: Material transfer agreements generally stipulate that the materials are provided for research purposes only and not for commercialization.[3]

A business's use of university faculty as consultants or its hiring of university students could also be considered forms of technology transfer.[4]

The Importance of Technology Transfer

Not only do university-industry partnerships increase the speed and frequency with which new discoveries move from the laboratory to the market, but "university-industry technology transfer can be a stimulant, precursor, or complement to building a high-skills, high-wage state economy."[5] In fact, the licensing of innovations by universities and other research entities added more than $40 billion to the U.S. economy and supported 270,000 jobs in 1999.[6]

Moreover, as described by the Industrial Research Institute, technology transfer provides many other benefits to both businesses and universities.[7] Corporate benefits include accessing expertise not available in corporate laboratories, assisting in the renewal and expansion of a company's technological inventory, gaining access to students as potential employees, using the university as a means of facilitating the expansion of external contacts for the industrial laboratory, expanding pre-competitive research with universities and with other companies, and leveraging internal research capabilities. Technology-transfer benefits to universities include obtaining financial support for a university's educational and research missions; broadening the experience of students and faculty; identifying significant, interesting, and relevant problems; enhancing regional economic development; and increasing employment opportunities for students.

It is important to note, though, that, while technology licensed to either in-state or out-of-state businesses is valuable, it does not result in many of the aforementioned benefits that stem from close university-industry collaboration or from the spin-off of local, university-generated start-up companies. Many state governments recognize that it is through these mechanisms, as well as through the related attraction of research and development-oriented firms from other states, that "university-industry collaborations can play a central role in economic development efforts."[8]

General Steps in Technology Transfer

As the typical first step in the technology-transfer process, a researcher will disclose to his or her university an invention that he or she develops or discovers while an employee of the institution. The university assesses the respective equities of the researcher and the university in the work and determines the extent to which the university should be involved in protecting, developing, and promoting the invention. If the university determines that the invention lacks commercial potential, the university returns the rights to the invention to the researcher, who may pursue commercialization opportunities on his or her own. When the university decides to exercise an interest in an invention, the technology-transfer office typically pursues a patent for the invention, markets the invention to the private sector, and, ultimately, executes a licensing agreement governing use of the invention.

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[3] Council on Governmental Relations, *A Review of University Industry Research Relationships*, Internet, 1996.

[4] Business-Higher Education Forum, *Working Together, Creating Knowledge: The University-Industry Research Collaboration Initiative*, 2001, p. 21.

[5] Association of University Technology Managers, Inc., *Surveys – Common Questions & Answers About Technology Transfer*, Internet, November 13, 2000; Louis G. Tornatzky, Ph.D., *Building State Economies by Promoting University-Industry Technology Transfer* (Washington, D.C.: National Governors Association, 2000), p.7.

[6] Association of University Technology Managers, Inc.

[7] Industrial Research Institute, *A Report on Enhancing Industry-University Cooperative Research Agreements* (Washington, D.C., 1995), p. 1, as cited by the Business-Higher Education Forum, p. 22.

[8] Business-Higher Education Forum, pp. 22-23.

With increasing frequency, universities are having to decide between licensing an invention to an established company or commercializing the technology through a new "start-up" or "spin-off" company that is usually locally based.

> The new companies are established to commercialize a university technology, rights to which are obtained through a license agreement. In consideration for the license, the university may take a small equity position in the startup company in lieu of or in addition to other consideration (fees, royalties, etc.). Most university spinoff companies include the university inventor(s) in the enterprise in some fashion, and the company may rely on the academic research group for the technology base essential to company formation and growth.[9]

If a license generates revenue, the proceeds are typically divided among the university, the researcher, and other relevant parties.[10] For recent statistics regarding the licensing activities of Florida universities, see Exhibits 1 and 2, below.

Existing Statutory and Regulatory Framework

Adoption by Congress in 1980 of the federal Bayh-Dole Act is widely recognized as a milestone in the history of U.S. technology-transfer activities. By vesting universities, as well as other not-for-profit institutions and small businesses, with ownership rights in inventions that arise from federally funded research, the act (Pub. L. No. 96-517) encourages universities to partner with private enterprise to promote commercialization. In exchange for granting title rights, the act requires universities to file patents on inventions they elect to own. The licensing royalties associated with intellectual property rights provide a valuable source of revenue for universities, and the opportunity to employ inventions in their operations encourages businesses to make potentially high-risk investments.

At the state level, a number of statutes, regulations, and policies govern technology-transfer activities.[11] Public universities in the state may create, with the approval of the Department of Education, divisions of sponsored research to administer and promote research programs (s. 240.241, F.S.). Seven state universities have established such divisions.[12] Though individual practices vary, many state universities have established technology-licensing or technology-transfer offices or units that facilitate the movement of university inventions into the marketplace. To that end, each university may secure letters of patent, copyrights, and trademarks on any work products and enforce its rights therein (s. 240.229, F.S.). This authority includes the ability to license, lease, assign, or otherwise give written consent to a corporation for the manufacture or use of a work product on a royalty basis or for other consideration.

The forging of relationships between state university inventors and the private sector is also affected by Florida's Code of Ethics for Public Officers and Employees (part III, ch. 112, F.S.). The code prohibits a university employee from holding employment or contractual relationships with entities doing business with the university, or from holding employment or contractual relationships that create a frequently recurring conflict between the employee's private interests and public duties (*see* s. 112.313(7)(a), F.S.). The code provides an exception when the transaction emanates from the university's technology-transfer and sponsored-research activities – if the transaction is specifically approved by the university president and the chancellor of the Board of Regents.[13]

Technology transfer in this state also is governed by administrative rules applicable to employment in the state university system,[14] the collective bargaining agreement with the United Faculty of Florida, and rules and policies of individual universities. Together the collective bargaining agreement and the universities' rules and policies establish the day-to-day procedures and standards applicable to technology transfer.

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[9] Council on Governmental Relations.

[10] The University of Florida's policy, for example, provides for net adjusted income of up to $500,000 to be divided into the following percentages: 40 percent to the inventor; 10 to the research program within which the invention was developed; 7.5 to the inventor's department; 7.5 to the inventor's college; and 35 to the Office of Research, Technology, and Graduate Education or to the University of Florida Research Foundation, Inc. For net adjusted income of $500,000 or more, the respective percentages are: 25, 10, 10, 10, and 45. *See* University of Florida, *Intellectual Property Policy*, Internet, pp. 10-11.

[11] Numerous education provisions, including the statutory provisions governing sponsored research and technology transfer by state universities, are currently the subject of a mandatory review by the Senate Committee on Education. In addition, the Florida Board of Education is under a statutory requirement to develop a new School Code (comprised of the revision of chs. 228-246, F.S.) by no later than January 1, 2002. (s. 229.0072(4)(n), F.S.)

[12] Auditor General, *Assignment by Universities of Intellectual Property and Related Income to University Research Foundations*, Report No. 01-144, May 2001, p. 1.

[13] Section 112.313(12)(h), F.S. Chapter 2001-170, L.O.F., abolished the Board of Regents effective July 1, 2001, and transferred its functions to the Florida Board of Education (s. 229.003(5), F.S.).

[14] Under rule 6C-5.945, F.A.C., for example, the Board of Regents prescribed employee ethical obligations, including prohibiting employees from engaging in business transactions in substantial conflict with the performance of their duties.

Technology Transfer in Other States

A review of policies from some of the universities in other states[15] frequently cited as technology-transfer leaders suggests that the fundamental steps – inventor disclosure, university ownership assertion, technological and market assessment, patenting, licensing, and royalty distribution – are essentially very similar. Likewise, these universities also have policies governing conflicts of interest that may arise for university inventors.

There are tangible differences reflected in the specific practices and policies of these various universities. Stanford University, for example, relies upon outside patent attorneys to handle patenting and administrative functions and directs the staff of its Office of Technology Licensing to focus foremost on invention marketing. With regard to conflicts of interest, the Massachusetts Institute of Technology (MIT) specifically contemplates that an inventor may have an equity position in a small, tightly controlled company to which an invention is licensed by the university. In such cases, MIT requires the inventor to sign a conflict of interest avoidance statement and requires approval by the university vice president for research before MIT may accept equity in lieu of royalty.[16]

Stanford University, similarly, appears to have a flexible approach to conflicts of interest, recognizing in its policies that conflicts of interest "are common and practically unavoidable in a modern research university." The Stanford policy requires disclosure to the university when an inventor has a significant financial interest in an entity with which a licensing arrangement is being considered. The dean of research must approve such arrangements.[17]

Differences in technology-transfer experiences, however, may be attributable, as well, to *intangible* factors, such as the culture at a given institution. Stanford University's culture, for example, may be reflected in a report on the history of its technology-transfer program. Explaining data which suggest that the office spends time on far more inventions than may actually produce income, the Office of Technology Licensing stated that "as a department of the university, we feel obligated to lend our services to all members of the Stanford community – researchers, faculty, staff, and students – who have inventive ideas that might be commercialized."[18]

METHODOLOGY

Staff of the Committee on Commerce and Economic Opportunities solicited information regarding technology-transfer processes, activities, resources, results, and barriers from state universities and major private entities involved with various aspects of technology transfer in the state.[19] Entities were also asked to suggest best practices used by other states, countries, or entities to increase technology transfer and ways to increase technology transfer within Florida. Staff from select entities were then interviewed. Committee staff also performed literature and Internet reviews on general technology-transfer-related issues.

FINDINGS

Florida Universities' Technology Transfer Lags That of Peers.

There are many different ways to measure a university's technology-transfer performance, including the number of invention disclosures by university researchers, the number of patent applications filed and patents received, the number of licenses executed and start-up companies formed, and the amount of revenue generated by technology-transfer transactions. While invention disclosures and patents are important because they indicate how much potentially transferable technology a university is creating, licenses, start-up companies, and associated revenue can provide insight into how effectively a university is translating its innovations into income and economic development.

With the possible exceptions of the University of Florida's (UF) patent generation, the University of South Florida's company establishment, and UF's and Florida State University's (FSU) license-income levels, Florida universities, in general, do not appear to be performing as much technology transfer as many of their peer universities. (*See* Exhibits 1 and 2.) Moreover, most of FSU's and UF's revenues were derived from a total of three products.[20]

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[15] Universities examined include Columbia University, the Massachusetts Institute of Technology, Stanford University, the University of Texas, and the University of North Carolina.

[16] MIT, *Guide to the Ownership, Distribution and Commercial Development of M.I.T. Technology*, June 1999, pp. 15-16.

[17] Stanford University, *Research Policy Handbook*, Document 4.1, "Faculty Policy on Conflict of Commitment and Interest," April 14, 1994, pp. 2-4.

[18] Hans Wiesendanger, *A History of OTL: Overview*, Stanford University, Office of Technology Licensing, Internet, 2000.

[19] Entities surveyed included the University of Miami.

[20] Auditor General, p.11. FSU holds a patent related to Taxol, a cancer-fighting drug. UF holds a patent related to Trusopt, a drug used in treating glaucoma, and receives royalties from the sale of Gatorade.

Exhibit 1: Technology-Transfer Performance of Florida Universities that Responded to the 1999 Association of University Technology Managers Licensing Survey

	Research Expenditures *(Rank)*	Invention Disclosures Received *(Rank)*	U.S. Patent Applications Filed *(Rank)*	U.S Patents Issued *(Rank)*	Licenses & Options Executed *(Rank)*	Licenses & Options Yielding Income *(Rank)*	Adjusted Gross License Income Received *(Rank)*	Start-up Companies Formed *(Rank)*
University of Florida	$280,408,217 *(23)*	136 *(21)*	127 *(14)*	58 *(12)*	10 *(67)*	45 *(39)*	$21,649,577 *(8)*	2 *(38)*
University of Miami	$175,600,000 *(47)*	27 *(91)*	9 *(103)*	8 *(83)*	9 *(72)*	22 *(62)*	$432,937 *(87)*	0 *(90)*
University of South Florida	$161,300,000 *(57)*	48 *(67)*	53 *(44)*	24 *(40)*	13 *(57)*	18 *(73)*	$490,408 *(82)*	8 *(4)*
Florida State University	$132,664,855 *(66)*	23 *(97)*	15 *(90)*	5 *(98)*	8 *(76)*	14 *(89)*	*$57,313,014 (3)*	1 *(60)*

Source: *Association of University Technology Managers Licensing Survey: Selected Facts and Figures for FY 1999*, as cited by the Business-Higher Education Forum, pp. 105-115.

Exhibit 2: Technology-Transfer Performance of Other State Universities in Florida (FY 1999)

	Research Expenditures	Revenue Received from Licenses, Royalties, and Options
University of Central Florida	$42,466,000	$65,632
Florida International University	$25,061,000	$5,988[1]
Florida A&M University	$21,622,000	$0
Florida Atlantic University	$17,151,000	$180,800[2]
Florida Gulf Coast University	$5,270,628[3]	$0
University of North Florida	$5,100,000[4]	$0
University of West Florida	$4,588,000	$0

Source (except where noted): National Science Foundation, *Academic Research and Development Expenditures: Fiscal Year1999*, Arlington, VA (NSF 01-329), June 2001, and letters sent to staff of the Senate Committee on Commerce and Economic Opportunities from universities in the state.

[1] Calculation based on data submitted by Florida International University to staff of the Senate Committee on Commerce and Economic Opportunities on August 13, 2001.

[2] Calculation based on data submitted by Florida Atlantic University to staff of the Senate Committee on Commerce and Economic Opportunities on July 6, 2001.

[3] Estimate based on funded grant total in *Florida Gulf Coast University, Office of Research and Sponsored Programs, Fiscal Year 1999-2000 Annual Report.*

[4] Estimate based on award total in *The University of North Florida 2000-2001 Fact Sheet*, Internet, June 18, 2001.

There Is No Cookie-Cutter Approach to Increasing Technology Transfer.

Research indicates that, given the high historical, geographic, demographic, cultural, and economic variability among and within states, there is no one-size-fits-all strategy that will lead to university-industry collaboration. Thus, it is not surprising that there is a lack of consensus among university officials and industry professionals in Florida on how to address a number of key issues regarding technology transfer and commercialization. Although the issues are numerous and span topics ranging from industrial psychology to patent law, they generally revolve around three main subjects: (1) differing university and industry cultures; (2) legal/policy impediments to technology transfer; and (3) lack of technology-transfer-related inputs.

Differing university and industry cultures

Business people and academics often have different goals and personalities, thus making productive relationships more difficult to establish and maintain. As noted by the Council on Governmental Relations:

> Two very different cultures interact in the collaboration between universities and industry. Universities have societal missions of education, research and service based on the free exchange of ideas and providing the public with access to an impartial source of information.…In contrast, the focus of industry is on meeting customer needs in a way that maximizes profit to stockholders.…It is inevitable that joining these different cultures creates challenges for the industry and university collaborators.…[21]

[21] Council on Governmental Relations.

Legal/policy impediments to technology transfer

The efficiency and effectiveness of technology transfer greatly depends on the legal and policy environments in which it is conducted. State and federal laws combine with university rules and policies to provide a framework for university-industry collaboration. Two important issues within this framework are intellectual property and conflict of interest.

Intellectual property. Intellectual property is defined as a "commercially valuable product of the human intellect, in a concrete or abstract form, such as a copyrightable work, a protectable trademark, a patentable invention, or a trade secret."[22] The value, ownership, and use of intellectual property are often the most contentious issues in technology-transfer negotiations between a university and a business. The Business-Higher Education Forum notes:

> Companies usually want to secure patent ownership in order to manufacture, use, and sell products that result from the research….Universities, on the other hand, are driven by different incentives. They often desire ownership to allow their faculty to be unencumbered as they work, publish, and collaborate with colleagues.…Patent ownership enables them to monitor the development activities of their licensees; it also allows universities to license the technology on a nonexclusive basis to more than one company, potentially increasing the licensing-revenue stream....[23]

Conflict of interest. As the worlds of university and industry researchers blend, the arising, or apparent arising, of conflicts of interest is inevitable. There are many different types of conflict of interest, including:

- financial conflict of interest, which can occur when a researcher's work and private financial interests overlap in a manner that raises questions regarding his or her ability to make unbiased research decisions;
- intellectual conflict of interest, which can occur when a researcher is faced with admitting that his or her prior work is misguided or in error;
- conflict of commitment, which can occur when an outside activity, such as private-sector interaction, interferes with a researcher's university duties; and
- institutional conflict of interest, which can occur when a university has a financial stake in or business relationship with a company, thus raising the possibility that the university will unduly bias its work or resources toward that firm.[24]

Lack of technology transfer-related inputs

Many different types of inputs are required to fuel the technology-transfer process, including research and development (R&D) and commercialization resources.

Research and development. The reality of R&D is that it usually involves much more research than development since few innovations have commercial potential. As with the University of Florida and Florida State University, the success of high-grossing research universities is typically due to a small number of blockbuster patents or copyrights. In fact, of the 20,000 active U.S. university licenses in place in FY 2000, only 120 have generated annual revenues in excess of $1 million over a number of years[25]

Despite the importance of R&D to the technology-transfer process, the state is lagging behind many of its competitors in terms of R&D intensity (*i.e.*, the ratio of R&D expenditures to gross state product). Although ranked 13th in the nation in 1998 in total R&D expenditures, Florida was ranked 31st in overall R&D intensity, last among the top 15 R&D-performing states.[26, 27] More specifically, Florida ranked 45th in the nation in terms of R&D performed by its universities and colleges as compared to the gross state product.

Commercialization resources. While universities perform a mixture of basic and applied research, technology investors are typically interested in more-developed, and thus less risky, products. Thus, there is often a gap between the raw research results of a university and the need of a company for a working

[22] *Black's Law Dictionary*, 813 (7th ed. 1999).

[23] Business-Higher Education Forum, pp. 55-56.

[24] Ibid., pp. 35-38.

[25] According to Raymond Bye, Jr., Vice President for Research, Florida State University, in a letter to staff of the Senate Committee on Commerce and Economic Opportunities, September 6, 2001, this data will soon be reported by the Association of University Technology Managers, Inc.

[26] The top-performing states ranking higher than Florida in R&D intensity were Massachusetts, Maryland, Michigan, Washington, California, New Jersey, Colorado, Pennsylvania, Virginia, Illinois, Ohio, New York, North Carolina, and Texas.

[27] Analysis is based on the National Science Foundation's most current data regarding R&D expenditures in the nation. *See* National Science Foundation, Division of Science Resources Studies, *National Patterns of R&D Resources: 2000 Data Update*, Arlington, VA (NSF 01-309), March 2001, and U.S. Department of Commerce, Bureau of Economic Analysis, *Regional Accounts Data, Gross State Product Data*, June 4, 2001.

product prototype or an experienced management team to commercialize a product.[28] The gap is sometimes called the "Valley of Death" because it is a key reason why many university invention disclosures are never commercialized.[29, 30] Research and feedback from state universities indicate that closing this gap in order to license products to existing or university spin-off companies usually requires a variety of resources, including pre-venture "seed" funding, sound business guidance, and administrative support.

Furthermore, as noted by Berglund and Clarke, "the availability of capital to support start-up and emerging companies – the type of companies on which the new economy depends – is essential if a region is to build its R&D base."[31] Florida, however, is not attracting venture capital at a rate comparable to that of many of its competitors. Although ranked 10th and 11th in the nation in total venture capital investment in 1999 and 2000, respectively, Florida was ranked 20th in terms of the ratio of 1999 venture capital investment to gross state product, next-to-last among the top 15 venture-capital-attracting states.[32, 33] Moreover, over the past 3-5 years, venture capital investment in Florida has grown more slowly than the investment in most of those states and has been concentrated in relatively fewer firms.[34] The bursting of the "dot-com" bubble has sharply reduced venture capital investment in Florida (and across the nation) with investors focusing on established, rather than start-up, companies.[35]

The Non-Metropolitan Locations of Florida's Main Research Universities are Disadvantageous.

> *If Florida were to start from scratch in technology transfer and put two of its four largest research universities in Gainesville and Tallahassee, the pundits would liken it to Mao Tse-tung's Great Leap Forward. The drive to transform the countryside by drawing tax dollars and bright students from the cities to the countryside led to disaster in China. Fortunately, because it wasn't done suddenly in Florida, it has led only to chronic suboptimalization, the Great Lagging Step.*[36]

One of the key differences between two of Florida's largest research universities (University of Florida and Florida State University) and institutions such as Stanford and MIT is that Florida's universities are located in small cities while Stanford and MIT reside in major metropolitan areas.[37] Research and survey responses sent to the staff of the Senate Committee on Commerce and Economic Opportunities indicate that technology transfer occurs more readily within large metropolitan settings. As noted by Standard and Poor's DRI, the "geographic concentration of business and people in metro areas creates unique economic conditions that generate new industries, speed the diffusion of knowledge, spur technological innovation, and increase productivity. Metro areas have larger markets for goods and services, more specialized labor pools, and more extensive and sophisticated transportation and telecommunications networks than non-metro areas."[38]

Two of the factors described above, specialized labor pooling and knowledge diffusion, are especially important with regard to technology transfer.

> Both in Silicon Valley and around Route 128 a key advantage is the existence of a pool of people with certain skills. In the Boston area, for example, growth companies in the software field can be reasonably sure of being able to find people with esoteric knowledge in a variety of sub-subdisciplines. At the same

[28] Raymond Bye, Jr.

[29] The term "Valley of Death" was used by Raymond Bye, Jr.

[30] Although 10,052 invention disclosures were received in 1999 by the 139 U.S. universities that responded to the most recent licensing survey of the Association of University Technology Managers, Inc., those universities only executed 3,295 licenses/options (i.e., a ratio of approximately three disclosures for every license/option). [*AUTM Licensing Survey, FY 1999 Survey Summary*, 2000, p. 34] The ratio for the four Florida universities described in Exhibit 1 of this report is nearly six disclosures received for every license/option executed.

[31] Dan Berglund and Marianne Clarke, *Using Research and Development to Grow State Economies* (Washington, D.C.: National Governors Association, 2000), p. 8.

[32] The top-performing states ranking higher than Florida in terms of the ratio of venture capital investment to gross state product were California, Massachusetts, Colorado, Washington, New York, Virginia, Maryland, Connecticut, Pennsylvania, Georgia, Texas, Illinois, and New Jersey.

[33] Venture Economics/NVCA/Thomson Financial Securities Data, Internet, 2001, as cited in State Science & Technology Institute, "Total Venture Capital Investments By State 1991-2000," *SSTI Weekly Digest*, August 31, 2001, and U.S. Department of Commerce, Bureau of Economic Analysis, *Regional Accounts Data, Gross State Product Data*, June 4, 2001.

[34] Venture Economics/NVCA/Thomson Financial Securities Data, Internet, 2001, as cited in State Science & Technology Institute, "Total Venture Capital Investments By State 1991-2000" and "Number of Companies Receiving Venture Capital Investments By State 1991-2000," *SSTI Weekly Digest*, August 31, 2001.

[35] Christopher Boyd, "Venture capital trickles in," *Orlando Sentinel*, November 1, 2001; Jane Bussey, "Venture capital investment slacking off," *The Miami Herald*, November 1, 2001.

[36] Thomas A. Breslin, Vice President for Research, Florida International University, in a letter to staff of the Senate Committee on Commerce and Economic Opportunities, August 13, 2001.

[37] Stanford is located near San Francisco, CA; San Jose, CA; and Silicon Valley. MIT is located in Boston, MA.

[38] Standard and Poor's DRI, *U.S. Metro Economies: Leading America's New Economy* (Lexington, MA: The McGraw-Hill Companies, June 6, 2000), p. 1.

> time, the Boston area has been a good place for people to invest in acquiring these skills, or for those with those skills to live: if a start-up goes bust, as many do, you can find another job without having to relocate.[39]

Additionally,

> [g]eographic proximity allows ideas to travel more rapidly, and therefore cities reduce the cost of moving ideas. These knowledge spillovers can lead to increased human capital accumulation through learning and ultimately to higher productivity levels.…The implication is that cities have advantages beyond the traditional ones related to transportation cost and market size. These additional advantages appear related to knowledge and learning, and accrue due to human interaction.[40]

Recognizing the geographic disadvantages of some of the state's major research universities, both the public and private sectors are beginning to propose innovative solutions to clear locational hurdles. The University of Florida (UF) and the University of Central Florida (UCF), for example, have proposed a memorandum of understanding that would allow each university to capitalize on the technology research and commercialization strengths of the other, not the least of which are UF's extensive research programs and UCF's strong business ties.[41] Meanwhile, in the private sector, a new venture capital fund will soon be investing in companies within Florida's newly designated "Tech Triangle" (between Orlando, Tampa, and Gainesville) because "[a]s individual cities, it's not likely that Orlando, Tampa or Gainesville could keep that [investment] team busy, but as a whole, the opportunities are there.…"[42]

RECOMMENDATIONS

Although there appears to be agreement among university and industry professionals with regard to the existence of certain broad state technology-transfer issues, there is a lack of consensus on how specifically to address a number of those topics. Furthermore, in order to ensure optimal implementation of future solutions, resolution of key issues must be agreeable to both parties in university-industry transactions. It is therefore important for university officials, industry professionals, and state economic development officials to meet regularly to resolve technology-transfer issues and lay the groundwork for informal interaction among technology-transfer players.

Thus, committee staff recommends that the Legislature direct the Florida Board of Education (Board) to establish a process that will facilitate the regular meeting of university officials, industry professionals, and state economic development officials for the purposes of discussing state technology-transfer issues, such as those identified in this report; developing solutions to state technology-transfer problems; creating mechanisms by which informal university-industry interaction can be increased; and facilitating synergistic collaboration between state universities located in non-metropolitan areas and those residing in the state's larger cities. In performing these duties, the Board should consult with organizations that work with both the academic and business communities, such as Enterprise Florida, Inc., the Florida Research Consortium, the InternetCoast Research Consortium, Florida High Tech Corridor Council, Inc., the Technological Research and Development Authority, and the Florida Space Research Institute.

The Board should regularly report on its activities to the Governor and the Legislature. At a minimum, progress reports should include the following information, as determined during the implementation of the Board's process: a description of the Board's activities, detailed descriptions of barriers to state technology transfer, summaries of issues regarding the facilitation of informal university-industry interaction and technology-transfer collaboration between state metropolitan and non-metropolitan universities, and proposed methods for enhancing technology transfer in the state. When appropriate, the Board should also make specific recommendations to the Legislature regarding proposed statutory changes that could improve technology transfer in the state.

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[39] Paul Krugman, *Geography and Trade* (Cambridge, MA: The MIT Press, 1991), pp. 64-65.

[40] Kelly Ragan and Bharat Trehan, "Cities and Growth," *Federal Reserve Bank of San Francisco Economic Letter*, No. 98-27, September 11, 1998.

[41] Chad Eric Watt, "UCF, UF to team on commercializing ideas," *Orlando Business Journal*, September 7, 2001.

[42] Chad Eric Watt, "VC firm pins hopes on 'tech triangle'," *Orlando Business Journal*, November 2, 2001.