

Why Great Research Universities Are Vital to Texas

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Great research universities will play a dominant role in Texas' future for several reasons:

- Prosperity and economic vitality are, and increasingly will be, concentrated in a relatively few places in the world where discovery and innovation dominate.
- The great research universities of America are magnets for talent and innovation – for this reason, they may well be our nation's most important institutions.
- A disproportionate fraction of new companies, jobs, and economic vitality are and will be concentrated in cities and regions where the creative genius of great research universities converges with the business and societal ingredients that fuel creativity, innovation, entrepreneurship, and new business development.
- One great research university can have an economic impact on the same order of magnitude as one of the great cities of America.
- We all wish to send our children to the very best universities – great research universities are where a disproportionate fraction of the nation's top talent is incubated and where the nation's best companies recruit most of their talent for high-paying jobs.

Talent is Concentrated in Spiky Areas

Talent is not dispersed evenly across the globe – talent is concentrated in relatively few places. Figure 1, at the top of the next page, depicts light emission across the planet at night. Light intensity is not evenly distributed but, rather, is clustered in the most heavily populated regions of the developed world.

What would a map of the world look like if, rather than examining global distribution of intensity of light at night, we examined intensity of discovery? Richard Florida, who wrote the book *The Rise of the Creative Class*, also wrote one of my favorite articles, *The World is Spiky*¹. Florida argues persuasively that the world is “spiky” in terms of distribution of discovery. A few places in the world are home to a disproportionate number of discoveries, creating “spikes” on a map where discovery is concentrated, and relatively barren areas with little intensity of discovery.

¹ *Atlantic Monthly*, October, 2005, pp. 48-51.



Figure 1. Intensity of Light at Night (Source: NASA²)

Florida's data show that the scientific citations are heavily concentrated in the United States, Europe, and a few other places (Figure 2, below). Within countries, production of scientific citations is uneven. In the U.S., for instance, one can see spikes in cities such as Los Angeles, San Francisco, and Boston. Florida's data are about a decade old. If we were to view a map of today's information, I expect that we would see more intensity of scientific citations in Asia.



Figure 2. Source of Scientific Citations (Florida, 2005, "The World is Spiky").

² http://www.nasa.gov/images/content/49259main_flat_earth_nightm.jpg

Florida also developed a map showing global distribution of patents (Figure 3, below). Discovery in the private sector leads to patents. Patent generation is not evenly distributed across the globe, but, rather, is concentrated in certain countries, and even in certain regions within those countries.

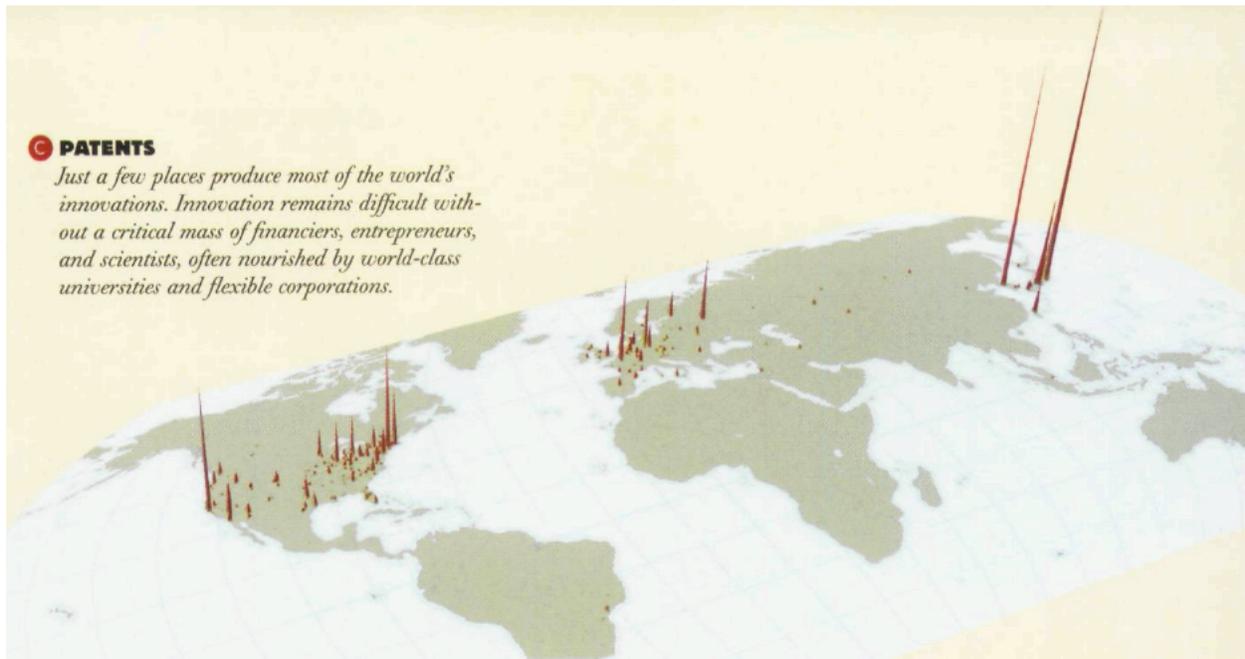


Figure 3. Source of Patents (Florida, 2005, “The World is Spiky”).

The Crown Jewels of American Higher Education, the AAU

A factor that is critical in the discovery process is the role of the world's premier research universities. In North America, the Association of American Universities³, or AAU, is the “club” of the great research universities. The AAU includes 61 U.S. universities, and 2 from Canada. The 61 AAU institutions comprise just 1.5 percent of America’s 4,000⁴ colleges and universities.

There are three AAU institutions in Texas: Rice University, Texas A&M University, and the University of Texas at Austin. The three Texas AAU institutions represent 5 percent of America’s 61 AAU institutions. Texas underperforms in terms developing great research universities in proportion to its population because Texas is home to 8% of America’s population⁵ but just 5% of its AAU institutions.

³ Information herein about the AAU comes from their website, www.aau.edu, and “AAU Facts and Figures” from this site.

⁴ There are 4,084 higher education institutions per <http://www.census.gov/prod/2003pubs/02statab/educ.pdf> Chart. No. 257.

⁵ Data source: <http://www.census.gov/popest/states/tables/NST-PEST2010-01.xls>

The AAU institutions are remarkable, as these statistics³ from the AAU show:

- The AAU institutions garner 54% of all federal research that goes to universities.
- The AAU institutions are home to overwhelming 87% of all U.S. academics who have been elected to the National Academy of Sciences (NAS), the National Academy of Engineering (NAE), and the Institute of Medicine (IOM).
- Since the founding of the Nobel Prizes in 1901, 70% of Nobel Prize winners at U.S. institutions have been affiliated with an AAU university.
- Among all National Merit Scholars, 64% are enrolled at AAU universities (and remember, the AAU institutions comprise just 1.5% of America's universities).
- Conclusion: A small number of world-class research universities attract most of the nation's brightest students and faculty members, and produce a disproportionate amount of the nation's creative output. **The AAU institutions are the crown jewels of higher education in America and perhaps throughout the world.**

The Role of Smart, Creative, Inspired Risk Takers

It was announced recently that Sony just manufactured its last Walkman⁶. Remember the Walkman? I loved mine. But it's gone. And the jobs to make and service the Walkman are gone, too, replaced by new jobs to make and service new devices that rely on new and better technology. This is the inevitable "churn" of jobs that occurs when new technology takes hold. The only uncertainty is where the new technologies will be developed and the new jobs created.

On April 4, 2010, Thomas Friedman, the *New York Times* columnist, wrote:

"According to the Kauffman Foundation, between 1980 and 2005, virtually all net new jobs created in the U.S. were created by firms that were 5 years old or less. Good-paying jobs don't come from bailouts. They come from start-ups. And where do start-ups come from? They come from smart, creative, inspired risk-takers. How do we get more of those? There are only two ways: grow more by improving our schools or import more by recruiting talented immigrants."

It's the smart, creative, inspired risk takers who are the key to our future.

We do not want to compete with China, India, and other developing countries on the basis of who offers the jobs with the lowest wages and benefits. The individuals and countries that out-innovate the others will secure prosperity. The inevitable "churn" will continue, new technology will replace old technology, and new jobs will replace obsolete jobs. It is the smart, creative, inspired risk takers who will create the new jobs and secure economic vitality.

⁶ <http://gadgetwise.blogs.nytimes.com/2010/10/26/sony-to-cassette-sayonara/>

Venture Capital Is a Critical Element that Fuels Economic Prosperity

The fuel that enables smart, creative, inspired risk-takers to create new business opportunities and their associated jobs is sometimes found within existing companies, but, in its most disruptive form, is often derived from venture capital. Venture capital is a tiny piece of our economy, comprising just \$22 billion per year⁷ in a \$15 trillion per year American economy⁸.

One could describe venture capital as the economic manifestation of the art of discovery, or the intersection between discovery and practical implementation in the private sector. Venture capital provides the essential dollars that enable the commercialization of discovery.

Venture capital is remarkably important to the economy as a whole⁹:

- Eleven percent of all Americans employed in the private sector work for a company backed by venture capital.
- Twenty-one percent of America's GDP comes from venture-capital-backed companies.
- In the period from 2006 to 2008, **jobs in venture-capital-backed companies grew at a rate that was 8 times greater than job growth in the American economy as a whole.**

The following table, which compares Texas with California and Massachusetts, is revealing:

State	Population (% of U.S.) ⁵	Federal R&D (% of U.S.) ¹⁰	NAS Members (% of U.S.) ¹¹	Venture Capital (% of U.S.) ¹²
California	12%	16%	30%	50%
Massachusetts	2%	11%	15%	11%
Texas	8%	4%	3%	4.5%

California has 12 percent of the U.S. population, earns 16 percent of all federal R&D dollars, and **earns a staggering 50% of U.S. venture capital**. Californians thank the rest of the nation for sending their federal tax dollars to California to fund research in their universities and, thereby, to attract venture capital. California is home to a remarkable 30 percent of all the elected members of the National Academy of Sciences (NAS).

⁷ Nat. Venture Capital Assoc, http://www.nvca.org/index.php?option=com_docman&task=doc_download&gid=690&Itemid=93

⁸ http://www.bea.gov/newsreleases/national/gdp/2011/pdf/gdp4q10_3rd.pdf (see Table 3)

⁹ http://www.nvca.org/index.php?option=com_docman&task=doc_download&gid=482&Itemid=93

¹⁰ <http://www.nsf.gov/statistics/nsf10314/tables/tab9.xls> (sum of all federal expenditure categories, which total \$100 B for U.S.)

¹¹ Source: on-line directory of the National Academy of Sciences, searched state-by-state

¹² <http://www.ssti.org/vc/>

Why does California have such a large fraction of the nation’s venture capital and National Academy of Sciences members? Simple answer: because California has the largest number of AAU institutions (9 of them, or 300% more than Texas, with 3). In addition, California’s AAU institutions are located in the great metropolitan areas of the state and have done an outstanding job of collaborating with business and venture capital firms, creating a “revolving door” of discovery, innovation, and business creation. **Great research universities located in great cities, working effectively with business, are the drivers.**

Massachusetts is a small state that with just 2 percent of the U.S. population but 15% of the nation’s NAS members. Massachusetts garners 11 percent of venture capital, or 550% more than its population fraction. Why such outstanding results? Great research universities (MIT and Harvard) located in one of the nation’s largest and most interesting cities where universities and local companies partner successfully.

How does Texas fare? Texas is home to 8 percent of the American population. We earn 4 percent of federal R&D, so we’re a net exporter of federal tax dollars to support research in other states. We have a paltry (by proportion) 3 percent of the nation’s National Academy of Sciences members. We only earn 4.5 percent of nation’s venture capital. Why does Texas earn so few venture capital dollars? Trace it back to so few (3) AAU universities, compared to 9 in California, 7 in New York, and 3 in much-smaller Massachusetts.

Within the State of Texas, venture capital distribution is spiky. As the following table depicts, the particularly interesting place is Austin:

Metropolitan Statistical Area	Population (% of Texas) ¹³	Venture Capital (% of Texas) ¹⁴
Dallas-Fort Worth	26%	28%
Houston	24%	13%
San Antonio	8%	2%
Austin	7%	55%

The key points are:

- Austin comprises just 7 percent of the population of Texas.
- But **Austin attracts 55 percent of all the venture capital invested in Texas.**

¹³ http://en.wikipedia.org/wiki/List_of_Texas_metropolitan_areas

¹⁴ Source: this information was supplied to the author about 3 years ago by Mr. Ron Nash, from industry statistics

Why is Austin so successful? The answer is simple: UT Austin and the incredible number of creative people and business enterprises that one finds in Austin. And it is no accident, either, that Austin has a flourishing music environment and other expressions of human creativity. Human creative capital in all forms, from computer science to performing arts, when aggregated in significant mass and located near a great university, represents a major economic force.

Many residents of Dallas-Fort Worth are well aware that creating more great research universities is very important for the future vitality of the DFW area. This is why the “tier one initiative” gained just broad and strong support.

The Relationship between Business Development and Research Universities.

Here is a quiz. Name three things that the following companies have in common:

- **Amazon.com:** Headquarters: Seattle, WA
- **Apple:** Headquarters: Cupertino, CA (Silicon Valley)
- **AOL:** Headquarters: initially Washington, DC, and now New York
- **Dell:** Headquarters: initially Austin, TX, and now Round Rock, TX
- **eBay:** Headquarters: San Jose, CA
- **Facebook:** Headquarters: Palo Alto, CA (founded in Cambridge, MA)
- **Google:** Headquarters: Mountain View, CA (Silicon Valley)
- **Intel:** Headquarters: Santa Clara, CA (Silicon Valley)
- **Medtronic:** Headquarters: Minneapolis, MN (pacemakers, etc.)
- **Microsoft:** Headquarters: Seattle, WA
- **Qualcomm:** Headquarters: San Diego, CA
- **YouTube:** Headquarters: San Bruno, CA (Silicon Valley)

Three things these companies have in common are:

1. They're all great companies to work for, each with thousands of employees and numerous middle-class jobs with great salaries and benefits – the kind of jobs that are critical to the prosperity of this nation.
2. All of these companies were backed by venture capital¹⁵.
3. **Every single one of these companies was founded in and is headquartered in a community with an AAU university.**

These companies give us a view of the future. **Creativity, innovation, and the kind of discovery that produces new businesses and great jobs will develop in great cities with great research universities.**

¹⁵ Source: National Venture Capital Association.

The following quote¹⁶ from Richard Florida summarizes the essential elements for securing a prosperous future:

“The United States of America is now facing its greatest challenge since the dawn of the Industrial Revolution. This challenge has little to do with business costs and even less with manufacturing prowess. And, no, the main competitive threats are not China or India. Our country – for generations known around the world as the land of opportunity and innovation – may well be on the verge of losing its creative competitive edge. The core of this challenge is what I’ve come to see as the new global competition for talent, a phenomenon that promises to radically reshape the world in the coming decade. No longer will economic might amass in countries according to their natural resources, manufacturing excellence, military dominance, or even scientific and technological prowess. Today, the terms of competition revolve around a central axis: a nation’s ability to mobilize, attract, and retain human creative talent. Every key dimension of international economic leadership, from manufacturing excellence to scientific and technological advancement, will depend on this ability.”

I believe that our great research universities are our nation’s most important institutions. As Tom Friedman said, we need more smart, creative, inspired risk-takers, and there are only two ways to get more of these: grow our own, or import them. This is exactly what our great research universities do: grow talent from within and attract the most talented from throughout the world.

MIT as an Example

Edward B. Roberts and Charles Eesley, with sponsorship from the Kauffman Foundation of Entrepreneurship, published a report in 2009, “Entrepreneurial Impact: the Role of MIT.”¹⁷ The authors performed a detailed evaluation of the impact of companies started by alumni of the Massachusetts Institute of Technology (MIT). Their findings include the following:

- MIT alumni have founded 25,800 companies.
- These companies employ 3.3 million people.
- **Annual worldwide revenues from these MIT-alumni-started companies totals \$2 trillion (for comparison, the gross state product of Texas is about \$1.2 trillion per year¹⁸).**
- MIT-alumni-started companies represent, in totality, the equivalent of the 11th largest economy in the world.

¹⁶ *The Flight of the Creative Class: The New Global Competition for Talent*, 2005. Harper Business, HarperCollins, p. 3.

¹⁷ http://entrepreneurship.mit.edu/sites/default/files/files/Entrepreneurial_Impact_The_Role_of_MIT.pdf

¹⁸ http://en.wikipedia.org/wiki/Economy_of_Texas

The authors of the report state, “Research- and technology-intensive universities, especially via their entrepreneurial spinoffs, have a dramatic impact on the economies of the United States and its fifty states.”

The economic impact of a great research university can be on the same order of magnitude as a great city of this nation or of the world. One need only think of UT Austin, and it’s impact on central Texas and the Texas economy, to recognize the scale of economic impact from one of the world’s great research universities. Other examples include Stanford, California-Berkeley, and Georgia Tech – all universities that have added tens of billions of dollars of wealth annually to their regions because of the great minds attracted to these institutions and businesses that evolved from alumni or in partnership with university researchers.

Brain Drain from Texas

A problem that some people are not aware of is that Texas exports large numbers of our best and brightest young people to other states. According to IPEDS data, in 2008 Texas sent 11,500 high school seniors to attend doctoral-granting universities in other states, and recruited 3,700 high school seniors from other states to attend doctoral-granting universities in the State of Texas¹⁹. Texas was a net exporter of 7,800 students per year in 2008, which is about twice what it was in the year 2000.

So we are shipping off, disproportionately, our best and brightest future discoverers to other states. And while it’s wonderful that some of our children go to Harvard and Stanford, wouldn't it be great if more young talent from around the nation and the world came to Texas to make their discoveries and establish their enterprises here?

To put the brain drain of 7,800 students per year into perspective, the freshman class at UT Austin is a little over 7,000 and the freshman class at Texas A&M is about 8,000, **so put in practical terms, we are shipping off a number of people essentially the same size as the freshman class at either UT Austin or Texas A&M each year to attend universities in other states.** Some people who leave to go to college out of state will come back home, but many won't. My daughter went to Berkeley, and guess where she lives now. San Francisco.

Why Ordinary Texans Should Care about Great Research Universities

Texas is blessed with millions of hard working, extraordinary “ordinary citizens.” Most of these citizens are not involved in venture capital and are not on the verge of creating the next Google or Facebook. Many of these extraordinary Texans do not live in a city with an AAU university. Why should these Texans care about great research universities? For two compelling reasons:

¹⁹ I give credit to Susan Rogers of UT Dallas for suggesting that I look at this issue, and to Larry Redlinger of UT Dallas for mining the IPEDS data to develop these statistics

1. **The economic vitality of the state, and its tax base, is critically dependent upon great research universities.** New technologies, new jobs, and the associated prosperity will occur somewhere. If “somewhere” is outside of Texas, then economic prosperity and a better future will belong to others, not to Texans. Our competitive position in the nation and world depends on our great research universities perhaps more than any other single factor.

2. **If you want a better life for your children and grandchildren, then you will want them to have the opportunity to attend an AAU institution.** For a great many people, the best opportunities are found at AAU universities. Only at great research institutions can students learn about new knowledge as it is being discovered, from the people making the discoveries. For students majoring in fields of science, engineering, health care, and technology, where research is constantly changing everything, great research universities give students a huge competitive advantage:
 - Students attending great research universities don’t just learn what’s in the book, they learn what the next edition of the book is going to say.
 - Undergraduate students have the opportunity to work in research laboratories and participate in discovery, honing their skills as innovators. Students not only learn course material, but they also they learn in a hands-on manner about research and about the future that research is revealing.
 - The best companies do most of their professional-level recruiting from the nation’s great research universities. This is because students who learn from the world’s leading research professors have a clear view of what the future will hold, offer more value to employers because of this knowledge, and possess the tools necessary to contribute and evolve over time.

But Things Are Good in Texas – Why Do We Need AAU Institutions?

Things are going relatively well in Texas compared to the rest of the nation. Despite our current state budget woes, Texas is better off than just about any other state in terms of job growth and overall economic outlook. One might ask: If great research universities are so important, how come we are going so well in Texas, compared to the rest of the nation, despite our limited number of AAU institutions? Doesn’t this mean that great research universities are not really that important?

It would be easy, perhaps, to dismiss the importance of discovery and great research universities given our current status in Texas. However, complacency can be fatal. The world changes over time. In 1920, just one lifetime and 91 years ago, the six most populous cities in America were those shown in the table at the top of the next page:

The Most Populous Cities in the U.S. in 1920²⁰

Population Rank in 1920	City
1	New York City
2	Chicago
3	Philadelphia
4	Detroit
5	Cleveland
6	St. Louis

Try telling the people in Detroit and Cleveland that past economic success assured prosperity today. Current economic success does not assure future prosperity.

If one stops to think about what the world is increasingly valuing and rewarding, and is likely to value and reward in the future, all signs point to education, research, and innovation as the key metrics that will determine future success in a global economy. We may feel pretty good about things in Texas today, but if we're smart, we'll realize that we have a major liability that limits our future potential. And that liability is too few great research universities, and a general lack of appreciation for the importance of the ones that we do have.

Closing Comments

Discovery is an art. It requires inquisitive minds practicing discovery in a highly creative, entrepreneurial environment with a critical mass of human creative talent. In many cases it also means expensive computers, equipment, and laboratories to tackle the most challenging problems in medicine, science, engineering, and technology. And for discovery to have a practical business impact, there must be strong collaboration on almost a daily basis between business and university researchers, as well as venture capital and business leaders who know how to start and build successful companies.

Future prosperity is given its best chance by bringing together a great research university, a strong community with an excellent business environment that values creativity, and the financial resources necessary to form and sustain new businesses. Texas can continue to be prosperous, but to do so in an increasingly competitive world we must make our current AAU institutions stronger, and build new ones, working closely with the private sector.

²⁰ http://en.wikipedia.org/wiki/Largest_cities_in_the_United_States_by_population_by_decade#1920