Tapping Department of Defense Commercialization Opportunities in Texas: The Next Frontier

By Wes Jurey

Scientific Research fuels economic growth through discovery. Discovery drives Innovation; Innovation drives the Market; and the Market drives the Economy. To Texas, therefore, science = jobs.[1]

Texas is currently sitting on a virtual "gold mine" of Department of Defense (DoD) based Intellectual Properties (IP), as well as significant ongoing DoD funded research. At the same time, DoD is actively seeking to commercialize this IP. This article serves to examine that opportunity, relative to what Texas must do to convert DoD research dollars into commercializable discoveries.

As we discuss this topic, it is important to understand that research and technology have historically been the primary drivers of economic growth and development, and that, for the most part, this technology led economic development has "clustered" around and been driven by research universities who understand that commercializable research is the basic cornerstone in the creation of technology-based startups.

The success of these technology led economies has generally been the result of effective partnerships between universities and the private sector, focused on technology transfer "from the lab to the marketplace".

In the early 1900's, technology discoveries resulted in the creation of assembly lines, sparking a 2nd Industrial Revolution. In a similar manner, the discoveries that led to the internet opened the door to what we now call the Innovation Economy. Today we're competing in an era in which the United States represents only 5% of the world's market while, consuming 26% of its available resources. This at a time when most of the planet's natural resources, people and capital are somewhere else.

It is the premise of this article that our competitive advantage has been and must remain at the leading edge of technology innovation, and that for Texas to do so, we must become acutely aware of the opportunities represented by government funded research.

Essentially, this article will look at four critical components in terms of effectively commercializing the research opportunities represented by DoD funded research in Texas. These critical factors include: (1) availability of significant research and development (R&D) dollars to fund applied research; (2) commercializable discoveries and the supportive processes to secure patents and licenses; (3) venture capital from investors willing to take a risk for an equity share; and (4) entrepreneurs to formulate and implement startup strategies, who often leave the company once it's completed its Initial Public Offering (IPO) or is sold to another corporation.

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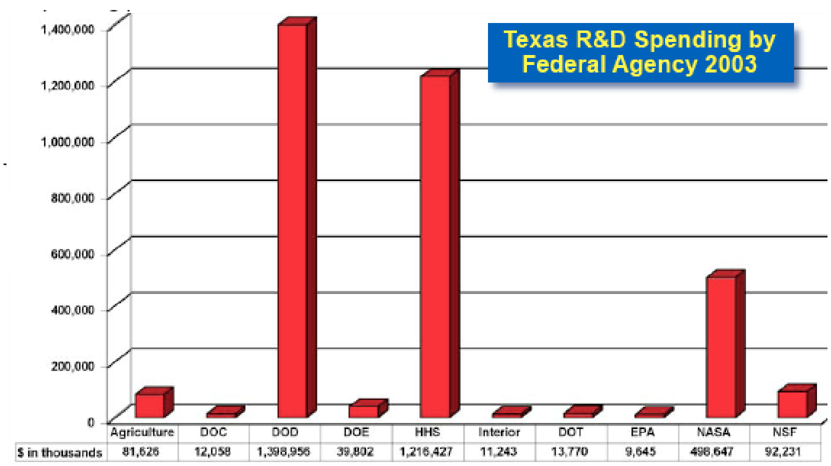
[1] www.Aboutastra.org

Availability of R & D Dollars in Texas

Texas' ability to remain competitive in the global marketplace may well depend on our ability to develop and commercialize basic scientific research. Our 21st century economic, military, and intellectual strength is derived from this research. Its commercialization leads to statewide, regional, and local economic growth.

Laboratory research has a benefit for all of us with its discovery and innovation resulting in products derived from science. In fact, 73% of all patents granted in the U.S. are attributable to basic scientific research. In 2004 Texas generated 5930 patents, 7.0% of the national total.[2] Funding of basic research by the federal government ensures that our economic growth remains competitive. Over the past 50 years, taxpayer investment in R&D has produced more than half of the nation's economic growth. Ensuring the future of economic development in Texas requires the maximum use of the technological productivity and the inventorship that is a strength of Texas. Prominent economists agree no other area generates a greater long-term return to the economy than basic research and the investment that enables the commercialization of scientific R&D innovations derived from it.

Figure 1



ration www.national.com through ASTRA, The Alliance for Science & Technology Research in America. www.aboutastra.org

It should be noted that the largest provider of federal funding for R&D to the State of Texas is DoD. Additionally NASA and the Department of Health and Human Services (HHS) are significant contributors. (Figure 1) The R&D funding goes mostly to industry (75-80%), with the balance of the funding going to basic research at universities.

The opportunity in Texas for economic development offered by DoD and NASA funding is that the innovations that arise from this research are available for commercialization. These federal agencies have extensive portfolios of licensable technologies, and are actively seeking licensees. The DoD and NASA not only desire to license this intellectual property but will actively assist in product development through the Small Business Innovative Research (SBIR) program.

The concept of universities, federal laboratories and military R&D programs as purveyors of the knowledge revolution and as seedbeds for industrial and economic development is widely acknowledged. Federally financed research and technology-based developments account for much of the national productivity growth [3] and has had significant impact upon

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[2] www.uspto.gov/go/taf/cst_utl.pdf

[3] Christina Jansen & Harrison F. Dillon (1999), "Where do Leads for Licenses Come From?"

local, regional and national economies during the past decade. The economic impact begins with the $90+ billion/year federally funded research expenditures to universities and federal laboratories across the nation ($14.7 billion to Texas in 2003) that flows into regional and local economies.

This research alone, however, won't drive economic growth in Texas. The extended economic impact can only be derived from the capitalizing of research innovations that the universities and federal laboratories generate. These innovations must be commercialized by the private sector. Otherwise, the intellectual property and innovations developed from the research dollars spent in Texas languish in the cellars of our ivory towers and lay in storage in government agencies. In the past, this lack of commercialization has led to political and social questioning by the taxpaying public as to the accountability for the federal financing of basic science. This led to the Bayh-Dole Act of 1981 that has allowed small businesses, federal labs and universities to own innovations created with federal funding and for labs and universities to grant exclusive licenses to private sector companies. [4]

HOW TEXAS R&D COMPARES:[5] Let's take a moment to look at the federal funds that come to Texas. Of the approximately $123 billion in all federal funding coming to Texas, federal R&D expenditures from all sources were nearly $14.7 billion in FY 2003, placing Texas 4th nationwide. Texas' gross state product (GSP) was $821 billion in 2003[6] - ranking Texas 4th in the nation. That number translated into $35,000 on a per capita basis in 2000, ranking **Texas** 18th. When you then compare the 2003 ratio of R&D expenditures with respect to the Gross State Product, Texas drops to 30th! This points to an area that needs to be shored up to make the state competitive within our nation. And, although we receive significant federal research dollars, we aren't as productive as we could be in terms of commercializing those dollars.

In looking at where these R&D funds come from, three of the federal agencies in figure 1 are responsible for almost 90% of federal support for physical science, mathematics, and engineering in Texas. Historically, NASA had been the largest federal funding source for R&D in Texas and accounted for 58% of the federal dollars spent on R&D within the state in FY 2000. Most NASA funding goes to industry, with 10 % going to federal labs within the state. By 2003, however, DOD spending had topped NASA, due to post 9/11 shifts in spending priorities (figure 1).

It is also important to understand where the federal dollars are being spent within the state. In 2003, federal R&D money was split almost equally between industry and universities.

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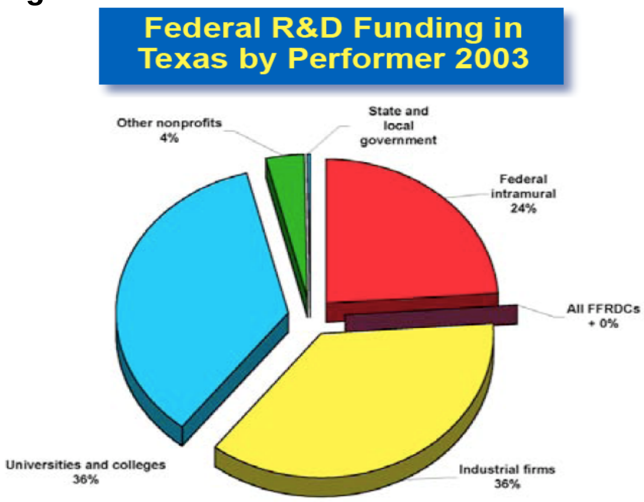
4 The Journal of the Association of University Technology Managers

5 www.Aboutastra.org

6 National Science Board, *Science and Engineering Indicators 2006, Volume 2, Table 4-23, 4-24*

Figure 2



Since our academic educational institutions represent a large portion of this federal spending, we should also focus on the ability of those institutions to train people to assimilate into a world where they can assist in the further development of technology based industries.

In Texas, Engineering and Life Sciences account for 82% of science degrees and contribute to the technology workforce. Texas also boasts the second largest technology workforce in the nation, with much of it concentrated in the North Texas area, which is second only to Silicon Valley in its number of tech trained workers.

In the 12 counties of the North Texas MSA, more than 2000 companies were awarded DoD contracts during 2005. The largest, Lockheed (DoD sponsored military manufacturing and lead producer of the Joint Strike Fighter) receives about $20 billion yearly from the federal contracts. This could reach $200 billion by the time production ends in 2040. Although this significantly impacts the economy of North Central Texas, commercialization of this research could provide an even greater economic boost.

Commercializable Discoveries

Are we focused on leveraging the commercializable discoveries that will position Texas for the Innovation Economy? In a study by the North Texas Commission (NTC)[7], the evolution of the regional economy in North Texas over the past third of a century was analyzed to identify, study and seek long-term solutions for issues affecting the region in the areas of education, economic development, regionalism, air quality, workforce development and population change.

According to the NTC report, the growth of Texas' business economic prosperity over the past three decades occurred in two distinct time frames. During the first era (1970-85) Texas experienced an industrial restructuring. The second era (1986-2000), evolved with recipes for economic growth based upon technology and organizational innovations by the region's lead industries. The two eras were divided by the banking/energy collapse of the 1980s.

[7] NTC--The North Texas Commission is a regional non-profit team of businesses, cities, counties, chambers of commerce, economic development entities and higher education institutions in the North Texas Region. A study conducted by Consultant Donald A. Hicks, Ph.D.

The NTC report emphasizes that the growth of the past two eras has masked lingering deficiencies in Texas' capacity to incubate new firms and industries on a sufficient scale to maintain its economic development. The state's capacity to exploit opportunities to host innovative activity in newly emerging fields is deficient. The deficiency can be traced primarily to an underdeveloped "Innovation Infrastructure".

These studies concluded that an "Innovation Infrastructure" is needed to generate future growth. This infrastructure must be anchored by high-quality research universities and distinguished specialized research programs, capable of attracting significant external funding and talented researchers. (It should be noted that there are 8 universities in Silicon Valley whose research drives the economy of Northern California.) This Innovation Infrastructure must also be capable of training the next generation of researchers, technologists and entrepreneurs by graduating students with the skills necessary to upgrade the competitiveness of employers, and inspiring cohorts of entrepreneurs who choose to found their new enterprises in the region.

It is important to examine the data to understand the 'deficiencies' of the Innovation Infrastructure in Texas. Let's start with the quality of the academic environment in Texas, which is equal to or better than the rest of the country, in that the universities and technology industrial sector generate patents and inventions at reasonably equivalent rates to other leading states. However, we are not as effective in transferring those discoveries to the marketplace.[8]

Figure 3

STATE	Patents Issued 1995-2004
California	157,683
New York	57,971
Texas	53,503
Michigan	35,031
New Jersey	34,784
Illinois	33,888
Mass.	32,437
Pennsylvania	31,959
Ohio	30,254
Conn.	16,715

California has generated the largest number of issued patents (10 year period 1995-2004) and gets the highest level of federal university research dollars relative to all other states, but **more significantly**, these funds and patents translate into **six (6)** times the intellectual property income [equity and royalty revenues] of Texas Universities, **three (3) times** the licenses and **twice (2 times)** the number of startup companies. In other words, we are generating licensed and/or patented technologies, but not converting them to start up ventures in Texas.

[8] www.uspto.gov/go/taf/cst_utl.pdf

ADDITIONAL SOURCES OF TECHNOLOGIES: In addition to commercializable discoveries resulting from applied research, it is also important to identify other sources of available technologies. The Federal Laboratory Consortium (a co-producer of the World's Best Technologies Showcase, held annually in Arlington, Texas) is the only government wide forum for Technology Transfer in the U.S. All available technologies can be found at http://www.federallabs.org/content/techs_for_licensing.html. *Access to NASA and federal laboratories technology is also available.* NASA operates a technology transfer network composed of a National Technology Transfer Center and six Regional Technology Transfer Centers (RTTCs) to meet the technological needs of American industry and boost U.S. international competitiveness. The hub of the national technology transfer network is the National Technology Transfer Center (NTTC). URL: http://www.nttc.edu email: technology@nttc.edu. Located at Wheeling Jesuit College, Wheeling, West Virginia, NTTC serves as a clearinghouse for federal technology transfer, linking U.S. firms with federal agencies and laboratories, the RTTCs, and state/local agencies. The center operates a "gateway service," providing toll-free telephone access to a full federal technology database and indexing system. By calling 800-678-6882, U.S. companies, universities, or entrepreneurs can access the federal laboratory system in search of technologies and research data that can assist them in developing their businesses.

Availability of Venture Capital in Texas

Let's now look at the availability of venture funding. Even though Texas' intellectual property production over the last 20 years has consistently ranked 3rd or 4th in the nation, the deficiencies of our Innovation Infrastructure are noticeable in the relative level of activity and the dollar amount of venture capital invested in Texas based technology companies (figure 4). As a way of thinking about this issue, the level of venture capital invested in commercializable discoveries in Texas ($335.5 million) is slightly less than the City of San Francisco ($360.5 million).

Figure 4

Venture Capital Investment By Year				
	Texas		United States	
Year	Companies	$M	Companies	$M
1996	100	499.0	1996	10777.5
1997	133	836.3	2485	14584.5
1998	140	1154.0	2900	20737.0
1999	240	3096.1	4337	53414.8
2000	365	5990.5	6291	104232.4
2001	248	2846.8	3763	40542.2
2002	141	1260.8	2604	21760.7
2003	141	1198.5	2406	19634.6
2004	133	1098.6	2559	22028.9
2005	139	1077.7	2624	22641.3

Pricewaterhouse Coopers/Venture Economic/NVCA

The level of Venture Capital investment in Texas in all areas of technology between 1996 and 2005 was consistently about 5% of the U.S. total, while in the Life Sciences sector, the total invested was an abysmal one half of one percent of the U.S. total. This, in spite of the fact that UT Southwestern Medical Center, UT M. D. Anderson Center and Baylor College of Medicine, are unparalleled institutions in the U.S. in their medical and Life Science accomplishments. (See figure 5)

Venture Capital Investment
Ranked By $
Quarter 2 2006

By State

No	State	Companies	$M
1	California	368	2920.5
2	Massachusetts	89	664.1
3	**Texas**	**45**	**335.5**
4	Maryland	33	334.0
5	Washington	41	311.6
6	New Jersey	27	249.3
7	Pennsylvania	31	248.0
8	New York	37	230.5
9	North Carolina	19	150.5
10	Illinois	12	126.9
11	Connecticut	9	111.7
12	Virginia	17	88.4
13	Colorado	19	84.4
14	Florida	13	66.5
15	Oregon	10	56.3
16	Minnesota	9	55.7
17	Georgia	19	55.5
18	Arizona	7	53.1

By Major Metro Area

No	State	Companies	$M
1	San Jose	219	1876.3
2	Boston	83	617.6
3	New York Metro	58	535.5
4	Washington Metro	54	454.7
5	Other US	73	373.2
6	San Fran/Berkeley	67	360.5
7	Seattle	39	268.6
8	Los Angeles	35	262.0
9	Philadelphia	26	226.8
10	San Diego Metro	24	207.3
11	Orange County	17	190.8
12	**Austin**	**21**	**170.5**
13	**Dallas**	**12**	**132.5**
14	Research Triangle	16	117.3
15	Denver	18	84.0
16	Great Lakes	19	79.2
17	Atlanta	19	55.5
18	**Houston**	**11**	**31.2**

Figure 5

The data and business formation statistics demonstrate that Texas venture funding infrastructure, necessary to facilitate conversion of DoD, NASA and university technologies to industrial products in the market-place is, indeed, seriously deficient. Both the Governor's Technology Council[9] and the NTC report point to the need for the generation of new economic growth based upon the commercialization of these technologies. These studies call for mechanisms to promote the flow and commercialization of basic science technologies into the business sector, most critically, venture capital.

EFFORTS TO PROVIDE ADDITIONAL SOURCES OF VENTURE FUNDING: There are in Texas a number of efforts aimed at developing greater access to risk capital.

In 2005, the state legislature established the 'Emerging Technology Fund' to support company startups with disruptive technology or with technology ready to manufacture and rapidly reach the marketplace.

The recently launched Texas Coalition for Capital, a partnership of business leaders,

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9 http://www.researchintexas.com/GovBio.pdf 2002 Report to the Governor - Council on Science and Biotechnology Development. Exhibit A146.

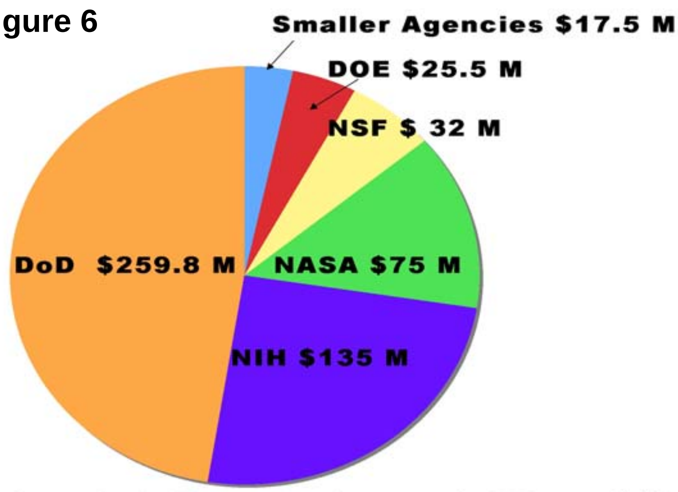
economic development officials and consumer groups, plans to grow the Texas economy by helping entrepreneurs and small businesses access long-term capital, holding their first conference in Austin in October, 2006.

Another effort is the World's Best Technology Showcase, held in Arlington each year to link emerging technologies that emanate from leading universities, federal labs and federal sponsored research and development institutions with institutional seed investors and corporate licensing professionals. This event annually attracts more than 100 bona fide venture funds to Texas. In 2007, the Federal Lab Consortium will combine its annual meeting with the Showcase, bringing a primary source of commercializable technologies to Texas.

These efforts are all directed at creating or attracting additional venture funding in Texas. "To keep Texas strong in today's economy, we must continue to seek new approaches to economic growth," stated Tom Kowalski, President, Texas Healthcare and Bioscience Institute, in a recent discussion on these efforts.

SBIR Funding: One additional source of capital supporting commercialization of technology is the government's Small Business Innovation Research (SBIR) awards. Over the more than twenty years of the SBIR Program, 622 Texas companies have won a total of 2,166 SBIR awards, totaling $547 million. Compare this, over the same period of time, to California (2,937 companies and 12,743 awards) and Massachusetts (1,234 companies and 8,649 awards). Obviously, Texas lags far behind other technology centers and, in fact, now ranks sixth overall in the total number of SBIR awarded companies and number of SBIR awards, behind California, Massachusetts, Maryland, New York, and Virginia. (Figure 6)

Figure 6



SBIR Awards to Texas by Agency (millions of $)
1983-2003
Innovative Development Institute Swampscott, MA

The DoD and the National Institutes of Health (NIH) have funded most of the Texas SBIR awards. This is not surprising, as these two agencies are the largest source of federal funding for the state and together control approximately 75 percent of all the SBIR money available. The chart in figure 6 shows the distribution of the awards to Texas companies by agency.[10]

The Dallas-Fort Worth-Arlington MSA is the second most populous area in the State with a very high level of technical expertise; however, the Small Business

[10] http://www.sba.gov/sbir/indexsbirsttr.html#sbirawards
http://utopia.utexas.edu/articles/tbr/sbir.html

Innovative Research (SBIR) grant submission and awards numbers are deficient compared to the population. Of the 204 Phase I and 89 Phase II awards made to Texas companies in 2004, less then 20% were awarded to North Texas, further indicating a lack of new business development in this region. (Figure 7)

Entrepreneurial Development

The fourth critical component is a culture that supports entrepreneurial development. A serious deficit exists in Texas in the number of persons willing and able to take the necessary risks to put sufficient effort into transforming a technology into a product and then to market that product to the world. Venture Capitalists as well as seed investors prefer experienced, serial entrepreneurs. Therefore, the availability of venture money has strings attached that are difficult to deal with in an environment where the human resources are limited to begin with. Therefore we need to understand what it takes for a person to be able to successfully kick-start a new business in our knowledge-based, technology-oriented society.

Figure 7

Small Business Innovative Research Awards [2004- by STATE]

State	Phase 1 Awards	Dollars	Phase 2 Awards	Dollars
California	886	$101,839,734	442	$313,858,829
Massachusetts	570	$68,125,638	270	$209,450,345
Maryland	242	$30,857,511	105	$82,741,742
Virginia	237	$22,469,108	121	$88,990,507
Colorado	215	$21,968,456	97	$66,935,037
Texas	204	$24,706,861	89	$64,939,911
New York	171	$23,916,960	80	$75,843,196
Ohio	167	$19,419,045	72	$51,811,691
Pennsylvania	165	$19,130,027	74	$52,639,172
New Jersey	115	$12,482,639	60	$47,994,548
Florida	108	$10,280,862	45	$31,947,870
Washington	99	$11,696,743	65	$47,193,974
Alabama	89	$9,047,548	40	$27,708,587

The Commercialization Process: At the outset, there is always a need to benchmark a state or region to determine just how our efforts compare. A second factor is how well we actually support the process of commercialization. In other words, how difficult is it to actually license or patent a discovery made in a university or government lab? Disclosures, patent applications, patents issued, licenses, startup companies formed, revenues & royalties, and start-up equity represent the commercialization benchmark factors. [11]The ratios of each of these benchmarks provide a means to 'weight' technology transfer activities. When related to total institutional research expenditures, the result provides a basis of comparison of the efficiency of technology transfer activities.

A second commercialization standard can be generated by comparing the research dollars expended to generate each benchmark relative to the average U.S. universities and federal laboratories. Significant royalties (> 0.01% of research expenditures) are produced by only about one half of U.S. universities, which clearly points to the inefficiency of the commercialization process at most institutions. However, royalties are not the only revenues that come from the private sector. Equity valuation is both speculative and intangible until a liquidation or exit event occurs. In our present economic environment, the ability to translate

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[11] AUTM Licensing Survey Association of University Technology Managers.

research into commercialization is critically important to U.S. universities and federal laboratory institutions. The overall efficiency of commercialization programs, even in the absence of royalty revenues or other income, is a valuable evaluation. The results produced demonstrate the efficiency, the quality and practicality of the research, as well as management of the commercialization process.

A significant step forward occurred in 2001, when the Texas legislature recognized the need for its state universities to more actively develop its discoveries, passing legislation (SB 1190) to encourage and facilitate translational research. The legislation specifically authorizes public educational institutions to establish and administer centers to commercialize their innovation and to develop technology.

The Entrepreneurial Spirit: Anyone that has observed, participated, or mentored the process of getting new businesses off the ground may use several clichés as necessary requirements for the entrepreneur; passion, hunger, commitment, patience, motivation, and leadership all come to mind. No single quality is sufficient; however, the ability to motivate oneself and others is a huge defining key. A person has to be driven and insistent enough to produce ongoing results, preferably in the form of cash flow and profits. The self-starter, driven entrepreneur, is a unique and rare breed.

You might expect that entrepreneurs who successfully grow their companies beyond 6-8 persons after the first two years (96% do not) fulfill all the business school criteria necessary to be successful; however, that is not the case.

In a survey of Inc. 500 companies by business Professor Abide of Columbia University[12], those that leapt towards being part of corporate America (he called them 'The Gazelles') have a number of unusual qualities. These characteristics were unexpected and surprising to the 'supposed' experts of most academic and business entrepreneurial programs, as well as to venture capitalists.

First, most founders were unemployed. Second, they didn't or couldn't borrow money and bootstrapped the venture with less than $10,000. Third, a large number had limited business experience and didn't write a formal business plan. And last, they were rarely technology pioneers.

Surprised? Then you might ask, if they were broke, unemployed, unable to borrow money, and without disruptive technology, what did these frontiersmen have that created success? Well, some detrimental qualities are double-edged swords. The majority had little to lose starting a new venture and could take the risk. Most [90%] had business customers and did not rely on the consumer market. Additionally, they provided an improved niche product or service to their business customers and, without funding, had to generate sales and cash flow immediately to survive. In order to quickly write and get orders, they provided their business customers with big productivity gains and, not having a formal fixed plan, remained flexible enough to be able to seize and capitalize upon opportunities as they arose.

The use of clichés to describe the startup entrepreneurs has some relevance to the degree

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[12] A. Abide. (2000) The Origin and Evolution of New Business. Oxford University Press, Inc. N.Y.

and rate of success for a new company. However, the help and advice offered to entrepreneurs by academics, venture capitalists and classic corporate practices manuals are, apparently, not the definitive factors. The services offered that include networking, elaborate professional financial and accounting advice, actually may be the antithesis for growing beyond the small business arena. This argues for the innovation system to be flexible and realistic enough to recognize talent and opportunity in many forms! It also argues for Texas to use some of its resources to better understand the dynamics of innovation and entrepreneurial activity through case studies, longitudinal research and sector-specific profiling.

Conclusion

In summary we find that there are significant R&D dollars invested in Texas annually, resulting in significant commercializable discoveries. Our challenges are twofold; (1) increasing the availability of venture capital in the state, and (2) enhancing the climate needed for entrepreneurial development.

In essence, four critical components must be brought together for Texas to emerge as a leader in this arena; (1) the R&D dollars currently invested in Texas, (2) the commercializable discoveries resulting from this research, (3) linking venture capital to finance these discoveries to move from “proof of concept” to “proof of market”, and (4) entrepreneurs who can formulate and implement start up strategies to establish commercially viable enterprises.

The critical success factor is the means to bring these four key elements together. Easier said than done. But given the globally competitive environment we face, it should be apparent that the future competitiveness of Texas and the United States, as well as our cities and regions, will largely depend on our ability to remain at the leading edge of technological innovation.

Wes Jurey is President and CEO of the Arlington Chamber of Commerce. During his tenure, the Chamber has partnered with UT-Arlington to establish the Arlington Research & Technology Initiative; formed the Arlington Technology Incubator; and annually hosted the World’s Best Technologies Showcase with the Governor’s office, bringing more than 100 bona fide venture funds to Texas.

He currently chairs the US Chamber Institute for a Competitive Workforce and the Strategic Planning Committee of the North Texas Regional Center for Innovation and Commercialization.