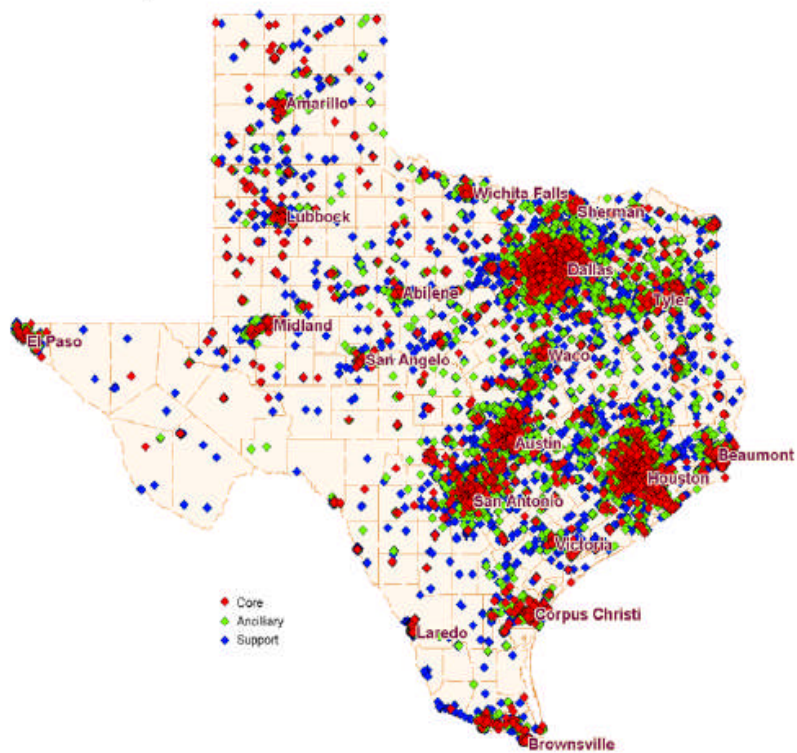


A 2008 Status Update of Texas Technology Economic Development

Industry Cluster Map



March 2009

ACKNOWLEDGEMENT

This independent evaluation of the impact of technology on the economic development within Texas has been led by Dr. Walt Trybula of the Trybula Foundation, Inc. This effort has involved a large number of volunteers throughout Texas.

The institutes of higher education that were included in providing data and input are: Texas State University System, the University of Texas System, Texas A&M System, University of North Texas System, University of Houston, Texas Tech University System, Baylor University, Rice University, Austin Community College, and Texas State Technical College.

The eight Centers of Innovation and Commercialization were involved. These are: 1) Texas Life Sciences CIC; 2) Central Texas RCIC; 3) El Paso/Trans-Pecos RCIC; 4) Gulf Coast RCIC; 5) North Texas RCIC; 6) Rio Grand Valley RCIC; 7) South Texas RCIC; and, 8) West Texas RCIC. A number of the Economic Development Offices throughout Texas were contacted. The local offices include: Austin, Dallas, East Texas – Tyler, El Paso Regional, Fort Worth, Greater Houston; High Ground, San Antonio, San Marcos, Seguin, Rio Grande Valley, and Waco.

In addition, a number of individuals who are involved in developmental efforts from across the state were contacted. The complete listing of individuals, alphabetical by last name, and their organizations is in Appendix G. The initial contacts to various organizations resulted in suggestions for additional contact at various affiliated organizations or, in the case of universities, additional schools within the systems.

Approximately 100 volunteers contributed to this effort and have been of great assistance in developing the overall picture of the current technology impact on the state of Texas. Time did not permit reaching out to many others whose capabilities would further enhance this report.

While this effort incorporates the input from individuals representing many organizations, it does not reflect the official position of any or all of the organizations proper. Dr. Trybula was involved in the initial Texas Technology Initiative, the Texas Workforce Commission Cluster efforts (both Aerospace and Advanced Manufacturing), and the State Strategy on Advanced Technology. Dr. Trybula is also the Director of the Nanomaterials Application Center at Texas State University-San Marcos. Questions and comments can be sent to Dr. Trybula at TechEcoDev@tryb.org. A PDF version of this report is available at <http://www.tryb.org/2008Update.pdf>.

EXECUTIVE SUMMARY

The world-wide economic climate in March 2009 is challenging for all countries. As a means of increasing economic development, national governments have focused on technology development. Countries are looking to emerging technologies as a means of developing sustainable economies in the global competition. The United States, long a leader in technology, appears to be falling further behind. CNET News published an article on February 25th, 2009 that was titled: “*US said to be losing innovative edge.*” [Ref. 1] Quoting from a report by Information Technology and Innovation Foundation, CNET highlighted the point that while the US ranks 6th of 40 countries based on 16 indicators of innovation and competitiveness, the US placed **last** in a measure of progress over the last decade. The 2005 report [Ref. 2] by the National Academies, “*Rising above the Gathering Storm*”, warned that science and technology were eroding at a time when other countries were increasing.

The *lesson-learned* from oil industry problems of the 1980s leaves concern about the continued economic development of Texas. Texas created the Emerging Technology Fund [ETF] in 2004 to expedite the commercialization of innovative technology that addresses the need for sustainable economic development throughout the state. In the evaluation of ongoing efforts around the state, the role of the ETF has risen to the forefront due to the significant amount of activity that it has generated. The ETF was created with a focus on six specific technology areas that support the six key Texas Industrial Clusters. To date, this effort has 79 emerging companies with ETF Commercialization Awards. The interaction among industry and academia has increased, and inter-institution collaboration has provided the ability to share information and tools to drive commercialization. Moving innovation out of university labs into commercial efforts has a higher percentage of success than individual start-ups. [cf. page 10]

This report is a evaluation of the impact of the ETF and other vehicles to drive commercialization and business expansion, reached out to nearly 100 people throughout Texas to determine the effectiveness of the efforts. An interesting result of this effort is the observations that the Houston medical community is foremost in the nation, sizeable amounts of academic-industry partnerships exist, and the significant amount of nanotechnology focused efforts reach across all Industry Clusters.

The funding mechanisms within Texas are evolving and filling an ever growing need to create the jobs of the future. The evolution of state participation from warrants to other vehicles, including stock, has significantly increased interest from emerging companies in participating in the fund. **The key recommendation is that this effort should continue and not be diminished by other pressures.** The business creation, business development, and business incentive funds need to be replenished to at least the original levels and the ETF is recommended to be increased. The suggested increase is due to the recommendations to refocus the Subchapter “E” to address Public-Private Partnerships and to support Proof-of-Concept efforts.

The additional recommendations are: set specific criteria, procedures, and a “RCIC”-like review board for Subchapters “E” & “F”, increase ETF staffing support to cover the increasing number of awards, and enhance business development support for ETF applicants’ state-wide. The next page provides a presentation-style listing of both the key findings and the key recommendations.

BULLET POINT SUMMARY OF 2008 UPDATE

FINDINGS:

- **Texas has improved in technology job creation but must focus on higher skill jobs**
- **Texas Industry Clusters are crucial to future job growth and economic development**
- **Texas development activities have fostered new university/industry collaborations and networking**
- **State funding programs to promote economic development and research commercialization in Texas have accelerated growth and are considered “best practice” by other states and Venture Capitalists**
- **Opportunity exists to improve critical elements of the innovation-ecosystem in Texas**
- **Commercialization activities in universities have accelerated**
- **Texas universities’ story of innovation and commercialization is not being heard**

RECOMMENDATIONS:

- 1. Provide appropriation support to required levels**
 - a) Increase Emerging Technology Fund to \$220 million, which includes an additional \$20 million for Proof-of-Concept [POC] efforts
 - b) Replenish Texas Enterprise Fund
- 2. Reduce the time to complete the ETF review and approval process**
- 3. Re-focus ETF Subchapter “E”**
 - a) Support Public Private Partnerships [PPP’s] for commercialization impact
 - b) Support Proof-of-Concept [POC] funding to accelerate development of ETF commercial venture opportunities
- 4. Establish and implement criteria, procedures, and a review board for Subchapters “E” & “F” funds**
- 5. Increase staffing support for expanding ETF asset management needs**
- 6. Facilitate business development support for ETF applicants state-wide**

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INTRODUCTION

This report is an update on the status of the impact of technology on the economic development in various regions throughout Texas and is primarily focused on the Emerging Technology Fund [ETF]. Texas has developed and implemented an integrated effort that coordinates all pieces of the Texas economic development plan that focuses on bringing the best scientists and researchers to Texas, attracting high-tech companies and jobs, and helping start-up companies get off the ground faster. The rationale for this effort is that the future of the economy lies in the creation and commercialization of emerging technologies.

Texas learned from the collapse of the oil and gas sector in the early 1980s that the state needed to focus efforts on developing technology sectors that could provide skilled jobs with the corresponding high wages. The manufacturing element became increasingly important as established companies, like TI, expanded and new companies, like Compaq, brought well-paying jobs to Texas.

CURRENT STATE OF THE ECONOMY

The following is from a January 15, 2009 memo from the Chair of the U.S. House of Representatives Committee on Appropriations. “The economy is in a crisis not seen since the Great Depression. Credit is frozen, consumer purchasing power is in decline, in the last four months the country has lost 2-million jobs and we are expected to lose another 3 to 5 million in the next year.” Of the recommendations for having an impact on the future economy, the memo states: “We need to put scientists to work looking for the next great discovery, creating jobs in cutting-edge technologies, and making smart investments that will help businesses in every community succeed in a global economy.” [Ref. 3]

The economy today is indeed global. The interdependence of trading partners intertwines global trends beyond the control of any single country. Innovation drives the adaptive economy with information technology providing the links that make everything work. According to Atkinson and McKay, the Information Technology revolution and its ability to transform business transactions was responsible for all labor productivity growth from 1995 to 2002! “The 2008 State New Economy Index” by the Kauffman Foundation points out that it will be important to ride the next wave of innovation. [Ref. 4] While the “winning” technologies are unknown, they should come from nanotechnology, materials, energy, manufacturing, or pharmaceuticals. The increasing U.S. deficit can be traced to the loss of manufacturing jobs. In the ten years ending 2003, manufacturing (without computers) has declined by almost 2% to 11.4%. Thirty percent of job growth has been in five states, and the Southern and Western regions have grown faster than other regions of the country.

The time to set the future direction and strength of the economy is in a downturn. Successful enterprises position themselves for the coming upturn by investing wisely in ventures that will pay dividends. The efforts in Texas over the last four years have been paying dividends. Continuing to forcefully provide programs that

encourage and support growth of small, emerging technology companies throughout Texas will provide a basis to rapidly expand when the economy resumes its growth.

THE CREATIVE ENVIRONMENT

A very small number of companies create the majority of new jobs. While only a small fraction of these companies are “tech” companies, by traditional definitions, most are the “innovators” in their fields. Innovation is the primary source of competitive advantage, driving high profits and capital accumulation, generating high jobs growth, and exerting upward pressure on wages. On a national average, only 5% of total regional economic growth is achieved by industrial relocation/attraction. On average, 8%-10% of a community’s economic base will be lost each year. Large companies create the most jobs, but also lose the most, generating a net loss over the last 10 to 15 years. Small and medium size enterprises have generated virtually all net jobs over the last 25 years. [Ref. 5]

The fastest growing (economically) communities are those that have established strong pipelines of innovation-to-marketplace. Most innovations die before they are successfully commercialized in what is termed the “Valley of Death.” Commercialization best practices, incubators, and state-supported sources of seed, pre-seed, and venture research funds help bridge the “Valley of Death.”

The obvious focus needs to be on the developing companies to provide additional growth opportunities. The availability of research institutions in Texas and the funding available through the ETF and the Angel and Venture Capital Networks continue to provide an advantage for communities to compete globally.

CLUSTERS

The six key industrial clusters were identified and their characteristics were quantified. An analysis of these characteristics provided an easy means of identifying the various locations throughout Texas that are involved in each of the Clusters. The six industry clusters targeted for Texas by the Governor’s 2004 Texas Industry Cluster Initiative [Ref. 6] are described more fully in Appendices A and B. This section provides a short synopsis of the Clusters and some activities occurring within Texas. The Clusters have begun to establish collaborative efforts that address the strengths of the Industry, the Regions, the local companies, and the Institutes of Higher Education. [Ref. 7]

The **Advanced Technologies and Manufacturing Cluster** is working to establish industry-academia interactions that will provide for technology and manufacturing advances. Examples of efforts include the developing Nano World Headquarters in Houston and the Rapid Response Manufacturing Center [RRMC] located at UT Pan American to serve the large established manufacturing base on both side of the border.

The **Aerospace Cluster** has multiple concentrations of industry in Texas. The research interactions involve a large number of academic institutions. An example, currently under development, is the Nanomaterials De-

sign Commercialization Center, which is focused in the Metroplex but involves the UT System, the A&M System, the University of North Texas System, and the Texas State University System.

The **Biotechnology and Life Sciences Cluster** has multiple locations throughout Texas. One example is the recent award of a \$5.5 million ETF research superiority grant to the University of Houston in conjunction with the Methodist Hospital Research Institute to create the world class Center for Nuclear Receptors and Cell Signaling further adding to the city of Houston's capacity, which already is the largest medical complex in the country.

The **Energy Cluster** has progressed further than other Clusters in forming an official organization. The Advanced Energy Consortium [AEC], established by the University of Texas' Bureau of Economic Geology and assisted technically by Rice University, includes 10 member companies that are funding basic research. While still in the early stage of implementation, AEC has received proposals and has selected projects that could be funded [Ref. 8]. The Pecan Street Project (smart grid and solar cells) in Austin is in development.

The **Information and Computer Technology Cluster** encompasses many industry segments, including computers, software, telecommunications, and IT services. According to the American Electronics Association (AeA) Cyberstates 2007 Report, Texas ranked first in computer training employment; and second in engineering services jobs, computer and peripheral equipment manufacturing employment, and semiconductor manufacturing jobs. The University of Texas at San Antonio (UTSA) received a \$3.5 million Texas Emerging Technology Fund grants to recruit Dr. Ravi Sandhu, a nationally recognized leader in cyber security. Dr. Sandhu is the founding executive director and chief scientist of the UTSA Institute for Cyber Security Research.

The **Petroleum Refining and Chemical Products Cluster** is critical to the Texas economy. Texas is the Number One producer of oil and gas, refined products, and chemicals in the United States, and its marketed production of natural gas represents one-third of total U.S. supply. Texas is the nation's largest chemicals producer, manufacturing 14 percent of the nation's value of chemical output. The Gulf Coast complex of chemical plants and refineries is the largest petrochemical complex in the world, home to more than 200 chemical plants. At least 124 of Texas' 254 counties have some amount of manufactured chemical output.

Comments: In part, collaborative efforts are inspired by previous consortia successes. Texas has a history of developing new models. The Microelectronics Computer Consortium [MCC] was a successful invention that brought a number of large employers to Texas. The competition for SEMATECH, the semiconductor research consortium, was nation-wide. The ability for Texas to "win" the competition was based on a number of factors, and the experience in developing MCC was a contributing factor. While MCC is no longer operational, the lessons learned have provided the building blocks for the semiconductor industry that made Texas strong and productive. With the semiconductor industry in a dismal recession, the availability of semiconductor facilities may provide the basis for the emerging solar market. Predicting the future is filled with many opportunities for error; however certain trends can be identified. Texas has established facilities that contain specialized operating conditions enabling many options. Medical-biological devices that are currently being

developed require clean assembly area, which are similar to those employed for semiconductors. There will be many other opportunities to leverage the available assets for emerging technology manufacturing.

BUSINESS START-UPS AND RISKS

The creation of jobs through the development of innovative technology requires many risks by the inventor and his/her supporters. The first item is to create the concept for the application that serves a market need. This can be daunting in establishing creative approaches that might be considered as disruptive technologies. The initial challenges range from the creation of the ideas to its Proof-of-Concept [POC]. Once the POC has been established, the focus needs to be simultaneously on developing the commercializable product, identifying the management team, and securing to funding to permit success. POC and product development phases are what many call the "Valley of Death" from a funding standpoint, as further described on page 14 of this report. Opinions vary on the success rate for ventures indicating a success range of from 1-out-of-10 to 1-out-of-100. Not all failures are due to lack of market, lack of addressing a society need, or even lack of an excellent product. Failures are also due to the lack of adequate infrastructure and required personnel.

Interactions among industry and academia provide a positive result, especially if the innovations flow from the universities. According to National Council of Entrepreneurial Tech Transfer, eight percent of all university startups go public, in comparison to a "going public rate" of only 0.07 percent for other U.S. enterprises. This is a factor of 114 times higher successes. Over 400 university startups are created nationally each year based on federally funded research and development [R&D], which included Google, Netscape, Genentech, Lycos, Sun Microsystems, Silicon Graphics, and Cisco Systems. Sixty-eight percent of university startups created between 1980 to 2000 remained in business in 2001, while regular startups experienced a 90% failure rate during that same time period. [Ref. 9]

The ability to find supportive technical and business collaborators reduces the pressures on the innovator. Establishing this climate is something that requires an effort by the communities, the local governments, and the state governments. It is possible for a state to develop the climate for business success. While it is not necessarily easy to establish the conditions, the attributes of innovation and technology leader states can be identified. Key characteristics are: **1)** strong basic R&D investment and funding through Proof-of-Concept; **2)** sufficient number of skilled scientists and engineers; **3)** flexible, skilled workforce; **4)** existing infrastructure; **5)** reliable utilities; **6)** favorable laws and regulations for plant location and business development; **7)** competitive angel and venture investors and favorable tax environment; **8)** level trade and Intellectual Property [IP] playing field. [Ref. 10]

GLOBAL COMPETITION

The findings from the “Report of the Select Commission on Higher Education and Global Competitiveness,” which was issued in January 2009 made some interesting points. The Commission envisions a dynamic Texas economy that ranks among the top economies in the world through ensuring the opportunity for a high quality of life for all citizens in the state. The key to accomplishing this is through the development of a highly skilled workforce effectively functioning in the global economy; and, developing and expanding an innovative economy that can employ the skilled workers. However, all of Texas is not globally competitive. “Texas also needs an innovation-based economy in all the state’s regions that can fully employ a more capable workforce. It must generate more external research funding and commercialize ideas and intellectual property at a volume substantially greater than currently taking place.” [Ref. 11]

Several recommendations from this report provide emphasis on the efforts underway. The following numbered items refer to the “Executive Summary” of the aforementioned report. “7. Reinforce and enhance existing research institutions and increase the number of top tier nationally competitive research universities by providing state incentive matching funds for research.’ “8. Utilize research capacity to enhance competitiveness of Texas employers and link with regional strategies to improve competitiveness.”

Texas ranks 4th nationally in the level of academic R&D expenditures that are funded by the federal government. However, Texas is the second most populous state and should therefore rank at least 2nd. On a more somber note, Texas ranks 32nd overall based on a per capita R&D spending, including both academic and industrial R&D. This implies that Texas needs more research capability. Data provided in the report indicates that Texas is a large exporter of college students, with a preponderance of the students attending research universities in other states. [Ref. 12]

Observations: Texas needs to address the specific points that are required to create a globally competitive workforce. These include the necessity to recruit and retain top tier research faculty and invest in institutions that have comparative strength in fields that need bolstering. Continued and enhanced research funding with a focus on creating nationally competitive research universities [Tier 1] will provide substantial benefit. Enhanced education for workforce development provides incentive for companies to relocate into an area that can provide trained workers.

EMPLOYMENT

Employment growth through the 1990s and 2000s brought significant wage benefits to many communities. However, the growth was focused in areas with a high concentration of skilled technical workers. The creation of the Microelectronics and Computer Technology Corporation in 1983 provided a model for collaboration. The subsequent winning of the headquarters for SEMATECH in 1987 increased the technology appeal of the Austin area with an aura that promoted the entire state. AMD and Freescale/Motorola increased their semiconductor capacity in Austin. Applied Materials established a manufacturing base outside of the city.

Samsung, the largest manufacturer of computer memory, also chose the city to locate and has added a second major facility. Many smaller semiconductor suppliers established a presence in Texas. This growth in the semiconductor industry has been very beneficial to the Texas economy.

The global competition for the location of semiconductor manufacturing facilities has resulted in governments offering incentives that exceed \$1 billion. At the same time, the total growth of semiconductors was appearing to slow while the cost of an individual manufacturing facility was increasing rapidly. These facts drove manufacturers to establish joint ventures to address the risk of the expense of new manufacturing facilities. The location of these facilities is driven by incentives to keep companies within their own countries. Another consideration is that the environmental impact evaluation of a new site requires a significant effort and can be accomplished in a timely manner on sites pre-approved. This industry's dynamics are changing.

With the change in the semiconductor industry since 2000 and Texas having ridden the growth to establish itself as a technology center, the state wanted to look at other areas that were critical to the state's future and could be leveraged in light of the developing economy. The state requested an evaluation of the potential for technology growth. The report that addressed these specific topics was the 2003 Perryman report. A summary of key items from the report is in Appendix A.

ECONOMIC GROWTH

A number of activities are focused on developing growth for the economy within Texas. For example, in 2007, the Texas Economic Growth Summit convened thought leaders from around the state and across the nation for the purpose of sharing global best practices and theory, and resetting the compass for economic development policy in Texas. Dr. Michael Porter of Harvard provided some intriguing information. [Ref. 13]

Texas lags in many key indicators. Incomes overall are below the national average, and wages rank seventeenth. While Texas enjoys a slightly lower cost-of-living than average in the nation, wages (and related productivity figures) overall are growing slower than the national average. Houston, Dallas, and Austin all enjoy wage levels above the national average, but only Austin and San Antonio are growing wages faster than the national average. All other cities in the state are at or below average in both wage levels *and* wage growth rates.

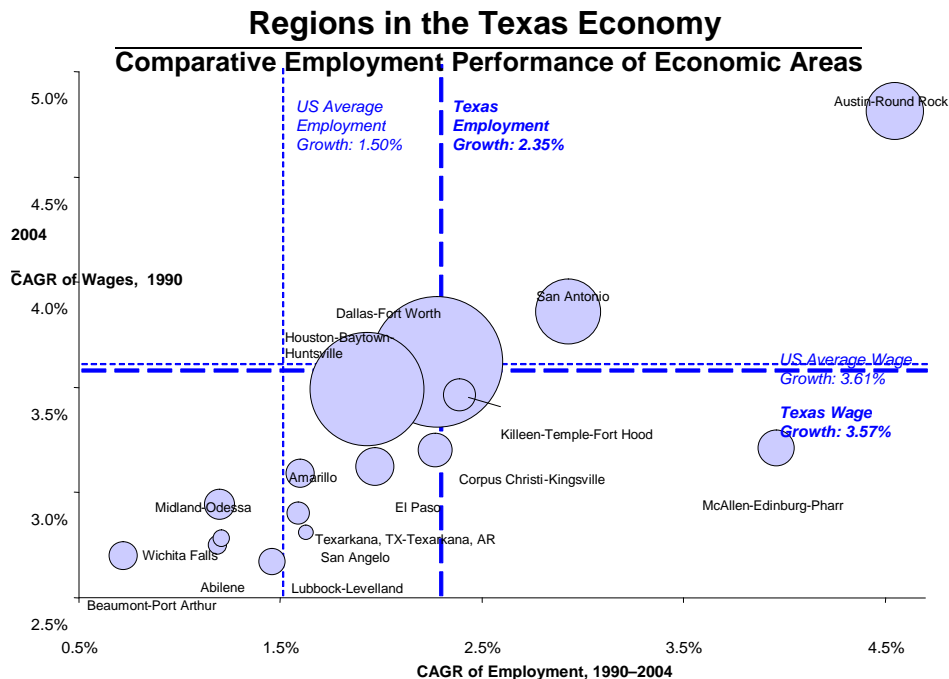
An important fact is that much of Texas is growing its jobs base at higher than the national average (1.5%), with the Austin (4.7%), McAllen (4.1%), and San Antonio (2.9%) regions leading. What these statistics reveal is that Texas is growing its lower wage jobs base much more rapidly than other job categories.

Porter also shed light on the popular misconception that Texas wages are lower because of large rural populations: "Rural employment is 10.5% percent of total in Texas versus 16.0% nationwide. Texas is less rural than the US by this measure. The average wage in rural Texas is 2.3% higher than the national benchmark." Texas average metro wages are 3.9% below the national average.

A number of speakers focused on the fact that Texas has embraced a “wealth creation” paradigm in its largest metro areas, but not in most of the remainder. It was pointed out that “jobs that count” stem from sources of competitive advantage. Job creation occurs as a natural function of developing innovative, globally competitive industrial growth clusters. Dr. Porter emphasized that the “*primary purpose of economic development for a state is enhancing the standard of living for the citizens of that state.*” This raises the question: “Despite a strong overall business climate, why does Texas rank far below where we think we should rightly be among our peer states?”

The problem is not that Texas has large rural areas with extremely low wages, artificially depressing overall state performance. The issue of the wage ranking is that **metropolitan** wages are nearly 4% below the national average. Somewhat mitigating the matter of wage levels is the fact that Texas enjoys a cost of living below the national average, but that does not address the issue of weak wage growth.

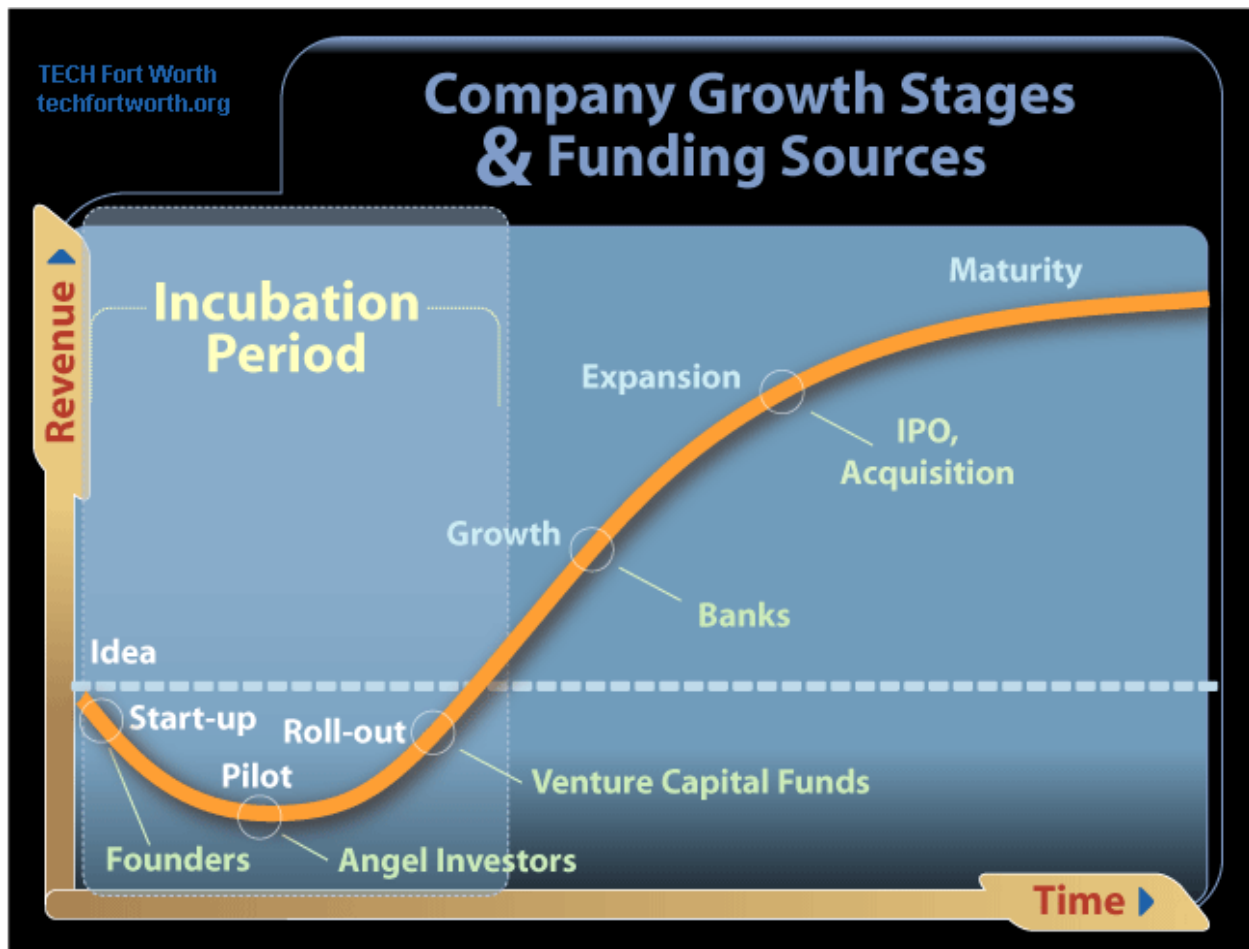
The chart (below) illustrates the issue. Texas metro areas are generally creating jobs at a rate equal to or higher than the national average, but wages are increasing more slowly than the national benchmark for all communities except the Austin and San Antonio statistical areas. The data demonstrates that Texas has a significant gap between those cities that know how to create new advantages, and those that don’t. Without innovation and new value-creation, industrial attraction strategies simply churn workers on the lower end of the scale. [Ref. 14]



Data: private, non-agricultural employment. Source: Cluster Mapping Project, Institute for Strategy and Competitiveness, Harvard Business School
20061114 Texas - Draft 20061111a 27 Copyright © 2006 Professor Michael E. Porter

EMERGING COMPANY CHALLENGES

The findings of the Perryman Study resulted in efforts that led to the creation of the Texas Technology Initiative [TTI] and the State Strategy on Advanced Technology [SSAT]. These efforts combined with the identification of the Industry Clusters enabled the development of a Texas strategy that focused on the major technologies that would contribute to the growth of supporting companies for the key industry clusters. This focus was identified as a matrix where each of the supporting technologies creates opportunities for the Industry Clusters. [Details of the TTI and SSAT are also available in Appendix A.] However, it was also recognized that the availability of funding from any sources that contribute to business startups was severely lacking in Texas. In 2002, almost all venture funding was from outside Texas and primarily from California and states in the New England region.



From the figure above, the area titled the “Incubation Period” is a critical time for an emerging company. The “dashed” line indicates the equality of income and spending. The term “Valley of Death” is employed to cover the time when the development of commercializable products requires an infusion of capital for the

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company to survive. In the rapid pace of global commercialization, the time to develop the commercial products is critical. Taking too long to market a product usually results in competitors succeeding and the emerging company failing. **[Ref. 15]**

Knowing this fact and having identified the key Clusters and the technologies required for their growth led to the establishment of the Emerging Technology Fund. As other states and VCs understand, this program is not a give-away, but an award that requires the company to relinquish some ownership to the state in return for funds. At various meetings, VCs and Angel Investors have indicated that they would like to have other states with a similar effort.



EMERGING TECHNOLOGY FUND [ETF]

The ETF was originally established as a \$200 million fund by the State of Texas to facilitate gap funding for technology ventures. Seven regions of the state have been established to administer the program, each through a “Regional Center of Innovation and Commercialization” [RCIC]. In addition, a statewide Texas Life Science Center of Innovation and Commercialization [TLSCIC, which is also known as the Texas Life Sciences Center - TLSC] also was formed. The RCICs and the TLSC act as the agent for the ETF Advisory Committee to identify, evaluate, and submit promising proposals from their respective regions or from Life Sciences to the ETF Advisory Committee. The ETF Advisory Committee makes final decisions on submitting vetted proposals for consideration of awards to the Governor, Lt. Governor, and Speaker of the House. All three of these elected officials must approve the award for the company before it can proceed to the contract negotiations, which when completed is the last stage prior to an award.

The advisory committee consists of leaders from across the state, with backgrounds ranging from entrepreneurial, venture capital, angel investors, industry and company development, and academia. The ETF consists of three separate categories: Commercialization Awards [Subchapter “D”], Research Grant Matching [Subchapter “E”], and Research Superiority Acquisition Grants [Subchapter “F”]. The descriptions are from the ETF website, while the comments refer to observations and submitted information.

The ETF maintains a “Dashboard” on its web site. The “Dashboard” link is http://members.texasone.us/site/DocServer/ETF_Dashboard__version_9_.pdf?docID=2601. It contains a listing of the awards to date, as well as information by region and by sector. Due to the constant updating of details on the site, data is not provided, since it would be obsolete with weeks. [Ref. 16]

The ETF is a unique vehicle for industry development, company development, and support to institutions of higher learning. Subchapter “F”, Research Superiority, not only evaluates the candidates’ academic credentials with respect to specific market-driven industry sectors; it also requires an evaluation of a track record in innovation and commercialization and receiving awards from industry and governments. This alone is a significant requirement, but the final point is that this research and commercialization record must be in-line with the technologies supporting the identified Texas Clusters. The results are that ETF drives the research and commercialization efforts among schools and industries to support the technology base. [Ref. 17]

COMMERCIALIZATION AWARDS – SUBCHAPTER “D”

ETF Commercialization Awards grow new businesses to accelerate new products and services to the marketplace. Through these investments, the goal is to ensure a vibrant economy for Texas and a global leadership position. Commercialization awards provide selected, early-stage investments in new, technology-based, private entrepreneurial entities that collaborate with public or private institutions of higher education in Texas, and which, if successful, may provide significant economic benefit to the state.

Priority for funding is given to proposals that involve emerging scientific or technology fields that have a reasonable probability of enhancing this state’s national and global economic competitiveness. Additional preference is given to proposals that:

- May result in a medical or scientific breakthrough;
- Have previous equity investment in the company;
- Have a demonstrable economic development benefit to this state; or
- Guarantee commercialization or manufacturing in Texas if successful.

The initiation of any effort requires some time before the impact is truly felt. While the ETF has been in existence for nearly four years, the disbursement of funds to companies has occurred over less than three years. This is still a relatively new procedure. The process for evaluating proposals, doing due diligence, recommending funding efforts, having a recommendation review by the Committee of 17, and having each of the three elected officials approve the “deals” is not accomplished quickly. Changes have been made to improve the process, but there is still a time lag before everything is accomplished. This duration to accomplish all the signoffs has resulted in a loss of some potential “deals” for Texas.

Comments: As mentioned in the section “Business Startup and Risks,” high failure rates are not unexpected with emerging companies. This is especially true when the scope of the investment includes very early stage companies. As mentioned, the ETF has not yet been providing funds for a long time. However, there has been one success and one failure. CardioSpectra was funded in 2006 and was acquired in late 2008 by Volcano Inc. (VOLC), a UTHSC-Houston spin-out. The return to the state will result in a 450% appreciation of the original investment. On the other hand, Nanocoolers, Inc. was funded in early 2007 with a high potential and a high risk to enter their market with a significant product. Unfortunately, the development and marketing effort was not successful and they went out of business. While there are no guarantees of similar successes like CardioSpectra, the pre-screening and due diligence by numerous volunteers provides some insurance of selecting the most promising business deals.

The table summarizes ETF combined total funding (Subchapter “D”, “E”, “F”) [as of 12/28/2009]. [Ref. 18]

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ETF Investment by Sector [12/28/2008]

| | % | Total # | Total \$K |
|---------------------------|-------------|-----------|------------------|
| Biotechnologies/Sciences | 43% | 32 | 61,034 |
| IT/Semiconductor/Robotics | 20% | 20 | 28,480 |
| Nanotechnologies | 18% | 10 | 25,525 |
| Energy | 17% | 14 | 23,300 |
| Defense/Aerospace | 2% | 3 | 2,550 |
| Total | 100% | 79 | \$140,889 |

RESEARCH MATCHING GRANTS – SUBCHAPTER “E”

The **ETF Research Grant Matching** goal is to create public-private partnerships which leverage the unique strengths of universities, federal government grant programs, and industry and provide a propensity for commercialization. This enables Texas to secure additional research funds from outside the state in key technical and scientific areas that contribute toward the growth of our emerging-technology economy. Leveraging federal and private funds enables Texas to build the capabilities and expertise to be competitive in our global economy.

Priority for ETF Research Grant Matching funds is to support emerging-technology R&D activities that will have a significant impact on Texas’ future economy or may result in major medical or scientific breakthroughs. Preference is given to research activities that involve collaboration among multiple Texas higher education institutions and private entities.

- The application must be submitted by a consortium comprised of an existing or newly created entity of one or more companies that has a “value added” research relationship with at least one Texas institution of higher education.
- The proposal must have received, or is actively pursuing documentation from a non-state entity, e.g. federal agency, foundation or business entity, which verifies that a grant from a qualifying entity has been awarded. Moreover, the applicant must have already received verification of the award of such a grant or must have already applied for such a grant.
- Intellectual property, facilities, or other benefits that are the direct result of ETF funding of this project must be made available to all members of the consortium through licensing agreements or other mechanisms acceptable to all consortium partners prior to funding.
- The proposal must involve research that is focused on areas of emerging technology that are of interest to an entire sector or sectors of industry with the potential for significant economic development

impact to the State or may result in major medical or scientific breakthroughs. In addition, the proposal must have a clearly stated commercialization component, including specific milestone listed within the project application.

RESEARCH SUPERIORLY AWARD – SUBCHAPTER “F”

The **ETF Research Superiority Acquisition** goal is to bring the best and brightest researchers in the world to Texas. This enables our Texas academic institutions to continue to build expertise in key research areas, attract and encourage students to pursue advanced degrees in math, sciences, and engineering, and provide an invaluable resource to the community, especially fostering innovation and commercialization in our companies. Priority for ETF Research Superiority Acquisition Matching Grants is given to market-driven proposals that involve scientific or technical fields that have a reasonable probability of commercialization and enhancing this state's national and global economic competitiveness, may result in a medical or scientific breakthrough, are interdisciplinary, have or may attract federal and other outside funding for research superiority, and are likely to create a nationally or internationally recognized locus of research superiority.

Preference is given to **Research Superiority Acquisition proposals** that have a high likelihood of supporting market-driven commercialization in key areas for Texas. **To be eligible for this award, the institution** must commit to acquiring new or enhancing existing research superiority (talent) at a Texas public institution of higher education and be sponsored by the institution's president and the board of regents chairperson. Equal matching funds are required from both industry and the institution requesting the grant.

Comments: Texas Governor Perry's remarks [Ref. 19] on February 5, 2009, at the awarding ceremony of \$5.5 million for the Center for Nuclear Receptors and Cell Signaling at the University of Houston, pointed out that \$56 million awarded to 16 universities have brought 40 top teams to Texas. This is the beginning of a journey that increases capabilities in both research and education. As research and the resultant commercialization grow, the recognition of Texas universities as top research institutions will grow.

Additional comments: The ETF has the ability to provide a focus on research that enhances the capabilities of institutions. The acquisition of superior research talent from outside Texas increases the recognition of capabilities in Texas and the potential to develop into Tier One Universities. [Tier One University status provides a competitive advantage in developing successful efforts for national and international funding.]

EVALUATION OF TECHNOLOGY IMPACT ON ECONOMIC CLIMATE

The evaluation of the impact of technology of the State of Texas was done through direct contact with the economic development organizations in various regions of the state, with the chairs of the Center of Innovation and Commercialization [RCICs & TSLC], with individuals involved in creating business opportunities, and with the various Texas university Systems and other schools. Their input is summarized in the following section. This data indicates the impact the ETF has had on commercialization activities in both the local regions and the various institutions of higher learning and the impact of funds from the TEF in convincing companies to relocate to Texas and the associated benefits. Details of the university input are in **Appendix C** and of the RCICs input are in **Appendix D**.

UNIVERSITIES

Many examples exist of schools within Texas driving innovation and commercialization. A few examples [one per system in this section] are provided below, while more examples are provided in **Appendix C**.

Texas Tech University received a \$2M award in 2008 from the ETF for researchers in nanophotonics. There is one startup company that has located in Lubbock. The ETF award was complemented by a \$5.35 million award from AT&T.

In Fall 2008, **Texas State University-San Marcos** received a \$4 million Research Superiority award to focus on Material and Science Engineering, specializing in multifunctional materials and nanotechnology. The 2008 efforts have resulted in two small businesses launched and another relocated to Texas.

UNT Health Science Center received an ETF Research Superiority award to establish the Center for the Commercialization of Fluorescence Technologies (CCFT). Work from the CCFT has resulted in several invention disclosures and patent applications, industrial research partnerships, and on-campus training opportunities for scientists and students from around the world.

The efforts of **Texas A&M-Temple** have developed a business plan that should result in 5-7 Texas spin-out companies in 2009 based on Texas A&M System and Scott and White technologies. The Research Superiority grant was the catalyst that opened the possibilities for other commercialization efforts in Temple, Texas.

UT Health Science Center at Houston (UTHSC-H) received an ETF Research Superiority Award for Dr. Mauro Ferrari, to help establish the Division of NanoMedicine in the Department of Biomedical Engineering. The division combines research in nano-engineering, mathematical modeling and biomedical sciences to develop nanotechnology-enabled therapeutic and diagnostic platforms for combating cancer, cardiovascular diseases, infectious diseases and other diseases. Two new portfolio companies (Leonardo Biosystems and Nanomedical Systems) and more than \$11.5 million in new research dollars have resulted from this program.

The **University of Houston** – ETF awards to two companies have resulted in the creation of over 60 jobs. The recent Research Superiority Grant of \$5.5 million will provide the creation of additional jobs that will drive the commercialization of innovative products.

Rice University researchers working with the Rice TTO establish commercial companies through the Rice Alliance for Technology and Entrepreneurship. Four Rice-based companies were awarded ETF funding in 2006, of which Nanospectra Biosciences is in clinical trials for cancer fighting medical technology. Rice Alliance companies have raised more than \$500 million in early stage funding.

RCICS

RCICS work closely with applicants to assist companies with ETF proposal development, post-proposal debriefings, and commercialization activities. In addition, RCICs are a strong focal point to increasing cooperation and spurring collaboration among industrial, financial, and academic entities. As in the previous section, the following are only a few examples of the impact the ETF has had on various areas. More details as reported from each of the regions are available in Appendix “D” and on the ETF web site. [Ref. 20]

TEXAS LIFE SCIENCE CENTER OF INNOVATION AND COMMERCIALIZATION

The Texas Life Science Center for Innovation and Commercialization (Texas Life Science Center, TLSCIC, TLSC) was formed to provide a central resource for the evaluation and commercialization of early stage life science companies throughout Texas, through the Texas Emerging Technology Fund (ETF). All life science applications to the ETF for commercialization awards are reviewed by the TLSC and the local Regional Centers for Innovation and Commercialization (RCIC). Companies may choose to submit their applications to either their local RCICs, who upon review will send the application to the TLSC, or directly to the TLSC.

CENTRAL TEXAS REGIONAL CIC

The Central Texas Regional Center of Innovation and Commercialization (CenTex RCIC) serves as a catalyst for emerging technology research, development, commercialization, and start-up incubation in Central Texas as part of Texas’ efforts to remain globally competitive. Serving a 15-county region, the CenTex RCIC accepts applications of commercialization and research awards from Bastrop, Bell, Burnet, Caldwell, Coryell, Falls, Fayette, Hamilton, Hays, Lampasas, Lee, Milam, Mills, Travis and Williamson counties of Texas. The CenTex RCIC is managed by the Austin Chamber of Commerce under arrangement with the Office of the Governor of Texas. Members of this center’s advisory council include representatives from area technology and economic development organizations. Commercialization investments in the CenTex region by the ETF were valued in excess of \$19 million as of February 2009.

EL PASO/TRANS-PECOS REGIONAL CIC

The El Paso/Trans-Pecos RCIC has had some successes with the ETF. There have been five ETF awards with a total value of \$10 million. The Subchapter D awards were in Energy (2) for a total of \$5 million, one in IT for \$2 million, and one in Advanced Manufacturing for \$1 million. A Subchapter “F” grant for research superiority in advanced manufacturing was received for \$2 million. The RCIC is moving forward with an effort to increase the success rate after approval by the local RCIC, which has been 67% (4 out of 6) funded. The RCIC engaged the Technology Innovation Group (TIG) to review the region’s innovation support system, assess the need for an incubator and make recommendations on what role Trans-Pecos / El Paso RCIC should play in incubation.

GULF COAST REGIONAL CIC

The Gulf Coast Regional Center of Innovation and Commercialization (Gulf Coast RCIC) serves the 30-county Gulf Coast region in southeast Texas. The Houston Technology Center (HTC) is the Gulf Coast RCIC, partnering with the Greater Houston Partnership (GHP), Economic Development Organizations (EDOs) and universities throughout the 30-county region. The Gulf Coast RCIC has announced 21 awards to area emerging technology companies for about \$20 million in funding, assisting companies across a broad cross section of technologies – life sciences, energy, nanotechnology and IT. The ETF has become established as a viable form of funding for early stage companies able to meet the ETF criteria, helping the companies to achieve the significant milestones needed to secure funding from traditional sources. A sign of success is that 2 years ago, Houston was barely in the top 20 of emerging technology centers and today ranks number 4. Working the media and introducing them to the technology development and especially the ETF awardees has resulted in a Forbes.com article listing Houston as 4th among emerging technology centers.

NORTH TEXAS REGIONAL CIC

The North Texas RCIC [NTXRCIC] is tasked with promoting awareness of the ETF, identification and preparation of quality deals for review at the state level, working with all elements of the Regional ‘entrepreneurial ecology’ and continued support to ETF companies that have received ETF funding in the 63 county “region”. Since the NTXRCIC began in 2005, the North Texas region has already secured over \$54 million in ETF investment for 28 projects, including 22 Commercialization awards, 4 Research Superiority grants and 2 Researching Match grants. In addition there are 9 more North Texas applicants that have been recommended for ETF investment by the state ETF Advisory Committee that are expected to receive funding soon.

RIO GRANDE VALLEY REGIONAL CIC

The Rio Grande Valley RCIC has seen an increase in the quality of submissions. While the initial submissions were not a large quantity, there were good concepts. Five initial efforts passed through the regional review and were approved by the Committee of 17. The RCIC acts as the regional agent for the Texas Emerging

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Technology Fund (ETF) Committee to identify, evaluate, and provide matching funding for new technology projects with the aim of increasing cooperation between industrial, financial, and academic entities, and of creating new commercial entities based on those technologies to establish new technical industry sectors in the region.

The Rio Tech Fund, Inc. was established to help bridge the gaps that inhibit entrepreneurial growth in the Rio Grande Valley region. The goal of the Rio Tech Fund is to: 1) Import Early-Stage capital to the Rio Grande regional economy; 2) Stimulate technology-based private investment from existing regional resources; NS, 3) Coordinate and support local sources of capital. The Rio Tech Fund accomplishes this goal by operating the Rio Grande RCIC and organizing a network of private "angel" investors. This network is a private investment group comprised of South Texas angel investors and high net-worth individuals. The Rio Tech Fund works directly with entrepreneurs and early stage companies to make qualified referrals to Rio Tech Fund's local, regional, national, and international network of venture capital funds and other private investors.

SOUTH TEXAS REGIONAL CIC

The South Texas Regional Center of Innovation and Commercialization (STRCIC) is managed by SATAI, a non-profit 501(c)(3) corporation funded in part by the City of San Antonio, Bexar County, the State of Texas, UT-SA, and the private sector. The ETF has to date invested over \$20 million in South Texas, and STRCIC's goal is to help entrepreneurs tap into the remaining funding to generate sustainable technology companies and jobs in the area. In addition to being the South Texas portal for the Emerging Technology Fund, the STRCIC has entrepreneurial services, training, a network of service providers, angel investors and venture capital contacts available to assist new inventors and seasoned entrepreneurs alike.

WEST TEXAS REGIONAL CIC

The West Texas region has not had the same success rate with applicants as other regions of the state. The lack of adequate business models inhibits their successful applications and guidance. An Odessa company received an \$850 thousand Subchapter D award in 2007 and an additional \$2 million from an investment group in Lubbock. The first two companies that received ETF awards have reported 2008 sales of \$3 million and project 2009 sales of over \$7 million. By 2010, all four awardee companies are projecting profitability and significant job creation. Without the WTCIC effort and the ETF, there would have been little investment.

FINDINGS

As stated earlier, the purpose of this report was to evaluate the status of the Economic Development provided by technology, which ended up primarily focused on those activities funded through the ETF. As shown in the previous section, there has been substantial activity that has resulted in company formation with its associated benefits. However, the job of economic development is an ongoing task. In the course of obtaining information for this report, many comments and recommendations were received.

INNOVATION

Recent advances in economic growth theory and practice show that regions that experience wage growth are those that constantly create new advantages through “innovation,” and rapidly transition those advantages into regionally-located high-growth companies. Such companies export the fruits of these advantages to global markets. They export goods and services and import capital and profits faster than the global competition – generating rapid wage growth *and* jobs growth. But, in Texas, only a handful of metro areas have made a successful transition to high-performance economies. As pointed out in the “Economic Growth” section [**this report page 12**], the metro area wages are below the national average. More than a dozen communities can lay claim to research universities and the sources of private capital that could potentially undergird the creation of a regional “innovation eco-system.” [**Finding: Texas has improved in technology job creation but must focus on higher skill jobs.**]

Such ecosystems are generated out of an understanding that high-growth companies require specialized resources in their formation and early growth, and enabling such enterprises to achieve their goals quickly is the key to developing dozens of sustainable new growth-engines. Most of the urban centers of Texas beyond Houston, Austin, San Antonio and the DFW Metroplex do not have “critical mass” with adequate resources to create an efficient lab-to-marketplace “innovation-ecosystem.” The identification of Industry Clusters in Texas provides a head-start in the ability to concentrate on key areas of technology that will support the established industrial base. Addressing the Cluster needs through the coordination of talent (research, entrepreneurial, managerial), innovative technology, and equity capital, built on a solid base of knowhow dissemination, regional cooperation and a favorable business climate will provide a successful growth of desirable jobs. [**Finding: Texas Industry Clusters are crucial to future job growth and economic development.**]

Texas has technology in abundance. The gap is in knowhow by regional leaders (public and private sector) in assembling the infrastructure of next-generation economies and providing appropriate levels of funding. Many communities look to the state for leadership and knowhow, and do not see the resources that fill this gap. In addition, because of the large geography and multiple university systems, Texas has been very good at creating new advantages, but not as good at capitalizing and leveraging to maximize the uniqueness of those advantages. Texas also has an overlooked advantage, with many regions on the Mexican border where the technology and management located in Texas drive the manufacturing facilities in Mexico. There is not,

however, adequate strategic coordination to maximize global competitiveness and broader research leadership in industry.

TEXAS FOCUSED INNOVATION

The Governor's mandate to increase the university economic development efforts and incorporate a commercialization culture in academic evaluation for tenure/promotion and in Technology Transfer Offices [TTO] has increased awareness and focus among Texas universities on commercializing their research discoveries. The ETF has helped to fund this mandate with 5% of Subchapter "F" grants being allocated to build capacity for university commercialization efforts including expansion of EIR (entrepreneur-in-residence) and "Venture Lab" programs alongside TTO Offices to contribute meaningfully to economic growth metrics. This 5% incentive benefits institutions that receive these Subchapter "F" awards.

There is a need to establish more academic-industry consortia/alliances in Texas focused on commercialization. These organizations are appropriately identified as Public-Private Partnerships or PPPs. The critical point of these organizations is to provide effective regional commercialization practices that start-up companies require and to address the needs of established Cluster Industries. Many collaborations among universities and between these institutions and various segments of industry have resulted from these efforts. [***Finding: Texas development activities have fostered new industry/university collaborations and networking.***]

State level developmental planning to maximally leverage the state's research competencies is needed. One of the most broadly recognized methods for leveraging advantages is the creation of Science and Technology Research Parks, as has been done in other states and countries. The development is often done as a public-private partnership, with development monies from the private sectors. Such parks serve as extension research campuses, and provide an entire innovation eco-system in a concentrated area, generating spillover effects for the entire region. They also then become powerful resources to leverage attraction strategies, in addition to the development of new companies and advantages. As a prime example, the UT Brownsville incubator has been operational since 2004 and has 47 successful companies out of 54 companies – creating more than 550 jobs created with many more projected in the next few years.

BUSINESS DEVELOPMENT

Texas currently has two ventures funds, the Emerging Technology Fund and the Texas Certified Capital Company Program [CAPCO]. [Ref. 21] Neither is designed specifically as an "evergreen" fund, intended to be invested, harvested, and reinvested ad infinitum. These funds, especially the ETF, are viewed by people from outside the state as innovative vehicles for assisting the development of businesses. The fund magnitude and the flexible funding features of the ETF, combining the impact of pre-seed, seed, star researcher, grant matching, and consortia development funds under one umbrella are particularly admired.

[Finding: Texas special economic funds have promoted growth and are considered “best practices” by other states and VCs.]

Most Texas communities do not have focused “innovation-ecosystem” development efforts, nor have the knowhow to pursue one. State programs providing only capital are of limited utility compared to a more comprehensive approach. The expansion of a Proof-of-Concept activity through various universities would enhance the ability of communities to have regionally-focused commercial development. Texas could design and deliver a course for economic development specialists through many different methods, including the State Universities. Requiring a “certification” of ecosystem development in order for a community to access ETF Subchapter “F” dollars would increase the probability of success.

A team of specialists/experts could be provided through the governor’s office to provide comprehensive programmatic design/implementation support for communities. Prior unified local support would have to be evidenced (joint application from mayor, county judge, state reps, university president, etc.).

Capital in many different forms is required to fuel innovation and the resulting growth companies that generate the bulk of economic expansion. Different stages on the continuum provide funding for basic and applied research, patenting and commercialization activities, pre-seed and seed stage investments, venture and mezzanine capital, and access to public capital markets. A lack of capital in any particular area will divert growth out of a specific economic region – a condition readily seen around parts of Texas.

LONG TERM ETF ISSUES

The ETF has a number of innovative features, particularly the Research Superiority and Grant Matching tranches, and fills a crucial seed stage investment role, but the ETF investment program also has several obstacles to *sustainability* and *scalability* compared to other state programs. [cf. Ref 22]

SUSTAINABILITY

The ETF has a small number of employees in the central office, in addition to a large volunteer board structure (ETF and RCICs). However, this organization cannot provide the same level of due diligence and monitoring throughout the state that professional venture funds provide. A range of support personnel are available at the RCICs and through the existing network, but each is different. The Gulf Coast RCIC awardees have access to Client services from the Houston Technology Center for at least one year. The Trans Pecos/El Paso RCIC monitors awardees’ progress on a monthly basis and works with the awardees to identify appropriate funding sources as they progress. Each RCIC focuses its efforts on strengths it can provide to emerging companies, which may not be the entire spectrum of services needed and is different among the RCICs.

The ETF is providing primarily equity capital, does not take a board position, and relies heavily on each of the RCICs to provide guidance. There is little opportunity for follow-on assistance or direction (as provided by

professional funds) beyond pro-forma monitoring. The RCICs do not typically have the type of employees who are experienced in overseeing emerging companies, and, the ETF does not fund companies that have private capital alternatives. So ETF investments are earlier stage and inherently more risky than private venture fund investments. Because of these factors, financial returns are likely to be less favorable than leading seed-stage venture funds. While staffing for asset management of ETF funded ventures might improve this situation, opportunities to provide a better oversight and mentoring capability by way of a joint Texas-Venture community effort, modeled after existing state-VC efforts elsewhere, might well be a direction to investigate before the 2011 Legislative session. [cf. Ref 23]

SCALABILITY

A number of issues inhibit the scalability of the ETF program:

- Activities across the state are not consistent. Some regions of the state do not have the knowledge-base and infrastructure to benefit significantly from the ETF program;
- As the volume of “deals” increases, the requirement to have the three leadership offices unanimously agree to each investment makes the potential funding timeline even more uncertain. The current timeline has resulted in drawn out “Deal closings,” which caused companies to not participate in Texas with the resultant loss of benefits to the communities;
- The program does not provide an obvious path of eventual transition to private sector investment and management, but requires that companies seek outside funding within 18 to 30 months. [In current economic times, the supply of “outside” funds may limit this ability and cause some serious issues.]; and
- Even though the ETF is designed to become self-sustaining, the methodology for this to happen is not clearly delineated. Consequently, the perception of the current incarnation appears to be designed as a permanent government program that requires continual funding.

Each of these items needs to be addressed and recommendations are provided in the next section.

Unless the state wants to continue considering this type of funding each legislative session, the overall structure needs to be modified. There are some successful examples of alternative state-venture fund activities. The matching/consortia tranche has been a program in transition. It could be enhanced to achieve industry/academic leadership through the development of new consortia/alliances, but such efforts require centralized coordination. There is evidence that this type of activity could be expedited by providing incentives to organize and initiate the activities. Beyond state venture programs and the importance of developing a home-grown venture industry, research has shown that state investment programs often fail where insufficient cultivation of local community and industry investment occurs. The state needs to partner with organizations and to extend Angel development and education programs to more regions around Texas.

STATEWIDE ACTIVITIES

Lessons of the 1980s and '90s left indelible proof of the mandate to nurture a broad and diverse economic base. Texas' geographic size and regional diversity both strengthen and hinder coordinated economic development efforts. The separation of university systems serving diverse constituents and the difficulty in coordinating among governments at the federal, state, and local levels further complicates the Texas challenge to develop major state/regional competitive advantages. There is currently no individual at the state level who can bridge the knowledge domains of business and science, nor the politics of academia, government and the private sector to help drive the coordination.

The state university systems have an enormous number of active research centers, large research portfolios, and a multitude of star scientists. Yet the perception has been perpetuated that Texas lags far behind in commercialization metrics compared to peer states. While there is always room for improvement, and accelerating efforts are underway, this perception is exaggerated. Some centralized coordination of reporting and publicizing would be helpful to bring the "Texas Universities Story" to national and global attention.

[Finding: Texas' story of innovation and commercialization is not being told.]

Texas statewide commercialization statistics are not published in aggregate, for example, and some System institutions report individually to the Association of University Technology Managers [AUTM] and the Texas Higher Education Coordinating Board. For example, UT Austin numbers are frequently compared to the entire University of California System, which includes seven tier-one research universities with billions of dollars in research expenditures. Aggregating the most recent AUTM data [2006] for Texas universities would have resulted in the following rankings compared to other states that report to AUTM [Ref 24]:

| | Texas Rank Among States | #/ \$'s |
|----------------------------------|-------------------------|-----------------|
| 2006 Licensing FTE # | 4 | 48 |
| 2006 Research Expenditures \$ | 4 | \$2,560,550,510 |
| 2006 Licenses/Options Executed # | 3 | 277 |
| Cumulative Active Licenses # | 3 | 1799 |
| 2006 Start-ups # | 9 | 19 |
| 2006 U.S. Patents Issued # | 4 | 190 |
| 2006 New Patent Applications # | 10 | 354 |
| 2006 License Income \$ | 8 | \$ 47,591,471 |

Cross-institutional work among Texas schools toward commercialization tends to originate among research faculty communications, and has accelerated in recent years. Research superiority award opportunities have helped to encourage networking and collaborations [e.g. nano, TTI, others], and related ETF 5% incentive

funds have supplemented capacity and infrastructure building by the universities. These activities must be encouraged further. Texas intellectual property is frequently commercialized beyond the boundaries of the state. [***Finding: Opportunity exists to improve critical elements of the innovation-ecosystem in Texas.***]

BENEFITS TO UNIVERSITIES

The comments provided in this section are expressions of the impact of the State of Texas' efforts in accelerating commercialization efforts within the state. The purpose of their inclusion is to demonstrate the perceived value of the ETF from the university perspective. (See Appendix C for inputs from a large number of various Texas universities Systems' locations.) As research capabilities, publications, inventions, and commercialization increase, the movement toward Tier One status will also increase. [***Finding: Commercialization activities in universities have accelerated.***]

Texas Tech System: We have found high value in the research superiority awards that we have received as they have increased our research and commercialization bandwidth. We also have found value in portfolio companies that have received an ETF award. However, we still believe there is a significant gap in the process. Specifically, Texas Tech could significantly improve its commercialization capacity if funding was available for Proof-of-Concept (POC). In addition to increasing our own internal capabilities, such funding would allow us to import technologies from outside of Texas for further development and licensing. We would like to see the POC funding opportunity explored in more detail and would like to outline some of the benefits that would be gained from this approach.

Texas State University System: The ETF has enabled Texas State University-San Marcos to accelerate its research efforts and attract talent from outside Texas that would not have been possible without the Fund. The focus of research collaboration has expanded system-wide due to the increased awareness of the commercialization efforts.

University of Houston System: UH believes that the efforts of the State of Texas with regard to promotion of commercialization of technology and intellectual property, via the Emerging Technology Fund, the Texas Enterprise Fund or other funding sources, are key to the support of UH's efforts in those fields, and in the future economic and scientific prosperity of the State of Texas. Such funds and sources are public statements of the State of Texas's commitment to technology research and commercialization of such technology. As such, they touch practically all aspects of UH's research and commercialization efforts, even in matters in which the state is not a funder. These state funding sources show the world that Texas universities are intended to be players in the world of research and commercialization, and helped UH build up a critical mass of researchers and has helped set a positive tone for research and commercialization at UH.

Texas A&M System: The impact of all of the major Texas Emerging Technology Fund awards to The Texas A&M System has been much broader than the focused efforts in regenerative medicine, bioenergy, or pre-clinical animal studies. The Emerging Technology Funds not only focuses attention, but also broadens the vision of the organizations involved in the Emerging Technology Fund efforts. Commercialization efforts be-

came part of tenure in May 2006. The number of disclosures has risen from 114 in 2006 to 153 in 2007 and to 226 in 2008.

UT System: The ETF has touched 11 of the 15 diverse institutions that comprise the UT System, with research superiority awards, matching research grants, and commercialization awards to companies affiliated with them. At **UT Dallas**, for just one example: the Enterprise Fund and the Texas Emerging Technology Fund have both had a tremendous impact. The University is working more with industrial partners than ever before. It is not only the funding provided by the ETF that is important, but with the help of the North Texas RCIC, getting companies to come to UTD to talk about collaborations that would not have even known about UT Dallas in the past. The ETF is viewed as an important part of the UTD research strategy in getting technology developed at the university into the market place as quickly as possible, and for the University to provide science and engineering research expertise for companies in Texas.

GENERAL COMMENTS

Academic institutions and emerging technology companies have made significant progress toward creating an innovative atmosphere and a commercialization culture. The ETF “Research Superiority” Grant has brought researchers to Texas who have continued to create businesses as they develop their research. The emerging technology companies have continued to create inventions and are being supported by ETF Commercialization Awards. While it is much too early to project winners and losers, the spirit of innovation seems to have taken hold. In the 79 companies currently under ETF awards, some gazelles will create significant growth for their communities.

The one major issue for Texas to address is everything that is being done is a great story and the economic development aspect shows the creativity of Texas, but the story is not being told. As just one recent example, the media reports about an \$8 million development in Michigan, but there was no national media related news about a \$4 million (\$12.5 million total) award to Texas State University-San Marcos. This is happening throughout Texas and emphasizes the point made under the “*Statewide Activities*” section immediately preceding this one. ***Expanded and targeted national/global public relations efforts are needed to help transition Texas from a “flyover zone” to the “Third Coast.” [Finding: Texas universities’ story of innovation and commercialization is not being heard.]***

RECOMMENDATIONS

The following recommendations are directed at issues that can be addressed in the current legislative session. Other, long term efforts, like the potential collaboration between Texas and VCs mimicking other states' efforts that can be developed and addressed in the 2011 legislative session.

RECOMMENDATION: FUND TO APPROPRIATE LEVELS

The funding for the Enterprise Fund should at a minimum be maintained at its current level. Competition from other states will increase and greater incentives will be required. The Emerging Technology Fund should be replenished to the full \$200 million level and an amount equal to Sub-Chapter E be added for the POC effort. This would provide an ETF funding of \$220 million. In this economic climate, an increase to \$250 million would permit the increase in oversight on funded companies and provide enhanced monitoring of award companies.

RECOMMENDATION: REDUCE THE TIME TO COMPLETE THE REVIEW AND APPROVAL PROCESS.

The procedures for the Commercialization applications are lengthy and fraught with delays. Additional due-diligence requirements have been added to the RCIC efforts. The vetting process is thorough and proceeds through many stages of review. With these findings and the approval of the Committee of 17, the elected officials should respond in a timely manner. The process at the elected official level should be one of action to reject rather than having staffers from the three different offices and the RCICs review the same material. It is suggested that the approval by the Committee of 17 be the initiation of a 30-day period when any of the three officials can deny the application or request additional information. If neither happens, the process should proceed to the negotiation stage.

RECOMMENDATION: RE-FOCUS ETF SUBCHAPTER "E"

Currently Subchapter "E" is directed at research matching grants. This section suggests re-focusing the grant matching to a focus on academic/industrial alliances [PPP] and Proof-of-Concept activities. The idea behind these recommendations is to increase the impact on innovative development, enhance the probability of commercial success, and integrate Texas research leadership within industry.

RECOMMENDATION: SUPPORT PUBLIC PRIVATE PARTNERSHIPS [PPP'S] FOR COMMERCIALIZATION IMPACT

A number of alliances have begun to develop within Texas between universities and companies. The goal of these alliances is focused on addressing the needs of one or more of the Texas Cluster segments. By combining industrial companies with multiple Texas Universities, Industry Cluster needs can be identified. Researchers can focus on solving critical issues for the Cluster. Any proposal that is submitted needs to demonstrate a sustainable business model. Initial "seed" funding of \$500 thousand to \$2 million would provide the means of establishing an operation and demonstrating its viability. A single second request could be permitted for expansion of the alliance in critical industries. The Alliance must be self-sustaining by its members after two years of operation. More details are provided in **Appendix E**.

RECOMMENDATION: SUPPORT PROOF-OF-CONCEPT FUNDING TO ACCELERATE DEVELOPMENT OF ETF COMMERCIAL VENTURE OPPORTUNITIES

Continuous funding throughout the innovation sequence is a critical challenge to technology commercialization. The federal government and corporate entities support basic research, while private investors mainly invest in later-stage products with proven concepts and working prototypes. The challenge is to bridge these two established funding streams. Funding POC projects will enable universities to translate promising discoveries into marketable products through activities such as prototype development, product testing, and analysis of business and market opportunities, thus reducing the risk for potential investors, licensees, and entrepreneurs. Unfortunately, without expanded resources for POC work, viable projects with the potential to diversify the Texas economy and change lives globally risk abandonment or delay in the time to market.

POC activities directly benefit the Texas economy because they will create more commercializable innovation than basic research, bringing the innovative products to a more definable stage of readiness for ETF equity funding and ultimately for private investment. And POC activities help attract inventors and investors from outside Texas to develop and manufacture in Texas. The Cancer Prevention and Research Institute of Texas [CPRIT] committee is currently developing a collaborative proposal for POC funding related to cancer research. It is suggested that these proposal concepts be adapted for the ETF to address POC needs broadly for all emerging technologies, with funding granted to the institution or System for Proof-of-Concept projects. More details of the rationale, track record, and structure of POC funding are provided in **Appendix F**.

RECOMMENDATION: ESTABLISH AND IMPLEMENT CRITERIA, PROCEDURES, AND A REVIEW BOARD FOR SUBCHAPTERS "E" & "F" FUNDS.

Existing instructions for application do not completely spell out the requirements, the submission forms, or the criteria for both Subchapters "E" & "F". The Committee of 17 has recently started to evaluate Research Excellence Award proposals. These additional responsibilities for the volunteers are stretching their available

time. The makeup of the Committee of 17 is focused on commercialization. With a different focus which is more academically based, some of the committee members should have different experience to approve and recommend research matching and research superiority awards.

RECOMMENDATION: INCREASE STAFFING SUPPORT FOR EXPANDING ETF ASSET MANAGEMENT

The staffing of the ETF does not permit oversight on all activities at levels that professional investment organizations have. With additional efforts ongoing in Texas and the number of ETF portfolio companies and award contracts expanding, there is a need for increased support within the ETF.

In addition, industry responses indicate a senior business/technology/academic liaison position needs to be created to interact with high-level corporate officers.

As a side note, there have been indications from people in industry that if this were a senior consultant role reporting to the Governor, it is possible for this position to be financially supported by Industry to ensure obtaining the caliber of experience required. Details and structure would need to be developed, but it provides an opportunity to attract people with the appropriate background to support technology development.

RECOMMENDATION: FACILITATE BUSINESS DEVELOPMENT SUPPORT FOR ETF APPLICANTS STATE-WIDE

The recommendation to provide state-wide training when requested by localities has been mentioned in the “Findings” section. A difference in the level of sophistication of the ETF Commercialization proposals has been observed over time and location. The larger population areas have seen the greatest improvement in the quality of submissions over the last three years. This could be due to the extra support provided through mentoring local companies. The more isolated areas of the state need to have similar efforts supported to help these communities develop the capabilities to draw emerging technology companies with the associated benefits including increased high paying jobs that have a multiplier impact on the region.



APPENDIX A – BACKGROUND ON TECHNOLOGY DEVELOPMENT INITIATIVE

This Appendix provides some background on the evaluation of technology importance to Texas and the development of various aspects of a technology strategy that resulted in the creation of funds that focus on emerging technology commercialization efforts.

HIGHLIGHTS OF PERRYMAN REPORT

A report on the evaluation of focused economic development through the promotion of emerging technologies was prepared by the Perryman Group and delivered to the state in March 2003. The report addressed the proposed Texas Technology Initiative and provided an assessment of its potential impact. [Ref. 12]

It pointed out that the “transformation of Texas from an area of extreme economic difficulty, volatility, and hardship in the 1980s to a national leader in expansion in the 1990s” was driven by the production of semiconductor and related devices. From 1990 to 2000, manufacturing growth increased by over 10% and the total wage/salary employment increased by almost 33%.

The total employment increase was not evenly spread with the Capital Region seeing a 68% increase, the Metroplex having a 38% growth, and the rest of the state having a 27% growth. The early 2000s witnessed a change in the business climate. There was a global slowdown after the 9/11 attacks, a corporate accountability crises, and fundamental changes in the technology structure. The Pacific Rim countries became more aggressive to acquire emerging technologies. The high tech manufacturing, like semiconductors, does not just replace equipment to accelerate the technology. Due to the high cost of the equipment, the facility is kept running for multiple generations of production, with the next generation equipment being established in a new facility. These new facilities were planned to become operational on a three-year cycle. So continual development became the norm.

Semiconductor manufacturing is key to successful development in other commercial products that derive from the biotechnology, med-bio, nanotechnology, information technology, MEMS/NEMS, smart materials, fuel cells, and other major markets. Having a source for fabricating leading edge electronics provides for rapid development of the related fields, which are mentioned above.

The Perryman report addressed the potential advantages of the Texas Technology Initiative [TTI], an Advanced Materials Research Center, and a National Semiconductor Foundry. The TTI was designed to establish a leadership position in creating and providing new products that would dominate world commerce in the future. The establishment and success of these proposed efforts were based on a strong and continued backing from both state and federal governments.

It must be noted that the efforts addressed by the Perryman Report had a very strong semiconductor focus, which would provide a high level of benefit for specific regions within Texas.

TEXAS TECHNOLOGY INITIATIVE [TTI] AND TEXAS ENTERPRISE FUND [TEF]

It was recognized that for the State of Texas to be globally competitive and remain a leading economy in the world, the State's government and educational institutions would need to partner in a new way with existing high-tech companies to attract the emerging, innovation-driven industries of the future. The Governor formed the Texas Technology Initiative ("TTI") in 2002 and charged it with the responsibility of developing the State Strategy on Advanced Technology ("SSAT") and accelerating advanced technology commercialization in Texas. The TTI is a technology-based platform for economic development based on innovations in semiconductor, nanotechnology, biotechnology, information technology / wireless, micro-electro-mechanical systems (MEMS), and advanced energy applications (collectively "Advanced Technologies" and specified in SB275).

During the 2003 legislative session, Texas addressed the global competitiveness issue directly by establishing a proactive economic development office with a legislative mandate to coordinate and drive Advanced Technology opportunities in Texas. The legislature also created the \$295 million Enterprise Fund as a unique tool for stimulating economic development. The SSAT prescribes how the use of these and other new tools can drive innovative partnerships between industry, universities, and government that make accelerating commercialization of Advanced Technologies a building block of future prosperity in Texas.

The Texas Enterprise Fund [TEF], the largest "deal-closing" fund of its kind in the nation, continues to attract businesses and jobs to Texas. The TEF can be used for a variety of economic development projects, including infrastructure development, community development, job training programs and business incentives. The TEF gives Texas the competitive edge in attracting new business to the state or assisting with the substantial expansion of an existing business. However, competitive states, like New York, employ a different tactic. The agreement with AMD to locate their new semiconductor manufacturing facility in upstate New York with incentives amounting to \$1.2 billion is based on the state's ability to issue bonds to acquire funds. The Enterprise Fund provides Texas with a similar, but smaller tool for bringing companies to locate in Texas.

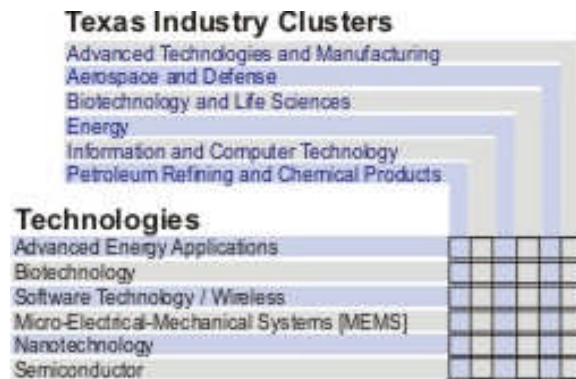
Recently, the TEF was the driving force behind Rackspace Managed Hosting's decision to expand its facility in Windcrest/San Antonio -- a move that will generate more than \$100 million in capital investment and will create approximately 4,000 new jobs for Texas. To date, the Texas Enterprise Fund has brought more than 51,874 new jobs to the state, generating more than \$13.7 billion in capital investment.

STATE STRATEGY ON ADVANCED TECHNOLOGY [SSAT]

The effort within Texas was focused on identifying the critical areas of the state’s economy. The TTI called for the development of a State Strategy on Advanced Technology (“SSAT”) establishing, as contemplated by SB275, a ten-year plan for creating leading-edge R&D programs, world-class infrastructure, and interdisciplinary networking that empowers the growth in Texas of knowledge-based industries that are the key to sustained prosperity in a global economy. Innovations in Advanced Technologies are fundamental to the competitiveness across the state’s six targeted industry clusters. The SSAT provided the directions to State leadership on how to foster innovation that strengthens targeted industry clusters, and even more broadly, establishes Texas as the world leader in emerging technologies. This long-term strategy required an unprecedented degree of collaboration *across* institutions, agencies, regions, and industries. The SSAT provided a comprehensive guide for such collaboration based on the historic precedents of initiatives such as SEMATECH.

The Texas Technology Initiative Steering Committee formed a development team for the State Strategy on Advanced Technology. This cross-functional team consisted of leading scientists and engineers from each of the advanced technology disciplines as well as liaisons to each of the targeted industry clusters. They were charged with inventorying and assessing the state of R&D programs, infrastructure, networking, and advocacy for Advanced Technologies in Texas.

They conducted a comprehensive geographic advanced technology capability assessment, including research programs and research infrastructure (labs, facilities, equipment, etc.) at Texas companies, universities, and high-tech research institutes. These coordinated assessments defined where Texas stood in 2003 in terms of the SB275 technologies. The results of the Advanced Technologies evaluation identified key technologies that support Texas’ Clusters. The key areas are: 1) Advanced Energy Applications; 2) Biotechnology; 3) Software Technology/Wireless (also called Information Technologies); 4) MEMS; 5) Nanotechnology; and. 6) Semiconductor. A focused support of the developments in these areas provides a strengthening of the support of the Cluster efforts. The inter-relation of the technologies with the Clusters is shown in the figure below. For any given Cluster application, it is possible to identify the correlation between the specific Cluster and the technologies required to accomplish the desired results. As can be seen in the figure, Cluster innovation requires support from multiple technologies.



TEXAS CLUSTERS

The effort within Texas was focused on identifying the critical areas of the state's economy. Governments in key US states, Asia, and Europe have implemented strategies to capture leadership in Advanced Technology research, development, design, commercialization, and manufacturing by offering unprecedented aggressive regional incentives to build up their own infrastructure and attract businesses. The danger to Texas competitiveness is significant, as these industries have forecast revenues exceeding \$3 trillion within a decade, and they will drive the world economy for the next fifty years.

In 2003 the Texas Legislature passed SB 275 calling for the development of strategies to strengthen the competitiveness of target industry clusters. As a result, the state identified the clusters, including a number of specified industries, and developed strategies to address economic growth and quality of life issues. Appendix B describes the six target industry clusters. These clusters build on the existing infrastructure and company presence to provide the best promise of success for overall economic growth and for bringing high-paying jobs of the future to Texas.

Targeting industry clusters increased awareness of specific regional workforce and economic conditions to inform policy action at the state level and to maximize use of limited resources to stimulate growth. Other industries link to the target clusters, and therefore, contribute to and benefit from this approach as success in these core clusters increases long-term competitiveness and regional prosperity in other industries. The objective is to stimulate sustained growth and justify/direct the allocation of state resources supporting economic and workforce development efforts for job retention, and recruitment and expansion efforts for job creation in target industry clusters such that all industries will profit.

THE INDUSTRY CLUSTER WAS DEFINED BY SB275, GOVERNMENT CODE, SECTION 481.001 (6) "INDUSTRY CLUSTER" MEANS A CONCENTRATION OF BUSINESSES AND INDUSTRIES IN A GEOGRAPHIC REGION THAT ARE INTERCONNECTED BY THE MARKETS THEY SERVE, THE PRODUCTS THEY PRODUCE, THEIR SUPPLIERS, THE TRADE ASSOCIATIONS TO WHICH THEIR EMPLOYEES BELONG, AND THE EDUCATIONAL INSTITUTIONS FROM WHICH THEIR EMPLOYEES OR PROSPECTIVE EMPLOYEES RECEIVE TRAINING.

APPENDIX B – DETAILED CLUSTER COMMENTS

This Appendix provides additional details of the characteristics, focus, and efforts within each of the six identified Industry Clusters that are key to future economic development in Texas.

ADVANCED TECHNOLOGIES AND MANUFACTURING

Manufacturing is still a primary driving forces of technology and economic advancement. Despite statistics that paint a negative picture of job outsourcing, plant closings and job displacement due to the implementation of technology, manufacturing is essential to the economic vitality of a community. Older technology manufacturing has a reputation of being outsourced to lower wage regions of the world. Emerging technology manufacturing is more skill intensive and consequently higher paying. The combination of the Texas innovation efforts and the advanced workforce development available through institutes of higher education and the state provides an advantage for high tech manufacturing in Texas.

AEROSPACE AND DEFENSE

This Cluster has opportunities in homeland and cyber security, Maintenance, Repair and Overhaul (MRO), Unmanned Aerial Vehicles (UAV), space program and industry commercialization, and composite aircraft. The success of the Industries in this Cluster is that they are adopting new technologies and improved processes for manufacturing in order to remain competitive. The application of nanotechnology, especially in novel materials development, will advance the aerospace and defense industries in Texas.

BIOTECHNOLOGY AND LIFE SCIENCES

This Cluster includes disciplines, markets, products and services that draw from biology and the life sciences, but it is a broad industry. It includes pharmaceuticals, medical devices, agriculture, oil spill and toxic waste remediation, marine and fisheries, biohazard sensors, and renewable energy sources. Texas houses the world's largest medical center and the world's capital of human space flight, and is home to outstanding technology, agricultural colleges and medical schools, engineers and scientists. The recently formed Cancer Prevention and Research Center of Texas [CPRIT] with its \$3 billion total funding will further increase the state's capabilities and the size of the industry directly involved.

ENERGY

The energy sector is one of the oldest and most diverse industries in Texas. The focus of Energy has changed from pump jacks, offshore rigs, windmills, and pipelines. The energy industry is now exploring issues like reservoir depletion, opportunities in diverse and emerging new alternative energy technologies, and energy storage. The dynamic and inter-related global marketplace creates new challenges and opportunities for economic development and investment in the energy sector. Research investment is critical to the Cluster retaining its leadership. ETF award reviews are challenging due to the nature of energy development that encompasses enhancements to existing technologies and the development of novel means of generating energy.

INFORMATION AND COMPUTER TECHNOLOGY

The Information and Computer Technology Cluster is significant in the industry segments it encompasses, which range from computers and software to telecom and IT-centric services. The computer gaming industry is a significant entity in itself. The Cluster is both an industry unto itself and an important if not a critical contributor to the other five clusters. This is one of the more challenging Clusters for ETF awards. “Innovative breakthroughs” are much more difficult to achieve in software that can be successfully protected. Additional consideration must be made by review committees to address the unique developments in this arena.

PETROLEUM REFINING AND CHEMICAL PRODUCTS

Texas is the nation’s leading producer of oil and gas, refined products, and chemicals. These industries are closely interrelated. For instance, the Texas chemicals industry is actually one of the largest consumers of Texas petroleum products – both refined products and natural gas. Chemical plants not only use oil and gas products as feedstock; they are substantial consumers of natural gas and electricity to power their operations. While most of the state’s chemical complexes are on the Gulf Coast, almost half of Texas’ counties have chemical manufactured output.

APPENDIX C – DETAILED COMMENTS FROM TEXAS UNIVERSITIES

While a few benefits were highlighted within the report, this Appendix is a compilation of the comments received from a number of Texas Universities. It shows the importance of efforts, like the ETF, to provide impetus to moving quickly forward in research, development, and commercialization. The University Systems have responded to the Governor's challenge to provide a greater focus on developmental efforts that can provide paths to commercialization successes. The following is a brief synopsis (edited) of inputs received from various Systems and individual Institutions. The listing is alphabetically with State schools first.

TEXAS A&M UNIVERSITY SYSTEM

TEXAS A&M SYSTEM

The Emerging Technology Fund Research Superiority investment in the Texas A&M Institute for Preclinical Studies was critical to complete the funding package for the imaging core facilities that will make the Institute such a unique research and commercialization facility for drug and medical device discovery. While the Research Superiority funding was a small part of the overall Texas A&M Institute for Preclinical Studies development cost, the targeted use of the funds to attract the research superstars and purchase key imaging equipment adds the critical elements of expertise and specialized equipment that make the Institute a uniquely qualified facility to commercialize discoveries.

The joint efforts in developing the proposal and creating of the Institute for Regenerative Medicine [See section on Texas A&M Temple below] have resulted in a much closer working relationship between all of the parties involved and has shown commercialization benefits far beyond the technologies of the Institute for Regenerative Medicine. As Texas A&M Heath Science Center, Scott and White Hospital, and The Texas A&M System planned for the commercialization of technologies from the Institute for Regenerative Medicine, the discussions expanded to include all technologies jointly developed between System and Scott and White researchers.

The Texas A&M System and the Office of Technology Commercialization have been expanding the commercialization support, industrial sponsored research support, and economic development support capacity at the System level by hiring additional personnel in key focus areas. Commercialization and licensing support has been expanded by 5 professional staff in the last fiscal year, with three of the other hires have direct licensing responsibility for the three research superiority awards that have been contracted with the Texas A&M System: Institute for Regenerative Medicine, Texas A&M Institute for Preclinical Studies, and Bioenergy. The additional personnel and focus on the research superiority awards will ensure close coordination of the research and commercialization efforts of our attracted superstar researchers.

FINAL REPORT

The Office of Technology Commercialization participates very closely with the local technology incubator, the Research Valley Innovation Center. The Director of Commercialization Services in the Office of Technology Commercialization is the co-Chair of the Advisory Council for the Incubator. All Texas A&M spinouts and licensees in the College Station area are strongly encouraged to be members of the Research Valley Innovation Partnership.

In addition, the Office of Technology Commercialization maintains close ties with other statewide incubators and local economic development centers. An example of this is the close working relationship that the Office of Technology Commercialization has with the Temple Health and Bioscience District. All commercialization and spin-out activity in Temple arising out of the Institute for Regenerative Medicine and Texas A&M Health Science Center's long standing relationship with Scott and White Hospital are coordinated with the Temple Health and Bioscience District. This strengthens the ties to the local community and opens local avenues for commercialization support and incubation for System spin-outs and licensees. The Office of Technology Commercialization also works closely with the statewide network of Regional Centers for Innovation and Commercialization to coordinate Emerging Technology Fund support for System spinout companies, and coordinate System support for companies applying to the Emerging Technology Fund.

TEXAS A&M COLLEGE STATION:

The Research Superiority grant received by AgriLife and the Texas Engineering Experiment Station (TEES) for bioenergy was a catalyzing event that was the first tangible result that showed the high level of support for bioenergy efforts in the state. Winning the Research Superiority award brought the researchers and research organizations in AgriLife and TEES together to identify other opportunities for renewable energy and explore how to leverage capabilities in bioenergy into sponsored research programs. The joint research efforts that flowed from the effort to win the Bioenergy Research Superiority award include master research contracts with companies such as Chevron, Vestas, and Ceres. In many ways the Research Superiority award for bioenergy was the foundation for the bioenergy efforts across AgriLife and TEES.

Additionally, the Research Matching grant received by Agrilife to pursue research and commercialization opportunities with General Atomics for algae to fuel has given focus to an area of bioenergy research for AgriLife. AgriLife already has leading expertise in bioenergy crops and in animal waste to bioenergy. The Research Matching grant has served to focus on algae to energy and has led to a target candidate for the Bioenergy Research Superiority grant who is an algae to energy expert.

Texas A&M Institute for Preclinical Studies developed a pharmaceutical discovery and testing program that if agreed to by our targeted industry partners would bring millions of dollars of industry sponsored research to the Institute and generate many new drug discoveries and imaging techniques that could be spun off into companies. [This research effort depends on the superstars attracted by the Research Superiority award and would be a significant milestone for the Texas A&M Institute for Preclinical Studies.]

TEXAS A&M TEMPLE

The effort to create the Institute for Regenerative Medicine and apply for and win the Research Superiority award to attract key researchers to the Institute was a catalyzing force in Temple, Texas to bring the Temple Health and Bioscience District, Scott and White Hospital, The Texas A&M Health Science Center, and the Texas A&M System together to work on a biomedical research program with a focus on commercialization and local economic development.

The joint efforts has developed a business plans that may result in 5-7 Texas spin-out companies in 2009 based on Texas A&M System and Scott and White technologies. The Research Superiority grant was the catalyst that opened the possibilities for other commercialization in Temple, Texas.

TEXAS STATE UNIVERSITY SYSTEM

SAM HOUSTON STATE UNIVERSITY

While there have been no awards to companies directly with researchers at Sam Houston, collaborative efforts have begun throughout the Texas State University System. The creation of a System-wide Nanotechnology Task Force is opening opportunities for commercialization efforts with emerging technology companies.

TEXAS STATE UNIVERSITY-SAN MARCOS

Commercialization activity is mounting, as evident from increases in the number of IP related agreements, and the launching of a Research commercialization center (formed in Fall of 2008), in conjunction with the Office of Technology Commercialization (formed in early 2008). The office oversaw 39 IP related agreements in 2008. The University is receiving royalties for the first time. The IP efforts are University-wide and training is being provided to faculty and staff. A \$4M Research Superiority contract is assisting the expansion the Material Science and Engineering effort with a focus on multifunctional materials and nanotechnology. In conjunction with the research superiority funds the University also received significant donations from Freescale Semiconductor of material processing equipment, to provide leading edge research with an emphasis on initiating small business start-ups in the region. The 2008 efforts have resulted in two small businesses launched, and one small business relocated from California to Texas

TEXAS TECH UNIVERSITY SYSTEM

TEXAS TECH

Texas Tech is currently exploring multiple avenues to increase commercialization capacity. In addition to finalizing the terms to raise an external fund, Tech is partnering to expand the deployment of incubator/accelerator facilities throughout their region. Additionally, Tech has increased their participation in economic development in West Texas. As it relates to ETF partnership, Tech is negotiating a license agreement with a large-multi-national company based on work supported by an ETF award. In addition, one of their ETF award companies is preparing for a significant expansion.

Texas Tech received \$1.94 million as the first ETF superior research award to develop the International Center for Excellence in Agricultural Genomics and Biotechnology. The ETF award was instrumental in recruiting renowned cotton researcher Dr. Thea Wilkins to head the newly created center at Tech. The College of Engineering received a \$9 million package – \$2 million from the Texas Emerging Technology Fund (TETF), \$5.35 million from AT&T and a \$2 million commitment from the university – to attract a team of world-class faculty researchers in the field of nanophotonics. As part of this effort to recruit the nanophotonics team, the start-up company was also recruited and was relocated in Lubbock.

UNIVERSITY OF HOUSTON SYSTEM

UNIVERSITY OF HOUSTON

UH has placed commercialization as a high priority. In each of the past two years, UH has received over \$1 million per year in technology licensing revenue. During the past two years, UH received a total of 67 invention disclosures, filed 47 first patent applications, filed 45 divisional/continuation patents, and received 13 patents. Five new companies have been formed with faculty members in the last two years.

UH has created or is in the process of creating centers for research and technology transfer, including UH's Center for Industrial Partnerships, which is building capacity by seeking out and developing commercialization grants, and by working with economic development organizations, like the Greater Houston Partnership. The Lone Star Wind Alliance, a consortium that UH is spearheading with other Texas universities and key players in the private sector, seeks to create new wind energy technologies that can be commercialized and brought to the general public via the private sector. Examples of other existing innovation centers are the Texas Center for Superconductivity and the Center for Advanced Materials.

UNIVERSITY OF NORTH TEXAS SYSTEM

UNIVERSITY OF NORTH TEXAS HEALTH SCIENCE CENTER

The TECH Fort Worth Acceleration Lab opened in April 2008 and promotes commercialization of research by providing support for start-up companies that are built on emerging technologies. The Acceleration Lab offers wet labs outfitted with workbenches, vent hoods, sinks, and other standard fixtures.

The ETF Research Superiority award to establish the Center for the Commercialization of Fluorescence Technologies (CCFT) has already had a tremendous impact at the UNT Health Science Center and its community. Work from the CCFT has resulted in several invention disclosures and patent applications, industrial research partnerships, and on-campus training opportunities for scientists and students from around the world.

In fiscal year 2008, the Commercialization office processed more total research-related agreements than ever before. Since formation of the office in 2004, the number of research-related agreements processed has increased by an average of 37% each year.

UNIVERSITY OF TEXAS SYSTEM

UT SYSTEM

UT System supports \$2.3 billion in total annual research expenditures statewide. The UT System Office of Research and Technology Transfer (RTT) was formed in Austin in 2006. The RTT team has expanded to include seven professionals with diverse backgrounds in research, patent law, compliance, finance, and administration. The RTT team coordinates efforts across the System to fill gaps, attract resources, and facilitate collaborations, working with ETF staff, RCIC's, venture capitalists, incubators, business schools, colleagues at other universities, and national standard-setting organizations to model best practices in realizing the commercial potential of university research discoveries.

In 2007 the RTT team launched the **Ignite Texas!** program, consisting of ten initiatives to expand the vast infrastructure, support evolving cultural shifts, accelerate the commercialization of UT System research discoveries. "**Ignite Texas!**" initiatives include policy drivers and incentives for tenure and promotion, IP search engines, standard documents, incubation with mentoring, expanded collaborations, and networking to capture the synergy and increase the momentum for commercialization of Texas technologies around the globe.

Notably, in 2008 the RTT team initiated two major new programs: the Texas Ignition Fund [TIF] launched with \$2 million committed by the UT Regents to fund POC" projects and prepare them for ETF applications; and the **Ideas on Fire!** entrepreneurship lecture series piloted for faculty at UTMDACC, and the video content is available on the RTT web site. [Ref. C1]

FINAL REPORT

In 2008 the UT System institutions reported 25 startup companies, not including many private companies that are mentored by incubators and economic development organizations sponsored by and hosted in UT facilities state wide.

ETF Research Matching Awards to four UT System institutions total nearly \$26 million for seven nanotech, semiconductor, IT, and life science projects. Commercialization Awards total [as of 12/28/08] approximately \$45 million for more than 40 companies with technology from eleven UT System institutions. Nine companies have collaborations with multiple universities. Research Superiority Acquisition of Talent grants totaling \$35 million [also as of 12/28/08] have been awarded to seven UT universities over the past two years. Four new startups have already resulted from new hires in this program. (Leonardo Biosystems, Nanomedical Systems, Denim Labs spin-off of Denim Group LLP, and SafeMashups Inc.)

UNIVERSITY OF TEXAS AT ARLINGTON (UT ARLINGTON)

With almost 800 professors and scholars participating in a collaborative partnership fostering entrepreneurship and research commercialization, the UT Arlington continues to positively impact the local and state economy. UT Arlington has experienced explosive growth as research expenditures climbed to \$66.5 million, an increase of 90% in the past 5 years. The reporting of inventions via IP Disclosures reached a record high of 60 with a concurrent rise in patent application filings of 126% over the past 5 years. As the state leader in Texas Ignition Fund awards totaling \$275,000, the 6 awardees have already begun commercialization efforts. Of these funded projects, all have obtained additional funding from non-University partners, several are in the process of being licensed, and one was selected to present at the 2009 World's Best Technologies Showcase. As co-hosts of the WBT Showcase and organizer of the WBT Poster Session, UT Arlington is critical to the success of one of the largest gatherings of venture capitalists, licensees, and Fortune 1000 companies in the country.

With \$2.5 million from the Emerging Technology Fund, \$1 million from Texas Instruments, \$500,000 from UT System STARS Program, and \$1 million of internal funding, UT Arlington has appointed Dr. Robert Magnusson to the newly created Texas Instruments Distinguished University Chair in Nanoelectronics. This \$5 million endowment will further research and commercialization of products relating to solar technology, biosensors, lasers, and display technologies. One of the companies, Resonant Sensors, co-founded by Dr. Magnusson has already received an ETF award and been recognized for its promise by receiving a Recognition of Excellence in Innovation Certificate from the U.S. Department of Commerce.

Ranking third in the state for sponsored research funding with over \$66 million in FY08, UT Arlington has increased collaboration with companies such Texas Instruments, Laerdal Medical AS, Whirlpool, and BP Solar. Also, two other ETF recipient companies (Terapio, and Texas Piezoelectric) with close ties to UT Arlington are actively commercializing new solutions. ETF funds have allowed them to develop new innovations, hire additional employees, and market products that may lead to treatments that reduce the side effects of chemotherapy (Terapio) and provide new sources of energy (Texas Piezoelectric).

FINAL REPORT

To increase the success of new ventures, UT Arlington has partnered with the Arlington Technology Incubator (ATI) to mentor fledgling businesses. Together, the incubator and ATI have hired a business coach who will guide faculty through the start-up process and assist existing local start-ups move from incubation to commercial success. UT Arlington's Venture Innovation Partnership (VIP), will encourage entrepreneurship among students, mentor start-up companies based on UT Arlington technologies, and promote economic growth through collaboration with the business community.

UNIVERSITY OF TEXAS AT AUSTIN (UT AUSTIN)

Over the past six years, UT Austin has created a total of 37 new companies to commercialize UT Austin technology. UT Austin has received two ETF research superiority awards, and several new companies with UT Austin technologies and/or incubated at ATI have received ETF Commercialization awards over the past two years.

IC2 Institute offers a masters degree in commercialization, provides consulting services to governments and universities in more than 40 countries, and operates the **Austin Technology Incubator (ATI)**, which is one of the oldest university incubators in the country. ATI has launched 175 companies since its founding in 1979, and these companies have raised more than \$750 million in private capital. UT Austin also is the home of Moot Corp, the oldest business plan competition in the world.

UT Austin's Office of Technology Commercialization recently launched an **Entrepreneur-in-Residence (EIR)** program to generate successful startups from UT research by identifying and extracting promising technologies and developing an efficient pathway to move these innovations to the market. The program was partially funded with ETF research superiority 5% incentive award funds. The EIR program's mission is to:

- Stimulate the creation of startups based on UT Austin technology
- Provide an enhanced "deal flow pipeline"
- Support the entrepreneurship ecosystem by requiring the submittal of business plans to the Central Texas Regional Center of Innovation and Commercialization
- Support UT Austin technology-based economic activity that provides incentive for UT Austin faculty, promotes UT Austin creates jobs and stimulates the economy

This additional focus on startups will provide a straightforward, productive, and mutually beneficial process to engage with faculty and external audiences (such as entrepreneurs, investors, and established industry) regarding commercialization activity. These enhanced processes will improve access and visibility, foster a culture of innovation, and maximize the impact of university innovations.

UNIVERSITY OF TEXAS AT BROWNSVILLE (UT BROWNSVILLE)

The UT Brownsville and Texas Southmost College, (UTB/TSC), incubator has been operational since January 2004. The Incubator has developed from a mixed use operation to one focused on technical and international companies. The summary of performance to date shows 54 companies in the incubator, with 47 companies succeeding and growing. The total number of jobs created is 558 and that number is expected to grow to 900 in the next 24 months.

UNIVERSITY OF TEXAS AT DALLAS (UT DALLAS)

UT Dallas has benefited tremendously from the Enterprise Fund and the Texas Emerging Technology Fund. UT Dallas, in collaboration with Texas Instruments, the UT System, the State of Texas, and local community leaders put together a program in 2003, which brought \$200 million to UT Dallas to improve and expand the engineering school, and in return, Texas Instruments agreed to build a new 12" wafer fab in Richardson, TX. \$50 million of the \$200 million came from the Texas Enterprise Fund. This support aided the engineering school in starting the Materials Science and Engineering Department and the Mechanical Engineering Department, by providing support to hire new faculty and to acquire new facilities. Direct outcomes of this project are an increase in research expenditures and PhD graduation rates. UT Dallas' research expenditures have grown from \$33.6 million in FY03 to \$64.3 million in FY08. The engineering school graduated 50 PhD students for the first time in 2007, up from only 10 as recently as 2000.

UT Dallas has participated in several Texas Emerging Technology Fund projects. For example, MicroTransponder and Solarno are two ETF-funded startups based on technology developed at UT Dallas and two major centers would not have been possible without the ETF support.

TXACE – TEXAS ANALOG CENTER OF EXCELLENCE

With the help of Texas Instruments, UT Dallas was able to win the Semiconductor Research Corporation Analog Research Center. The Center was made possible because of a \$4.5 million Research Superiority Grant which was provided to help hire 3-4 new faculty to expand the research expertise of TxACE. The total value of TxACE over the first three years is greater than \$13 million. We have already hired one of the leading analog design engineers (Prof. Ken O) in the country to be director of TxACE. This program will make UT Dallas one of the leading analog research universities in the country over the next several years.

TXNRSI – TEXAS NANOELECTRONICS RESEARCH SUPERIORITY INITIATIVE

In conjunction with UT Austin and UT Arlington, UT Dallas led a proposal for a research superiority initiative to bring 8 of the best nanoelectronics scientists and engineers to the state of Texas. The ETF provided \$10 million, the UT System provided \$10 million, the Universities provided \$10 million and the universities are raising \$10 million in endowments, bringing the total program to \$40 million.

FINAL REPORT

This program allowed UT Austin, as the prime, to win the Nanoelectronics Research Initiative Southwest Academy for Nanoelectronics, in which UT Dallas is a key participant. This research superiority award provided the support for UT Dallas to hire Prof. Yves Chabal from Rutgers University to be the Texas Instruments Distinguished Chair in Nanoelectronics. Since joining UT Dallas, Yves was awarded the Davisson-Germer Prize in Surface Physics – the highest prize awarded in surface physics.

The Office of Technology Commercialization works with the Institute for Innovation and Entrepreneurship to link local companies seeking ETF funding with research partners at UT Dallas. There have been a number of successful collaborations and several are actively developing. The result of the ETF awards includes the ability to bring key researchers to Texas. More companies are interested in talking with universities to develop ways to collaborate. Staffing for commercialization in conjunction with research superiority funding has provided support for UT Tyler and new ventures.

UNIVERSITY OF TEXAS AT EL PASO (UTEP)

UTEP has received an ETF research superiority grant to establish and staff a new **Center of Inland Desalination Systems**, in partnership with the city's desalination plant – a joint project of the El Paso Water Utilities and the U.S. Army. The Center's mission will be to develop and implement technologies to create alternative water sources in Texas and across the globe.

The \$100,000 ETF incentive funds from the research superiority grant are being used to help staff UTEP's new **Center for Research Entrepreneurship and Innovative Enterprises (CREIE)**. CREIE fosters economic development through activities that support business creation, growth, technology transfer, and commercialization. CREIE programs educate students, business owners, and prospective business owners about the formation and management of companies in free enterprise systems. UTEP faculty, staff, and students conduct research to add to knowledge about entrepreneurship and communicate results to practitioners, policy makers and other scholars.

UNIVERSITY OF TEXAS HEALTH SCIENCE CENTER AT HOUSTON (UTHSC-HOUSTON)

UTHSC-Houston Office of Technology Management has a robust technology commercialization program with widespread corporate relations. UTHSC-Houston filed 121 U.S. patent applications in the 2005-2008 period. The office executed 120 new license/option agreements during the same period, bringing the cumulative total to 242. Annual gross revenues for technology management operations exceed \$3 million since 2005. Total cumulative gross revenues for the office exceed \$32 million.

UTHSC-Houston and UT M.D. Anderson Cancer Center received a \$25 million award from the Texas Enterprise Fund [TEF] to match the GE Healthcare contribution of millions of dollars in state of the art imaging equipment for the joint Center for Advanced Biomedical Imaging Research (CABIR) currently under construction at the UT Research Park in Houston. Completion of CABIR will be in 2009.

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UTHSC-Houston received 2 ETF Superiority Awards for a total of \$7.5 million. The first Superiority award for Dr. Mauro Ferrari helped establish the UTHSC-Houston Division of NanoMedicine in the Department of Biomedical Engineering. The Division focuses on inter-disciplinary research to combine nano-engineering, mathematical modeling and biomedical sciences to develop nanotechnology enabled therapeutic and diagnostic platforms for combating diseases including cancer, cardiovascular diseases, infectious diseases and others. The NanoMedicine Division currently has 45 members including faculty, postdoctoral fellows, graduate students, research and administrative staff. Two new portfolio companies (Leonardo Biosystems and NanoMedical Systems) have recently been established from this program. Research dollars awarded to this division exceed \$11.5 million.

The second Superiority award to recruit the research team for Dr. John Holcomb (recently retired as Commander of the U.S. Army's Institute for Surgical Research) helped establish the UTHSC-Houston Center for Translational Injury Research (CeTIR). CeTIR provides new medical technologies based on the integration of biology and informatics to improve the diagnosis, care and survival of trauma victims. CeTIR investigators are engaging in clinical and/or pre-clinical studies of resuscitation devices/strategies, hemostatic dressings, hemorrhage control, and medical monitors. Dr. Holcomb was recently awarded the UT Chancellor's Health Fellow for Trauma and Injury Programs. Research dollars awarded to this center total \$9.2 million. CeTIR currently has 25 members including faculty, postdoctoral fellow, graduate students, research and administrative staff.

UTHSC- Houston has 17 portfolio companies, three of which received ETF funding (Endothelix (4 employees); \$1 million; PLx; \$2 million (6 employees) and Nanomedical Systems; \$3.5 million (6 employees). UTHSC-Houston spin-off company, Volcano Therapeutics (VOLC, NASDAQ) recently acquired the UTHSC-San Antonio/ UT Austin spin-off CardioSpectra (ETF awardee) for a reported \$25 million.

UNIVERSITY OF TEXAS M.D. ANDERSON CANCER CENTER (UTMDACC)

UTMDACC created The Office of Technology Discovery as interface between innovators and entrepreneurs. They report that over the last five years, there have been 1437 formal faculty contacts, 79 projects teams formed, 47 projects presented, and 31 projects funded via their internal seed fund to allow for proof-of-principle. As of October 2008, there have been direct investments of \$1.85 million with a current value creation of \$7.46 million, a growth of more than a factor of four. The 2008 *Ideas on Fire! Life Sciences* entrepreneurship training course for faculty has led to the development of two startup companies. Several of UTMDACC's startups applied for ETF funds and two have so far been elected to receive ETF funding.

UNIVERSITY OF TEXAS MEDICAL BRANCH AT GALVESTON (UTMB)

Despite struggling to recover from the damaging hurricane, UTMB commercialization activities are ongoing. The Center for Technology Development is charged with the management of UTMB's Intellectual property assets, while promoting and encouraging scientific research. Notably, UTMB has a POC "Business Acceleration

tion Program” that started in 2006 with \$1.2 million from the sale of equity in a UTMB startup company. The fund intended to encourage UTMB entrepreneurs to form start-up companies around technologies developed at UTMB, and awards are designed to assist in the transfer of UTMB’s innovative technologies to the commercial sector. A few examples of companies that have emerged with UTMB technology are:

- AptaMed, Inc. is a biotechnology company in Galveston, TX that has licensed proprietary technology from UTMB, Efforts have been extensively expanded by DARPA, DHS and NIAID funding and are focused on phosphoromonothioate and phosphorodithioate oligonucleotide “thioaptamers” targeting a wide range of biomolecules. Several of the thioaptamers are currently in pre-clinical development as therapeutics for infectious diseases such as West Nile virus and arenavirus hemorrhagic fevers. AptaMed has also developed proprietary technology for high-throughput screening of bead-based combinatorial libraries of thioaptamers. This technology is being used with Ciphergen’s SELDI MS technology to identify proteins bound to the thioaptamers and to develop new thioaptamer arrays for proteomic diagnostics.
- Chrysalis BioTechnology, Inc. is a biopharmaceutical company developing new therapeutics to accelerate the healing of hard and soft tissue. The Company's lead product, Chrysalin[®], is currently in Phase III human clinical for bone fracture healing, and Phase II trials for chronic diabetic ulcers.
- RedStorm Scientific is a statistical and structural proteomics company that utilizes proprietary Computational techniques to assist pharmaceutical and biotechnology companies in significantly reducing drug development time and costs by streamlining the therapeutic design process.

UNIVERSITY OF TEXAS - PAN AMERICAN (UTPA)

UTPA has a focus on advanced manufacturing, a key cluster identified for Texas and a key development opportunity on both sides of the border in the Rio Grande Valley where approximately 100 Fortune 500 companies maintain active operations. The **Rapid Response Manufacturing Center [RRMC]** was opened in April 2008. The RRMC provides research, engineering design, and production expertise to enable organizations scale production from a concept to finished goods as rapidly and efficiently as possible. The Center is part of the North American Advanced Manufacturing Research & Education Initiative (NAAMREI) directed to develop world-class advanced manufacturing industry in the Rio South Texas Region with UTPA as the lead research institution. The RRMC received federal funding in 2007 and has been supporting clients’ commercialization efforts since before its official opening.

UTPA partners with regional economic development corporations in recruiting and supporting manufacturing in the South Texas region and has a growing portfolio of research partnerships with companies focused on the benefits of rapid response manufacturing. The first corporation is in the process of relocating its engineering group to Texas to benefit from the rapid response manufacturing research underway at UTPA. The first commercial entity created in South Texas based on UTPA inventions will be based on “Multi-Level Superfine Fibers” (nanotechnology), a recent TIF award recipient from the UT System. Invention disclosures in 2008 were up 50% over 2007, and patent filings were up just under 30% in the same period. UTPA already

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earns royalties based on nanohydrogen storage systems IP (nanoenergy) exclusively licensed to a major European company and has licensed IP for image enhancement algorithms to a start-up in Iowa.

UNIVERSITY OF TEXAS HEALTH SCIENCE CENTER AT SAN ANTONIO (UTHSCSA)

UTHSCSA created the National Trauma Institute (NTI), a collaborative research project to establish the primary site for trauma research in the U.S. NTI received \$3.5 million from an ETF research matching grant and \$2.4 million federal appropriations to advance trauma treatment for those injured in combat.

As a successor to the UTHSCSA technology transfer office, the South Texas Technology Management [STTM] began operations in fiscal year 2008 and manages intellectual property and technology transfer for UT Health Science Center at San Antonio (UTHSCSA), UT San Antonio (UTSA), UT Brownsville (UTB), and UT Pan American (UTPA). STTM is organized and staffed to: 1) **Accelerate** the transfer of technologies to the marketplace; 2) **Capitalize** on the financial potential of opportunities through an energetic, entrepreneurial spirit and high level of performance; and 3) **Stimulate** growth in the quality and size of the University of Texas intellectual property portfolio.

In addition to current inventions managed, STTM manages a portfolio of 300 patents and 80 active licenses that were established by the former UTHSCSA tech transfer office, i.e. the Office of Technology Ventures (OTV). The STTM operation indicated that over the last five years, they and their predecessors have executed 64 licenses and have had 9 start-up companies founded with "Managed Technology." Invention disclosures have recently improved and are on track to exceed last year.

STTM also supports the research enterprise of the served institutions by funding faculty research directly. In April 2008, STTM reserved \$1 million for POCsparc, through which awards are made to faculty inventors for the purpose of advancing inventions to the market. Through 2008, STTM has awarded \$500,000 in support of two dozen faculty inventions across the four served institutions. Requests for proposals (RFPs) are planned for April and October, 2009. POCsparc success will be assessed, in part, by new funding enabled by completion of successful POCsparc-funded projects. For example, an April 2008 award generated data that was used to compete successfully for a UT System TIF award, which was funded in September 2008. Successful completion of the TIF project will produce an FDA-approved medical device that can be used as the core technology of a San Antonio-based start-up company, thereby supporting a primary STTM objective to build companies and create jobs in south Texas.

UNIVERSITY OF TEXAS AT SAN ANTONIO (UTSA)

The UTSA **Institute for Cyber Security (ICS)**, launched and supported in part with an ETF research Superiority award, conducts world-class sponsored research on all aspects of cyber security in collaboration with leading academic, industry and government partners. Recent grants include a million dollar Air Force grant on "Managing the Assured Information Sharing Life Cycle (AISL)" and a quarter million NSF grant on "Securing Dynamic Online Social Networks." With 5% incentive funds from the ETF research superiority award, STTM initiated

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the POCroadrunner (POCrr) award program in 2008. POCrr is administered concurrently with POCsparc, with awards solely for UTSA faculty. To date, 2 awards of \$25,000 each have been directed to UTSA faculty.

The South-West Texas Border Small Business Development Center Network [SBDC] has experienced steady growth since 1990 to currently provide 29,500 businesses annually with consulting, training and research services. The Institute of Economic Development's [IED] principal programs extend UTSA's presence through 10 offices spanning 79 counties along the South-West Texas Border with a business population of 135,600 SMEs and a general population of 6.9 million, with certain programs operating nationwide in both the U.S. and Mexico. The IED team includes 150 staff, routinely involving 25-30 students engaged in service-learning roles, and faculty collaboration for specialized research requirements.

Highlighting results from FY2007, IED client engagements led to the creation of 3,928 new jobs, started 472 new businesses, expanded another 470, increased sales by \$748.7 million, and attracted \$175.5 million in new growth capital. These outcomes were accomplished via 6,576 business engagements delivering 62,563 hours of consulting and technical assistance, over 1,000 business workshops attended by 19,000 entrepreneurs, and 3,870 business research tasks completed.

UTSA supported the founding of the San Antonio Technology Accelerator Initiative (SATAI) that is still hosted on the UTSA campus today and manages the South Texas RCIC. Please refer to Appendix D of this report for a more detailed description of SATAI.

UNIVERSITY OF TEXAS SOUTHWESTERN MEDICAL CENTER (UT SOUTHWESTERN)

There are a number of commercialization activities at UT Southwestern, including the construction of a 500,000 square foot BioCenter that will serve as the commercialization center. All activities have been self-supporting with IP revenues and/or financed by venture capitalists and private equity. There has not been any interfacing with either of the Texas funds. Due to the successful commercialization history, private equity sources have been extremely willing to step in at an early stage to provide necessary funds.

UNIVERSITY OF TEXAS HEALTH SCIENCE CENTER AT TYLER

UTHSC-T received a \$50 thousand TIF award last year to help develop a patented drug agent with protective peptides that block pulmonary fibrosis and scarring in the pleural space that surrounds the lungs. TIF funds will combine with private funding to help pay for manufacturing the agent; an NIH RAID grant recently awarded and NHLBI funding will move the project forward to toxicology and other FDA requirements; and the faculty member plans to form a company and apply for NIH support for phase I/II clinical trials or apply for ETF funding.

UNIVERSITY OF TEXAS AT TYLER (UT TYLER)

The Texas Emerging Technology Fund awarded UT Tyler a \$3.75 million research superiority grant to establish the **Texas Allergy, Indoor Environment and Energy Institute (TxAIRE)**, the first collaborative research institute of its kind in the United States, led by executive director Dr. Jan Sundell, a research professor of engineering and a leading international researcher on indoor air. The 5% incentive funds associated with this award have enabled UT Tyler to hire a full time staff person dedicated to IP management, and to contract for technology transfer and commercialization support from UT Dallas' Office of Technology Commercialization.

RICE UNIVERSITY

Rice University generates more patent, licensing and commercialization activity than some state university systems – let alone individual institutions. Although it is the smallest Tier-1 research university in the US, Rice's patent portfolio is large and economically significant, consistently judged as one of the top IP generators in the country, especially in the areas of Nanoscience and Nano-Bio [Ref. C2]. This is possible because (1) Rice has built a culture of collaboration – across departments, with other universities, and with government and private industry, through organizations like the Richard E. Smalley Institute for Nanoscale Science and Technology, and (2) Rice has assembled and nurtured the resources for taking technologies to market, such as the Rice Alliance for Technology and Entrepreneurship, the Office of Sponsored Research and the Office of Technology Transfer. Some examples of Rice's collaborative work:

- With the University of Texas at Austin, Rice in 2008 birthed the Advanced Energy Consortium (AEC), in which ten major oil and services companies contribute \$1 million/year to a research fund for using Nanotechnology to find more oil and gas, and to produce more oil from existing reserves.
- Also in 2008, Rice and Lockheed Martin Corporation launched the Lockheed Martin Advanced Nanotechnology Center of Excellence at Rice University (LANCER), for funding research in nanoscale technologies that improve systems and materials for defense, energy and more. LANCER is funded by a minimum of \$1 million/year for three years from Lockheed Martin.
- With the Air Force Research Laboratory in Dayton, Ohio, Rice is working on two-year, a \$2.6 million project to prove and perfect Armchair Quantum Wire, a high-conductivity and high-strength material that promises to be a significant part of the country's efforts to gain energy independence and rebuild its infrastructure.

In the last 12 months, Rice has generated 79 invention disclosures; filed for 118 patents; optioned or executed 14 licenses, with 13 licenses generating income; received 20 patents and launched four startup companies. In all, Rice has received over \$81 million in research funding in the last year, with a majority coming in the form of government grants.

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One of the university's startups from 2002, Nanospectra Biosciences, is now in clinical trials with gold nano-shell therapy that yielded stunningly effective research results in fighting cancer. Nanospectra Biosciences was funded in part by ETF, in a September 2006 award. Three additional Rice University startups received ETF awards in 2006: Carbon Nanotechnologies, Inc., itRobotics and NanoComposites. In all, Rice has spun off at least 11 companies related to university IP in Nanotechnology. **New companies mean new jobs.**

Rice University – both alone and in its many collaborations across the country – is a best-practices example of an innovation-ecosystem, and provides superb leverage for State and Federal funding for research. Every State dollar spent on Rice efforts and Rice spinoffs attracts funding from multiple sources, and the University's culture, structure and resources ensure that the innovations produced in its laboratories find a clear and unobstructed pathway to commercialization, job-creation and success.



APPENDIX D – RCICS

This Appendix provides detailed comments from RCICs regarding the impact of the ETF funding with respect to their locals as well as the improvement in the quality and understanding of business submissions. The Regional Centers of Innovation and Commercialization were established as the first point of contact in the Emerging Technology Fund process. Each of the seven regional centers addresses submissions from within their region of the state. The Life Sciences Center is state-wide and works with the regional centers, but focuses on the medical biological submissions to the ETF. There is a significant effort to enhance business development, which, in part, is expedited by the ETF.

TEXAS LIFE SCIENCE CENTER OF INNOVATION AND COMMERCIALIZATION

Since its founding, the TLSC has reviewed a total of 172 life science applications by 134 companies seeking funding of approximately \$260 million (as of Round 14). As of November 17, 2008, the ETF has funded 25 Subchapter “D” life science applications totaling \$27 million. Of the 31 Subchapter “D” applications in the current pipeline, 15 applications are life science applications.

CENTRAL TEXAS REGIONAL CIC

The Central Texas (CenTex) RCIC has seen great success with the ETF as well as continued increase in the activity and level of interest in regional entrepreneurs. The CenTex RCIC has reviewed approximately 186 applications since the first round. As of February 2009, 17 Subchapter D awards for a total of over \$19M have enhanced the Central Texas economy.

The CenTex RCIC considers all regional business start-ups and entrepreneurs to be of great merit and benefit to the Central Texas business community. Our critiques are intended to assist start-ups with opportunities to increase the chance for their success in creating a growing and profitable company in our area. We look forward to all submissions as we consider them opportunities for our region.

The entire CenTex RCIC scope of work is overseen and integrated into all aspects of regional economic development via the Greater Austin Chamber of Commerce, the lead economic development organization for Central Texas. A special emphasis was placed on coordinating this initiative through the Chamber’s business retention and expansion program which has specific focus area/activities regarding work force, regional universities, incubators and institutions of higher education, technology innovators, and angel and venture capital groups in the Central Texas region as well as collaboration with 52 organizations throughout Central Texas that assist business development and growth. To date, as of February 28, 2009, the State of Texas has leveraged over \$49M into 16 Central Texas companies (Subchapter D) and seven university deals (3 Subchapter E and 4 Subchapter F) commercializing technology and encouraging innovation that might otherwise have left

the state. Adding to Texas' growing place in the Life Science industries, 5 of the 16 Central Texas commercialization awards were to life science companies, totaling almost \$8M. The newest of CenTex's Research Superiority awards was \$5M to the create an Institute of Regenerative Medicine at Texas A&M Health Science Center- Scott & White Campus in Temple, Texas. We view all of these results as a remarkable success attributable to the people and technologies in our region.

TRANS-PECOS/EL PASO REGIONAL CIC

In order to increase the success rate of ETF applications and enhance the development of emerging technology companies, we are developing an El Paso's Innovation Support System. This focuses on a regional system to support innovation. Technology commercialization does not take place in a vacuum, but is part of a larger environment that either enables or hinders entrepreneurial activity. Major players in this ecosystem are universities, businesses, and government. Key environmental factors of the system are talent, technology, capital, and know-how. Understanding the nature of this ecosystem is important for many reasons:

- It provides a baseline for assessing which resources and elements are present in the region.
- It furnishes a framework for determining the gaps in the system.
- It is helpful in establishing priorities for either directly obtaining or gaining access to resources to fill those gaps.

A fundamental requirement for a technology-based economy is access to talent, a source of individuals trained in science and technology who can both be the source of the innovations and take the technology from the laboratory to the marketplace. Again, universities provide the primary source of such talent. It is not sufficient just to train scientists and engineers. They must have opportunities so that they will remain in the community.

Though there are pockets of R&D in the area, the current pipeline of technologies is not particularly large and much needs to be done to tap these sources. Most research and development in the area is conducted at the major universities, UTEP and NMSU. Another resource for technologies care engineers and technical personnel working at the technical centers in Juarez, mainly in the automotive industry. Research and development activities in the region will increase dramatically in the next few years. The new campus of the Texas Tech University Health Sciences Center will aggressively increase its research activities. The expansion of Fort Bliss and the creation of the Future Combat Systems program will become a magnet for defense contractors seeking to locate operations nearby. The Paso Del Norte Corridor, which extends from El Paso, Texas to Santa Fe, NM, has over \$8B in research at universities and national labs that are opportunities for commercialization. The focus is on growth of emerging technology companies that address the industries in the region, which includes Juarez, Mexico and our sister state, New Mexico.

GULF COAST REGIONAL CIC

The Gulf Coast RCIC has announced 21 awards to area emerging technology companies for about \$20M in funding, assisting companies across a broad cross section of technologies – life sciences, energy, nanotechnology and IT. For those companies that do not meet the ETF criteria, the Houston Technology Center has been able to provide Client services and assistance to be successful without ETF awards.

Through the ETF's Subchapter F Research Superiority Awards, the Gulf Coast RCIC and Houston Technology Center has established a relationship with the region's first Subchapter "F" awardee – the Alliance For Nano-Health [ANH], and has provided assistance to the first companies commercializing technology from ANH.

By serving as the Gulf Coast RCIC, the Houston Technology Center [HTC] has established strong relationships with all major universities and medical schools in the region. Because of the relationship of the HTC with the ETF program, the first annual Gulf Coast Innovation Conference was held in November, 2008, providing the opportunity for 12 area research institutions to promote companies commercializing their technologies. The HTC is also working with area universities to implement the Innovation Pipeline program to build a path for commercializing technologies developed at the universities.

A conscious effort has been made to promote the ETF program and the State as a Center of Technology Innovation and Commercialization via newsletters, press releases, speeches, media interviews, on campus meetings and working with reporters. The result has been articles and Page 1 stories in the local press. Renewable energy efforts have been increased with a presence at a major energy conference that showcased two ETF clean energy companies.

NORTH TEXAS REGIONAL CIC

The NTXRCIC promotes awareness of the ETF, develops cooperative relations between industry, finance and academic partners and provides the post award support to entrepreneurs for commercialization. Our region is comprised of 63 counties, approximately 8 Million people, 66 Institutions of Higher Education (IHEs) and multiple industry and businesses across diverse markets.

In North Texas, the NTXRCIC's success is largely due to solid 'Resource Partnerships' we have built with the regional IHEs, businesses, incubators, economic development agencies, service providers, investment community; and to the volunteer mentors and business evaluators that power the NTXRCIC Commercialization award selection process. These partnerships are important both to support early stage companies and the entrepreneurial communities. The regional IHE's also have major roles in the ETF program, as every ETF company must have a collaboration with a Texas IHE.

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In addition to our Commercialization and Mentor Programs, the NTXRCIC Stakeholder Relations Program promotes awareness and support services for the ETF through developing cooperative relationships between industry, finance and academic partners. Our partner organizations and institutions include:

| | |
|-----------------------------------|--|
| Chamber of Commerce (s) | Economic Development Agencies |
| Angel & Venture Capital Investors | Financial & Banking Institutions |
| Business Service Providers | Institutions of Higher Education (IHE) |
| Workforce Development Boards | Technology Business Incubators |

The NTXRCIC engages with Stakeholders that will promote and advance the mission of the ETF and the NTXRCIC. Our main objective is to align ourselves with Stakeholders that assist in marketing of the ETF, provide business services and or consultation for start-up companies, academic research support and introductions to entrepreneurial ventures that may qualify as research and or commercialization opportunities for the ETF. We have created resource partnerships with our Stakeholders in the form of Memorandums of Understanding (MOUs) and participate in activities that benefit both parties. The NTXRCIC website is an excellent source of information [<http://www.ntxrcic.org>].

RIO GRANDE VALLEY REGIONAL CIC

The Rio Grand Valley RCIC has seen an increase in the quality of submissions. While the initial submissions were not a large quantity, there were good concepts. An original CGRCIC submission was an Australian company incorporating a novel energy saving engine. The company was approved through all stages, but the deal was lost due to the warrant requirements in the early stages of the ETF. Five other early efforts passed through the regional review and were approved by the Committee of 17. These were passed to the elected officials for review and signing. Three were not signed and two were redirected to other regions, where the ETF awards were made. Consequently, there has been no official ETF award through the local RCIC.

SOUTH TEXAS REGIONAL CIC

The South Texas RCIC, which covers a 32 county region roughly from Fredericksburg, down and through San Antonio, and on to and including Corpus Christi and has had excellent success with the Emerging Technology Fund. The South Texas RCIC is managed by SATAI, a non-profit 501(c)(3) corporation funded in part by the City of San Antonio, Bexar County, the State of Texas, UTSA, and the private sector. The ETF activities of SATAI constitutes one of the major functions of SATAI; however, SATAI also works with the South Texas Angel Network (STAN) and others to “Inspire, Create, and Grow” high tech startups in the south central Texas economy. In a recent report to SATAI’s stakeholders, SATAI commissioned the UTSA Institute of Economic

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Development to prepare an economic impact statement as to SATAI's activities and those of its client companies. This report states in pertinent part:

SATAI contracted with the IED to conduct an Economic Impact Study to calculate the impact of SATAI portfolio company operations and investment on the regional San Antonio and Bexar County economy. IED used the well established IMPLAN 2002¹ input-output software model to run its calculation for the years 2003 to 2006, calendar year 2007, and their totals.

The results were exceptional. From 2003 thru 2007, the SATAI portfolio contributed \$261 million of direct impact in the local economy. Additionally in the same period, SATAI portfolio companies generated \$12.2 million in government tax and non-tax revenue and are calculated to have created over 1,200 new high-technology jobs.

From 2003 through 2007, SATAI has served 612 clients, with 460 new high tech jobs created. A total investment of over \$115M was acquired, with over 50% being VC funds. The total economic impact, which also includes indirect impacts (purchases from local suppliers by portfolio client companies) of \$68 million and induced impacts (purchases by portfolio client companies' employees) of \$45 million, was calculated to be \$261 million in 2007. Three SATAI portfolio companies were recommended for funding from the \$200 million Texas Emerging Technology Fund (ETF) in 2007. Without the funding of the Emerging Technology Fund it is certain these successes for technology companies and the region would be greatly diminished.

WEST TEXAS REGIONAL CIC

The West Texas RCIC [WTCIC] has served as a catalyst to bring economic development efforts from the six largest cities in the region together to fund a regional effort. The ETF raised the awareness in West Texas of the importance to create the required infrastructure for the generation of knowledge-based economic wealth creation. This ongoing transformation from the regional competition to a collaborative effort to attract companies and encourage development. Abilene in conjunction with Texas Tech School of Pharmacy has developed a biotechnology presence. Abilene has started construction of a 24,000 square foot life science accelerator, which will provide wet labs space for emerging technologies and early stage companies. The San Angelo area has a new angee investment group working with various emerging technology companies. The West Texas region has not had the success rate with applicants as other regions of the state. The lack of adequate business models inhibit their successful applications and guidance. An Odessa company received a \$850K Subchapter "D" award in 2007 and an additional \$2M from an investment group in Lubbock. The first two companies that received ETF awards have reported 2008 sales of \$3M and project 2009

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sales of over \$7M. By 2010, all four award companies are projecting profitability and significant job creation. Without the WTCIC effort and the ETF, there would have been little investment. Much more needs to be done, but the seeds have been planted for future growth. With proper nourishment, significant successes are sure to develop. The WTCIC has four companies approved for funding. Three have been funded and one is still in due diligence. These companies and their location are: 1) Falcon International, Inc., Odessa; 2) Receptor Logic, Inc., Abilene; 3) Animal Innovations, Inc., Amarillo; and, 4) Turbo Trac, Inc., Midland.

The Development Corporation of Abilene, Texas (DCOA) will open the 22,000 square feet Abilene Life Sciences Accelerator (ALSA) December 2009 (currently preleasing). The ALSA offers early-stage biotech companies leased laboratory space and “time-shared” use of major research equipment – the only facility of its kind in West Texas. Tenants will license discoveries made at the Texas Tech University Health Sciences Center (TTUHSC) and other universities to develop products and treatments to improve human quality of life. Once well-established, companies will “graduate” into commercial lease space for product manufacturing and continuation of their research. The ALSA is part of a much larger biotech initiative to diversify the regional economy. In 2005 community benefactors donated over \$15 million toward establishment of a branch of the TTUHSC School of Pharmacy (SOP) in Abilene. The second class of 40 students began their four-year Doctor of Pharmacology program this fall and total enrollment will increase to 160 students within two years.

In December 2007 Arthur Nelson, Dean of the School of Pharmacy, agreed to expand the SOP research faculty by establishing the Center for Immunotherapeutic Research in Abilene. The DCOA committed \$3 million for laboratory start-up funding and major capital equipment and TTUHSC SOP committed \$4.5 million to provide salaries and operating overhead for 5 years. The Center Director is now recruiting faculty with a desire to take their discoveries from “bench to bedside” through commercialization, as Dr. Weidanz and Receptor Logic are doing.

Development of a workforce to meet the needs of biotech companies has involved all levels of education: Last year the Abilene Independent School District opened a medical magnet high school on the campus of Hardin-Simmons University; this fall McMurry University began offering a B.S. in Biomedical Science for students interested in careers as researchers, health professionals, science educators and support personnel; and Cisco Junior College was recently approved to offer a biotechnology technician associates degree. Growing the Abilene biotech sector is a community-wide objective.

APPENDIX E - PUBLIC PRIVATE PARTNERSHIPS

The concept of Public-Private partnerships [PPP] is not novel. In March 2007, the Governor's Industry Cluster Initiative saw a presentation titled: "the Texas Model for Public-Private Partnerships [Ref. E1]." This presentation addressed the medical biotechnology cluster. This basic concept applies to the other Industrial Clusters. Examples of one possible PPP effort are included later in this Appendix in detail to provide an example of the structure of PPPs.

There have been a number of other initiatives that developed to address specific technologies within a single cluster, like the Texas Nanotechnology Initiative [TNI]. TNI was created to address nanotechnology materials manufacturing. Initially in Dallas, it has expanded to encompass the state. However, it has come together to address specific issues of nanotechnology manufacturing in an emerging industry. In 2008, the technology is applicable to all regions of the state.

Establishing a methodology to request support for PPPs would provide the ability for the creative people to work together and improve the ecosystem in Texas. A review committee, similar to the TLSC, but with a makeup that is an equal mixture of people from Industry, Academia, and Government (including local Economic Development offices) would be able to judge the "goodness" of the proposal for the long term benefit of the state.

As an example, here is a proposed review methodology scenario [Ref. E2]: There would be nine individuals on the panel, with no more than 4 of the 9 being from higher education. Members of the advisory panel from academe will need to have broad understanding of research and technology transfer in universities. Members from the private sector should have a broad view of the emerging technology fields important to the state. The recommended categories of members for the panel include:

- Two vice presidents for research or deans of academic units in emerging technology fields that can assess the quality of the emerging technology research as well as the qualifications of the faculty researchers nominated for the RS grants;
- Two technology transfer leaders at the university or system level that can assess the viability of commercialization of RGM and RS grants;
- Two or more private-sector investors or economic development experts in emerging technology, ideally with university technology transfer or university-driven start up investment experience, that can assess the potential economic benefit of the emerging technologies to the state;
- Two or more leaders from the Texas Industry Cluster Initiative that can assess the role of industry and relevance of proposed emerging technology on important sectors of the state's economy.
- One member of the governor's office

Any funding provided to the requesting organization would need to be based on benefits to the Texas ecosystem, the ability to fill critical gaps in business and technology, and the ability to be self sustaining within three to four years. In order to provide an idea of the type of organizations that would be created, an example follows.

PPP EXAMPLE

The Aerospace Cluster is an industry that is continually evaluating novel ideas and emerging technologies. The two key drivers are weight and cost-performance. Nanomaterials appear to hold promise for significant design enhancements that will create new levels of performance. As a means of supporting the Aerospace Cluster through an alliance of industry and academia, the Nanomaterials Design Commercialization Center [NDCC] concept was conceived. The development to date has been primarily by volunteers to develop the business/university plan to create a sustainable alliance. While it is not the case for this report to provide a recommendation on individual efforts, the goal of bringing industry and university researchers is an important goal.

In order to function effectively, there will need to be a complete business plan developed and all participants need to agree to the operation and support of the organization. For this type of operation, an Organizational Structure, Governance, and Operations might include the following:

- 1) Non-profit 501(c)(6) organization;
- 2) At least one identified Texas location – the headquarters – with meeting facilities;
- 3) Governing Board;
- 4) Members participation agreements with uniform terms for engaging with each other and participating research universities, including:
 - a) Financial obligations;
 - b) Identified precompetitive areas;
 - c) Personnel assignment; and,
 - d) IP policies.
- 5) Business plan, including funding;
- 6) Methodology of funding allocation;
 - a) Membership responsibilities;
 - b) Facilities locations; and,
 - c) Identification of research teams.

NANOMATERIALS DESIGN & COMMERCIALIZATION CENTER

Specific details on the NDCC have been provided to use as an example in this report. The “NDCC is a consortium of leading **Aerospace, Defense and Advanced Manufacturing (ADAM)** companies, research universities and the State of Texas working together to identify and address *pre-competitive* materials design, technology insertion, and fabrication challenges in order to accelerate the transit of laboratory nanoscience into commercial projects. The NDCC was created to provide member companies a more efficient pathway through the high value/high-risk nano-enhanced materials and manufacturing domain by offering a way to tackle *together* wicked technology challenges faced by all producers. As technology barriers yield to collaborative pre-proprietary R&D, member companies can then focus their internal R&D resources on using NDCC-sourced solutions to develop their own distinctive “differentiators” and competitive advantages.

“The NDCC Value Proposition consists of:

- 1) Multi-university knowledge network to enable identification of potential nanomaterials and technology insertion solutions faster and at a lower cost;
- 2) Rapid asset mapping and orchestration of university-based resources that can design and develop technology solutions;
- 3) Facilitate/extend the “reach” of industry-university collaborative research work to downstream development, demonstration, and commercialization;
- 4) A full portfolio of commercialization services including solution demonstration, supplier recruitment and new venture investment/incubation for nanomaterials IP emerging from university labs or internal industry “skunk works”; and,
- 5) Development of skill upgrade training programs for incumbent workers – distance learning and/or classroom/workplace delivery. In addition, working in concert with community colleges and universities, NDCC develops enhancements to science/engineering/technology curricula to better prepare the ADAM workforce of the future.” [Ref. E3]

The key objective of this Center is to create an opportunity for an important Texas Industry to be able to access the research capabilities within the state. This is presented as an example of how a PPP might be structured to address the needs of an Industry Cluster.

APPENDIX F – PROOF-OF-CONCEPT [POC] FUNDING EFFORTS

The current economic climate is witnessing the pull back of investments by a number of organizations. In the last few weeks, several emerging companies have had committed funds withheld by investors due to the uncertainty of the markets. In the last 18 months, housing valuation is down over 20%, the market is down 50%, credit lines have been significantly reduced. Investors are making contingency plans in case there is a further erosion of their market value. These are difficult times to commercialize products, no matter how innovative, and to develop a successful company.

Continuous funding is required throughout the innovation sequence and is a critical challenge to technology commercialization efforts. In the U.S., the federal government makes a substantial contribution to economic competitiveness by supporting basic research. Corporate entities also support a small percentage of the basic research conducted at universities, while private investors mainly invest in later-stage product opportunities with proven concepts and working prototypes. In the current economic climate, investors are taking less risk, amplifying the gap in funding between basic research and marketable products. The challenge is to bridge these two established funding streams. Historically, a number of entrepreneurs were able to “max out” their credit cards, reach to family for additional funds, or find researchers willing to work for future benefits. The ability for this type of financing has disappeared.

Incorporating a POC program within the ETF makes sense in Texas because of the culture of commercialization and collaboration that has evolved. The Texas innovation-ecosystem’s broad-based support for this culture encompasses the ETF, Regional Centers for Innovation and Commercialization (RCICs), Life Sciences Institute, Cancer Research Fund, UT System’s TIF program, incubators, mentoring and entrepreneurship training programs, angel networks, community and industry support, and many other elements.

Based on a review of established state-funded and university-based POC programs, and on recent experience with the TIF, three related but different approaches to POC programming should be considered as follows:

- The CPRIT committee is considering a POC program component of the Cancer Research funding, unrelated to the ETF and exclusively to support cancer research commercialization efforts. The concept is well developed and warrants emulation of its structure.
- ETF Subchapter “E” matching funding for POC programs should be available to Texas public universities and health institutions to fund Proof-of-Concept projects for all emerging technologies, excluding those eligible for cancer research funds.
- Companies with promising technologies that apply to the ETF for Subchapter D equity commercialization awards sometimes need further development to prove the viability of their products/ technologies. An ETF Subchapter E POC funding pool would help these companies strengthen their ETF proposals and ultimately their chances for success. ETF POC awards would be limited to one per exceptionally promising company per funding cycle. This POC fund will need an evaluation board that is distinct from RCIC review committees, but working in concert with them.

The following section was summarized from a “white paper” developed by the UT System RTT office to document the rationale, track record, and structure of successful POC funding programs. Their full POC white paper is incorporated in a collaborative proposal that is currently being developed as part of the Cancer Prevention and Research Institute of Texas [CPRIT] effort. It is suggested that the proposal concepts also be adapted for the ETF to address the POC needs broadly for all emerging technologies.

BRIDGING THE ECOSYSTEM DEVELOPMENT GAP

The first hurdle that many companies face is to provide enough detailed information on their concepts to convince the investor community. Usually, this information is a means of proving out the concept being developed. In many cases the requirement might be obtaining professional services to analyze or test the developed product – a “Proof-of-Concept” [POC]. With the disappearance of small amounts of investment funding, the innovator has no-where to turn for funding at this stage. This type of analysis is required before an ETF award would even be considered. Providing a means for POC funding would ensure that new discoveries and life-changing technologies are not delayed or abandoned, but find their competitive place in the market.

POC funds currently exist as a critical, yet fragmented, and situational funding stream within some universities. For example, five Texas public university systems spent \$9.2 million of institutional funds last year (\$24 million over the past five years) for POC and early stage technology development (ESTD), and have set aside \$6 million more in future funding for this purpose. Sources of these funds have included royalties, private donations, overhead funds, and proceeds of sale of stock in university spinoffs. This does not address the need for POC support in the non-university invented emerging technology community. Even in the university realm, shrinking private donations and discretionary funds, and pressures to reduce spending, threaten the feasibility of public university-based POC funding in the future.

Competition from other states is addressing the need to close this gap and expedite the development of commercial products. **“The Massachusetts Technology Transfer Center (MTTC)** was created in 2004 as a program in the Massachusetts Economic Stimulus Bill to support technology transfer activities from public and private research institutions to companies in Massachusetts.” [Ref. F1] **“The Maryland Technology Development Corporation (TEDCO)**, an independent entity, was established by the Maryland General Assembly in 1998 to be Maryland’s leading source of funding for seed capital and entrepreneurial business assistance for the development, transfer and commercialization of technology.” [Ref. F2] **“The Bioscience Discovery Evaluation Grant Program (BDEGP)** was created by the Colorado legislature to foster development of the industry in Colorado, supporting both new business development and quality jobs for Coloradans.” [Ref. F3]

POC BENEFITS TO TEXAS

Funding POC projects will enable universities to develop well-defined, promising discoveries into marketable products through activities such as prototype development, product testing, and analysis of business and market opportunities. Additionally, moving new technologies across this significant funding gap reduces the risk for potential investors, licensees, and entrepreneurs. Unfortunately, without expanded resources for POC work, funded projects risk abandonment or delay in the time to market. This could result in the possibility that promising projects with the potential to diversify the Texas economy and change lives globally could be passed entirely.

SHORT-TERM BENEFITS

Additional funding for POC projects has direct economic benefits to the local region. According to the AACU [Ref. F4], every \$28,000 spent in basic research generates one job. POC activities lead to commercial results and thus are likely to create more jobs in a shorter timeframe than basic research. So applying this conservative metric in the Texas example implies that \$24 million spent by Texas public universities for commercialization activities have generated at least 855 jobs over the past five years, and matching funds would multiply that benefit.

LONG-TERM BENEFITS

Benefits for POC funding extend beyond short-term financial rewards and job creation. A commitment to POC funding further demonstrates the partnership between the local entity and higher education toward economic development and commercialization goals. By filling a crucial funding gap in the innovation-ecosystem, this relationship attracts additional businesses to partner with that state's entities. The innovation-ecosystem ensures that when future discoveries emerge from universities, existing partnerships will help turn concepts into products.

TEXAS PROOF-OF-CONCEPT FUND SUCCESS: ONE EXAMPLE AT UTMDACC


The following was received as part of the overall report information gathering and is being incorporated into this section to provide an example of a very successful established POC program in Texas. It shows the direction that research institutions will follow to increase commercialization results.

UTMDACC's Office of Technology Discovery (OTD) established a program for POC gap funding in 2003, seeded originally by a grant to the institution. OTD staff consult with faculty to help them through the discovery, development, and commercialization process for technologies. OTD works with potential entrepreneurs to develop milestones, timelines, and budgets related to commercialization. A 32-member Technology

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Review Committee reviews proposals during a monthly meeting and makes funding recommendations to an executive management team.

Over the past six years OTD has discussed inventions with almost 1,500 faculty and established 77 project teams, linking inventors to appropriate resources to move ideas along the discovery pipeline. UTMDACC has invested almost \$2 million in 31 projects, with an average investment of \$66,000 in each technology. Short-term financial benefits are enhanced by increases in start-up companies, invention disclosures, patent applications, signed licenses/options, publications and presentations. In the past three years, the program boasts a four-fold financial return through increased licensing income, SBIR/STTR funding, sponsored research agreements, external grants, and external investments from venture capital firms and angel investors. Long-term benefits are expected to be much greater.



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APPENDIX G – ALPHABETICAL LISTING OF INDIVIDUALS CONTACTED

| | | | |
|--------------|---|------------|--|
| Adams | , | Wade | Rice University |
| Aguliar | , | Hector | Austin CC |
| Anderson | , | Steve | West Texas Regional CIC |
| Berzina | , | David | Ft. Worth ED |
| Bettersworth | , | Michael | Texas State Technical College |
| Bodisch | , | Charisse | Austin ED |
| Brier | , | Barbara | UT Medical Branch |
| Brix | , | Don | University of Houston |
| Butler | , | Bruce | UT Health Sciences Center - Houston |
| Carey | , | Teresa | Texas State University |
| Casselbury | , | Craig | Quorum Public Affairs, INC. |
| Clark | , | David | SATAI |
| Cook | , | Bob | El Paso ED |
| Cornwell | , | Brett | Texas A&M University |
| Cotten | , | Don | Lamar University |
| Covey | , | Ray | Valley |
| Crago | , | Catherine | Semicon Group |
| Cruz | , | Adriana | Austin ED |
| Davenport | , | Susan | Central Texas Regional CIC |
| Davies | , | Peter | UT Health Sciences Center - Houston |
| Downum | , | Kelsey | UT Arlington |
| Eibeck | , | Pam | Texas Tech University |
| Elam | , | Anthony J. | Baylor College of Medicine |
| Ellison | , | Mark | Texas A&M University |
| Gallinaro | , | Delia | Sam Houston State University |
| Gannaway | , | Dale | Emergent Technologies, Inc. |
| Gnade | , | Bruce | UT Dallas |
| Gonzalez | , | Fernando | RioGrande Valley Regional CIC |
| Gracy | , | Robert W. | UT San Antonio |
| Hallam | , | Cory | UT San Antonio |
| Herman | , | Brian | UT Health Science Center - San Antonio |
| Hicks | , | Don | UT Dallas |
| Holt | , | Jim | UT Brownsville |
| Hopper | , | Leslie | Sul Ross State University |
| Hyde | , | Truell W. | Baylor University |
| Hyde | , | Carliss | Texas State Technical College |
| Kam | , | Kelly | UT San Antonio |
| Kantor | , | Jeffrey | UT San Antonio |
| Kephart | , | Jim | Baylor University |
| Kowalski | , | Tom | Texas Healthcare & Bioscience Institute |
| Lockerd | , | Mike | North Texas Regional CIC |
| Madison | , | Amy | San Marcos ED |
| Marsh | , | John | Rice University |
| McBee | , | Barry | UT System |
| McClain | , | Robert | University of North Texas - health Sciences Center |
| Michel | , | Jacquelyn | UT PanAm |
| Midkiff | , | Sabrina | UTHSC Houston |
| Miller | , | David L | Texas Tech University |
| Mullins | , | Tom | Tyler ED |

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| | | |
|-----------|---------------|---|
| Murphy | , Sean | Advanced Energy Consortium |
| Myers | , William | City of Bridgeport ED |
| Nat | , Andrew | Texas Life Sciences Regional Center of Innovation |
| Osborne | , John | San Antonio ED |
| Osegueda | , Roberto A. | UT El Paso |
| Pallares | , Beto | TransPecos Regional CIC |
| Peterson | , Larry | Lyceum |
| Poage | , Jim | South Texas Regional CIC |
| Powers | , Pike | Fulbright & Jaworski |
| Prochnow | , Bob | GulfCoast Regional CIC |
| Richard | , Craig | Greater Houston ED |
| Robb | , Bob | UT Dallas |
| Roberts | , Sara | Waco ED |
| Rosa | , Mike | Dallas ED |
| Schaeffer | , Lynn | Baylor College of Medicine |
| Schuler | , Emmanuelle | University of Houston |
| Schwab | , Carlton | Texas Economic Development Council |
| Sossi | , John | UT Brownsville |
| Stevenson | , Michelle | UT System |
| Stone | , Dennis | UT Southwestern |
| Strong | , Harold | University of North Texas |
| Swain | , Cathy | UT System |
| Toombs | , Leslie | UT Permian Basin |
| Trevino | , Terry | Seguin ED |
| Trybula | , Walt | Trybula Foundation, Inc. |
| Ulrich | , Walter | Houston Technology Center |
| Venumbaka | , Reddy | Texas State University |
| Vincent | , Lorie | High Ground ED |
| Webb | , Jeff | Austin-San Antonio Corridor Council |
| Wenker | , Oli | UT M.D. Anderson Cancer Center |
| Woo | , Tony | UT El Paso |
| Woods | , Lea Ann | Consultant |
| Woods | , Marianne R. | UT San Antonio |
| Yzaguirre | , Mark R. | University of Houston |

APPENDIX H – REFERENCES

- [Ref. 1] CNET News. “U.S. said to be losing innovative edge” February 25, 2009.
http://www.nytimes.com/2009/02/25/technology/25innovate.html?_r=1&scp=1&sq=losing%20competitive%20edge&st=cse
- [Ref. 2] The US National Academies. “Rising Above the Gathering Storm”. 2005
- [Ref. 3] January 15, 2009 U.S. House of Representatives memo from the Chair of the Committee on Appropriations
- [Ref. 4] Information Technology and Innovation Foundation. “The 2008 State New Economy Index.” Web site <http://www.itif.org/index.php?id=200> & Kaufmann Foundation. Web site www.kaufmann.org.
- [Ref. 5] Information Technology and Innovation Foundation. Summarizing information from the “2007 State New Economy Index.” Web site <http://www.itif.org/index.php?id=30>
- [Ref. 6] background summarized at <http://www.texasindustryprofiles.com/PDF/twcClusterReports/ClusterInitiativeBackground.pdf>
- [Ref. 7] From State Strategy on Advanced Technology web site – <http://www.txti.org/ssat.html>
- [Ref. 8] <http://www.beg.utexas.edu/aec/>
- [Ref. 9] NCET2 website <http://www.ncet2.org/> (3/31/09)
- [Ref. 10] From Professor Michael Porter website <http://www.isc.hbs.edu/>
- [Ref. 11] Report of the Select Commission on Higher Education and Global Competitiveness.
- [Ref. 12] The Perryman Group. “The Potential Economic Impact of the Proposed Texas Technology Initiative: An Initial Assessment”. March 2003. Waco, Texas
- [Ref. 13] Personal communication from Larry Peterson
- [Ref. 14] Permission to use from Prof Michael Porter
- [Ref. 15] Permission to use from Brent Sorrells of Tech Fort Worth
- [Ref. 16] ETD Dashboard http://members.texasone.us/site/DocServer/ETF_Dashboard_version_9_.pdf?docID=2601 or http://www.texasone.us/site/DocServer/ETF_Dashboard_version_9_.pdf?docID=2601
- [Ref. 17] ETF web site http://www.texasone.us/site/PageServer?pagename=tetf_homepage
- [Ref. 18] ETF Web site as of 12/22/08
http://www.texasone.us/site/DocServer/ETF_Dashboard_version_7_.pdf?docID=2601
- [Ref. 19] Web site as of 02/09/09 <http://governor.state.tx.us/news/press-release/11892/>

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[Ref. 20] http://members.texasone.us/site/PageServer?pagename=etf_about_RCICs

[Ref. 21] Funded by "Insurance Premium Tax Credits", the CAPCO program supports economic development and generates tax revenues for the state through business growth and job creation.

<http://www.window.state.tx.us/capco/index.html>

[Ref. 22] New York has a Small Investment Program. [<http://www.ins.state.ny.us/press/1998/p9805181.htm>] Florida has a Economically Targeted Investment program which references the programs in Texas, New York, and California.

[<http://www.oppaga.state.fl.us/reports/pdf/0872rpt.pdf>]

[Ref. 23] Michigan has a \$95 million Venture Michigan Fund and \$109 million 21st Century Investment Fund and Kelly M. Williams oversees both.

[http://blog.mlive.com/ann_arbor_business_review/2008/04/fund_expert_vc_efforts_need_ti.htm]. West Virginia About 40 people were on hand for what was the initial discussion in the formation of an organization that will work to facilitate links between potential investors and entrepreneurs, as well as provide education and resources to improve capital formation efforts. [<http://www.highbeam.com/doc/1P3-87059835.html>] The diversification of the state's two enormous public pension funds into private equity is transforming Indiana's venture capital sector.

[<http://www.allbusiness.com/banking-finance/financial-markets-investing-funds/10582709-1.html>]

[Ref 24] <http://www.ssti.org/Digest/Tables/032608t.htm>

[Ref. C1] <http://www.utsystem.edu/rtt>

[Ref. C2] According to the US Patent Board, a Chicago firm, Rice jumped from 17th to 5th amongst US universities in patent and technology strength from 2007 to 2008. This puts it behind MIT, Stanford and the entire University of California system, and ahead of Harvard University.

[Ref. E1] http://www.twc.state.tx.us/news/ti_texasmodel.pdf

[Ref. E2] Personal communication from Dean Pamela Eibeck

[Ref. E3] Personal communication from Joe Maly, Acting Director of the NDCC

[Ref. F1] Information obtained from The Deshpande Center website accessed February 2, 2009 at <http://web.mit.edu/deshpandecenter/about.htm>

[Ref. F2] The programs are funded by the Maryland Technology Development Corporation. More information can be found at <http://www.marylandtedco.org/tedcoprograms/utdf.cfm>

[Ref. F3] <http://www.cobioscience.com/hb1001info.php>

[Ref. F4] Hurely, D. (2008, October). *Tapping state college research and development capacity in support of state economic development*. American Association of State Colleges and Universities. Available online at:

<http://www.aascu.org/media/pm/pdf/pmoct08.pdf>

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