A Report to the Governor's Competitiveness Council

Improving the Competitve Positon of the Biotechnology & Life Science, Computer & Information Technology, Advanced Technologies & Manufacturing, and Aerospace & Defense Industry Clusters

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1.1 BACKGROUND

Chief executive officers recently ranked Texas as the number one state to do business in the nation citing a strong and growing economy, low cost of living, and high quality of life.[1] Since 2005 nearly 1,000 new plants have been built in Texas by companies including Microsoft, Samsung, and Fujitsu and 345,000 new jobs were created by foreign-owned companies.[2] Over the twelve month period ending in April 2008, Texas added 262,000 jobs, more than half of the total jobs added in the U.S. Since July 2003, Texas has added over 1.2 million jobs and the most recent unemployment rate in April 2008 was 4.1 percent. Despite the tremendous growth and opportunity created, Governor Perry recognizes that the state must continually work to stay competitive in a fast-paced global economy.

> *"To remain competitive in the 21st century global economy, Texas must create a seamless system of opportunity and innovation, starting when young Texans enter grade school and continuing until they graduate from college, qualified for jobs that will keep our state at the forefront of the global market."*
>
> *~ Governor Rick Perry*

In 2003 Governor Perry supported and signed Senate Bill 275, calling for the development of strategies to strengthen the competitiveness of several key industry clusters economists project will be the engines of job creation and economic development in Texas in the 21st century. Clusters are defined in the legislation as "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."

From this legislation, the Office of the Governor (OOG) created the Texas Cluster Initiative. The objectives of the Texas Cluster Initiative were to identify the clusters that would be the engines of job creation in the 21st century, and to stimulate the long-term and sustained economic growth of the clusters by developing a growth strategy focusing state resources on cluster success. The six clusters identified by the Texas Cluster Initiative are:

- Advanced Technologies and Manufacturing;
- Aerospace and Defense;
- Biotechnology and the Life Sciences;
- Information and Computer Technology;
- Petroleum Refining and Chemical Products; and
- Energy.

1 Chief Executive Magazine, "CEOs Weigh In On Best, Worst States To Do Business," December 2007.
2 The Wall Street Journal, "Texas v. Ohio," March 3, 2008.

By focusing on the needs of these clusters, Texas will be able to maximize its limited resources and will be better positioned to compete nationally and internationally for jobs of the 21st century. Other industries linked to the target clusters will also benefit from this approach, as success in these core clusters increases long-term competitiveness and regional prosperity in other industries. As part of the initiative, the OOG, including the Economic Development and Tourism office, and the Texas Workforce Commission (TWC) have worked to form state and regional partnerships to foster growth and development in the six target clusters. The initiative has also led to the development of industry-based strategies for recruitment and expansion within the state.

In order to build upon and continue the efforts of the initiative, in November of 2007, Governor Rick Perry appointed 29 public and private sector leaders to the Governor's Competitiveness Council. He charged the Council with:

- Identifying significant competitiveness issues and opportunities arising from the follow-up research on the six targeted industry clusters, and
- Making recommendations to the Governor that establish an agenda for action for both the State of Texas and state agencies, whereby opportunities for increasing Texas' competitiveness are leveraged and barriers or weaknesses are eliminated or minimized.

In order to assist the Council in identifying cluster issues and potential recommendations for improvement, in January 2008, the OOG, in partnership with the TWC, tasked International Business Machines (IBM) with preparing a detailed analysis of the following clusters:

- Advanced Technologies and Manufacturing;
- Aerospace and Defense;
- Biotechnology and the Life Sciences; and
- Information and Computer Technology.

Specifically, IBM was tasked with assessing the trends in these clusters and Texas' competitive position compared to other global players; identifying barriers to cluster growth for sub-sectors within these clusters and for individual regions within Texas; and providing specific recommendations on both the priorities and programs that would enhance Texas' competitive position.

1.2 Our Approach to This Task

Globalization has fundamentally changed the competitive business landscape. Global integration is the new playing field. The impact of the globally integrated economy and the rapid pace of change flowing from innovation in business models, processes, technology, and services apply to nations, states, regions, companies and individuals.

As a corporate competitor in this globally integrated economy, IBM had to transform to remain competitive. From regaining customer and shareholder confidence during the "burning platform" days of the early 1990s to building a new model for growth in the 21st century, IBM has more than a decade of experience in business transformation. This transformation has required a fundamental shift in how IBM approached strategy to remain competitive in this dynamic, globally integrated marketplace. As a result, IBM has created the IBM Business Leadership Model that serves as the basis of the strategy formulation and execution process within IBM. The IBM Business Leadership Model is a systematic way of aligning our

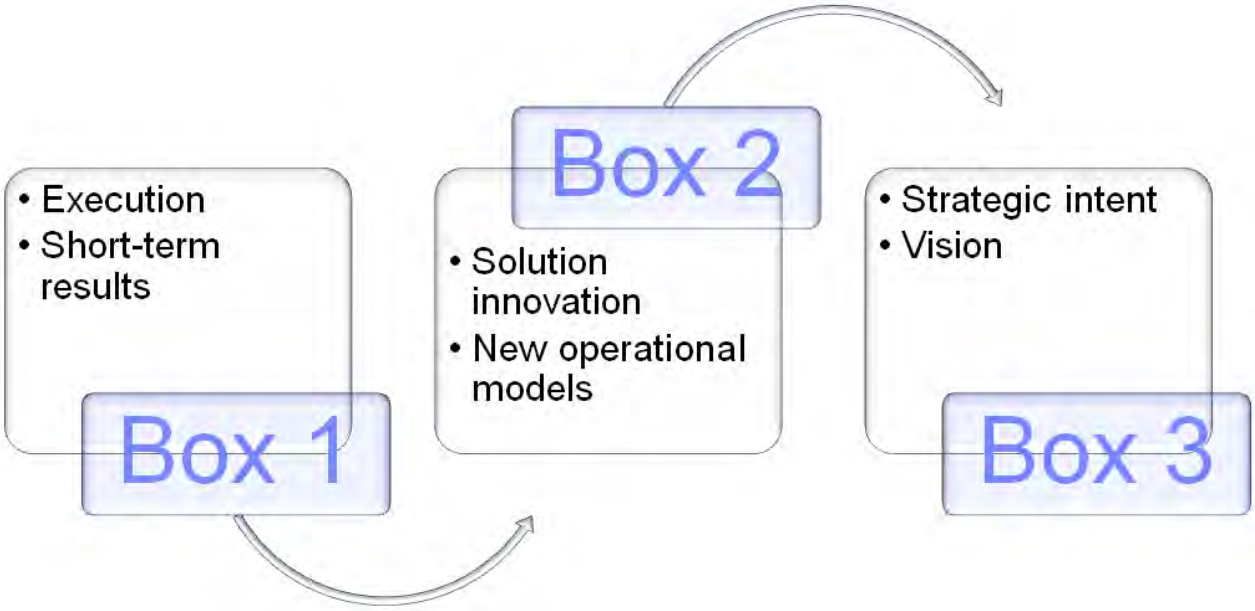
strategy and execution to achieve desired business results. This model is based upon the following guiding principles:

Good strategy and effective execution begins with leadership's consistent attention to strategic issues and opportunities. Leadership conducts regular executive meetings focused on monitoring progress, tracking strategic issues and commissioning new projects to gain new insights and set new directions.

Strategy development begins with a clear understanding of the vision for the future and an articulation of the "gaps." Gaps are discrepancies or shortfalls between the current results and those that are expected or desired.

Solutions must be aligned with a clear definition of the gap they are trying to close. Better execution of current processes and models may not be sufficient to realize an organization's vision or strategic intent. New innovative solutions and/or competencies may be required to bridge strategic gaps. Figure 1 illustrates this concept through a typical "Three-Box" approach to strategy formulation.

FIGURE 1: THREE-BOX MODEL



Successful transformation requires strategy, solutions, and execution. Successfully linking strategy and execution is the key to success. A strategy without a realistic execution plan and management system to govern is bound to underperform or fail completely.

Strategy is ongoing action and effective strategy must be continuous. What is critical is the ability of strategy to adapt to changes in the global marketplace with a new business design and supportive organization. Strategy cannot be static.

Processes and organizational structures must be designed to build in the flexibility required to self-adjust to change. The most effective way to handle a moderate amount of change is to create processes and structures within an organization that can respond in a timely and effective manner. High-performing organizations can respond to market changes quickly because clear responsibilities have been delegated to key individuals that are knowledgeable and able to make appropriate decisions and actions.

IBM approached the task of identifying barriers to cluster growth and providing specific recommendations for improvement as a transformational strategy initiative. As such, IBM has coupled its Business Leadership Model principles and experience in economic development and site selection services to define an executable strategy for Texas to realize its vision of ensuring cluster success. The purpose of this report is to detail the findings of the analysis and share recommendations for improving Texas' competitive position in the four industry clusters. Specifically, this report addresses the following questions:

What are Texas' vision and objectives for economic development in these four industry clusters? This question is addressed based upon the strategic vision and direction outlined by Governor Perry and the Governor's Competitiveness Council.

What is the state of the competitive environment and what is Texas' competitive position in these industry clusters as compared to global competitors? In order to answer this question, in-depth competitive positioning and workforce analyses were prepared for each cluster and for three sub-sectors within each cluster. Importantly, for the three sub-sectors selected within each cluster, a detailed competitive positioning analysis was performed. This analysis is similar to that used to advise corporate clients trying to determine where to expand or relocate their business or a component of their business. This site-selector approach provides an invaluable external view of Texas' competitive position because it is based on external data available to site selectors, business, individuals and economic development consultants around the world who are making critical decisions about where to expand or relocate among many competing domestic and international locations. An overview of the competitive positioning analysis is provided in Section 3.6.

What gaps must Texas address to improve its competitive position in these industry clusters? This question is addressed based upon the findings of the competitive positioning and workforce analyses, as well as information received from members of the Governor's Competitiveness Council, Texas economic development leaders, and stakeholders interviewed across various regions in Texas. Listings of the stakeholders that contributed to this effort are included in the acknowledgements. Once the gaps were identified, they were organized around the following set of basic levers of economic development. Each lever represents an area where Texas can focus on making improvements in order to impact its competitive position:

- Workforce;
- Research, development and commercialization ;
- Venture capital and business start-up support;
- Infrastructure;
- Government services and regulations;
- Cluster management; and
- Marketing and business development.

What potential solutions to these gaps exist and how are other competitors addressing these gaps? This question was addressed based on industry experience and the results of competitive research. Potential solutions to address these gaps are organized around the identified levers.

Where should Texas focus its resources to improve its competitive positioning in these industry clusters? A universe of potential solutions exists to address the various gaps identified; however, it is unrealistic for Texas to attempt to execute all of the possible solutions. Rather, Texas must focus its resources around a prioritized portfolio of investments. Therefore, the report includes a targeted set of recommendations where Texas will realize the greatest return on investment based upon the expected impact and complexity of implementation. The recommendations are organized around the following three themes:

- INNOVATION – What Texas must do to improve its innovation capabilities (e.g., universities, research, and development, entrepreneurial activity)?
- WORKFORCE – What Texas must do to improve the management and development of the Texas workforce to remain competitive in a globally integrated environment?
- BUSINESS MODEL – What Texas must do now to optimize its business model for economic development so that the State will have the agility required to adapt to changes in a dynamic, globally competitive environment?

The sections that follow aim to the answer these questions.

SECTION TWO: TEXAS' VISION AND OBJECTIVES FOR ECONOMIC DEVELOPMENT

Governor Perry has called for an economic development strategy for Texas that focuses on fostering areas where Texas has the greatest growth potential. The Governor has stated that in today's globally integrated economy, "knowledge and capital are rapidly being deployed to parts of the world where the right combination of talent, technology, business climate, infrastructure, and markets converge." Although Texas views itself as a leader in many areas of economic development, it realizes that momentum alone will not ensure a prosperous economic future since it is no longer just competing with neighboring cities or states, but is a competitor in a larger, global marketplace.

Texas' vision is to stimulate long-term sustained growth and focus the allocation of state resources on key industry clusters that will have high job creation and be drivers of economic development in the 21st century. Additionally, Texas wants to assure that education, workforce and other state resources are aligned with future workforce needs.

Texas has established the following workforce system strategic goals:

- Develop a globally competitive workforce.
- Ensure an employer driven workforce system.
- Support current and future worker employment needs.
- Provide employers ready access to potential workers.
- Support a wide range of sustainable employment opportunities for all Texans.
- Provide relevant educational and training opportunities for current and future workers.
- Support life-long knowledge acquisition and skills development.
- Develop and coordinate partnerships among business, education, labor, government and other communities of interest.
- Hold system partners accountable for the successful execution of their respective workforce development system objectives and the continuous improvement of the workforce development system.

In summary, Texas wants to remain one of the top skilled global competitors in six high-growth clusters of economic activity, while providing education and employment opportunities for all of its citizens.

3.1 INTRODUCTION

There are a variety of methods available to assess a cluster's competitive position and identify strengths and weaknesses. Some of these methods include reviewing past cluster work, analyzing the existing competitive environment, reviewing gaps in workforce needs, reviewing information from other third-party studies and utilizing a combination of IBM's Global Investment Location Database (GILD) and other information available to potential site selectors. All of these methods were used to determine Texas' competitive position and identify gaps.

In Section 3.2 key findings of the past Texas Industry Cluster Initiative are summarized.

In Section 3.3 an overview and analysis of the competitive environment are presented. Research from the IBM GILD which compiles current interstate and foreign investment decision data and serves as an indicator of current trends is also included.

In Section 3.4 the Texas workforce needs are analyzed for future gaps that may develop in cluster related occupations.

In Section 3.5 the Harvard Institute for Strategy and Competitiveness Cluster Mapping Project was used to prepare an analysis of certain Texas clusters and sub-sectors within those clusters. This analysis was only possible for areas where significant overlap existed between the Cluster Mapping Project's work and the clusters identified for analysis in Texas.

In Section 3.6 an overview of IBM's competitive positioning methodology is presented. This methodology considers a broader range of factors than the Harvard study and incorporates data that might be used by a site selector, corporation, or individual in performing an initial screening of locations for investment.

Section 3.7 presents some broad conclusions about Texas competitive position in each cluster and three sub-sectors within each cluster.

3.2 PAST TEXAS INDUSTRY CLUSTER REPORTS

The 2005 Cluster Assessment Reports, authorized by the Texas Legislature and driven by the OOG, brought together more than 250 stakeholders in the targeted clusters from across the state, including elected officials, industry leaders, and members of academia. Recognizing that world-class cluster development relies on "the continual advancement and investment of companies, infrastructure, and technology to maintain a competitive advantage", the reports addressed how Texas can continue to be competitive and improve its global position within the targeted clusters.

The reports identified many of Texas' strengths in each cluster. Hangars, airports and airline hubs, military bases and the space program were identified as providing Texas with major advantages in the aerospace and defense cluster. Major companies involved in cutting edge research and development in emerging technologies, as well as strong industry associations allow for a good base of cluster development in both information technology and advanced manufacturing. The demographics and world-renowned medical centers of major cities in Texas showed the state is well positioned to be a leader in life sciences and biotechnology.

The reports also identify some gaps that, if not addressed, could seriously hinder the development of cluster industries in the future. Centering on the important themes of workforce and education development, research and commercialization, infrastructure and the general business environment, the reports offered more than 50 recommendations to address identified gaps.

The reports provide an important base for IBM to begin its cluster analysis and were critical to the development of the final recommendations for future cluster improvements included in this report.

3.3 Competitive Environment Overview

3.3.1 Industry Trends

Five key trends are impacting industry and, therefore, state economic development. These trends drive corporations to alter their behavior in order to compete. In response to these trends, corporations may change their partners and suppliers, where they invest in plants and offices and what type of talent they require. States that understand these trends may position themselves to help corporations address these challenges and, consequently, improve their regional economies. These trends are the basis of competition for industry:

- Global Markets;
- Business Components;
- Collaborative Business Models;
- Innovation; and
- Talent.

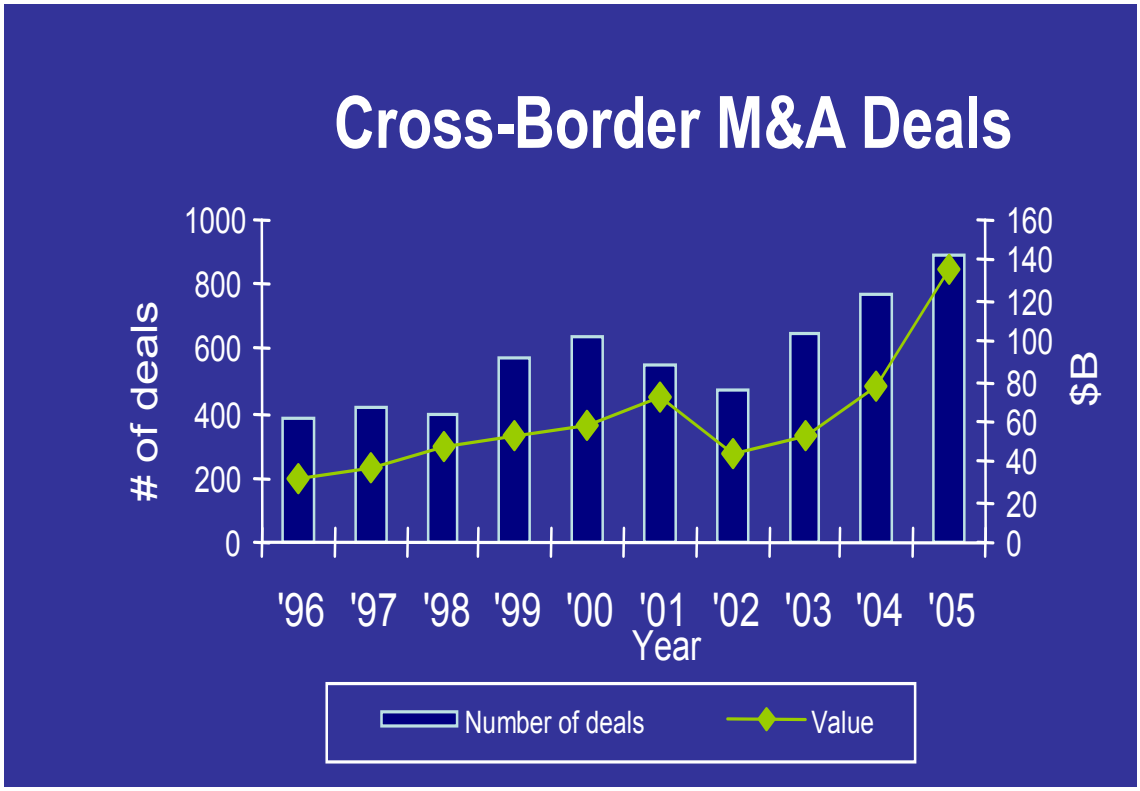
Global Markets

In a global marketplace companies have open access to markets and human capital in developed and developing countries around the world. Developing countries with emerging economies provide low-cost and/or highly educated employees to produce products for sale in developed nations with large middle classes. Simultaneously, the middle class grows in the developed nations and creates demand for the products and services both from developed and developing nations. The increase in global trade[3] (See Figure 2) and the number of cross-border mergers and acquisitions (M&A) deals[4] (See Figure 3), indicate the rapid degree of globalization being undertaken by companies around the world.

3 Forrester Big Idea Report – "The Rise of Globally Adaptive Organizations," Dec 2006.
4 UNCTAD, World Investment Report 2006 – FDI from Developing and Transition Economies: Implications for Development.

FIGURE 2: INCREASE IN GLOBAL TRADE

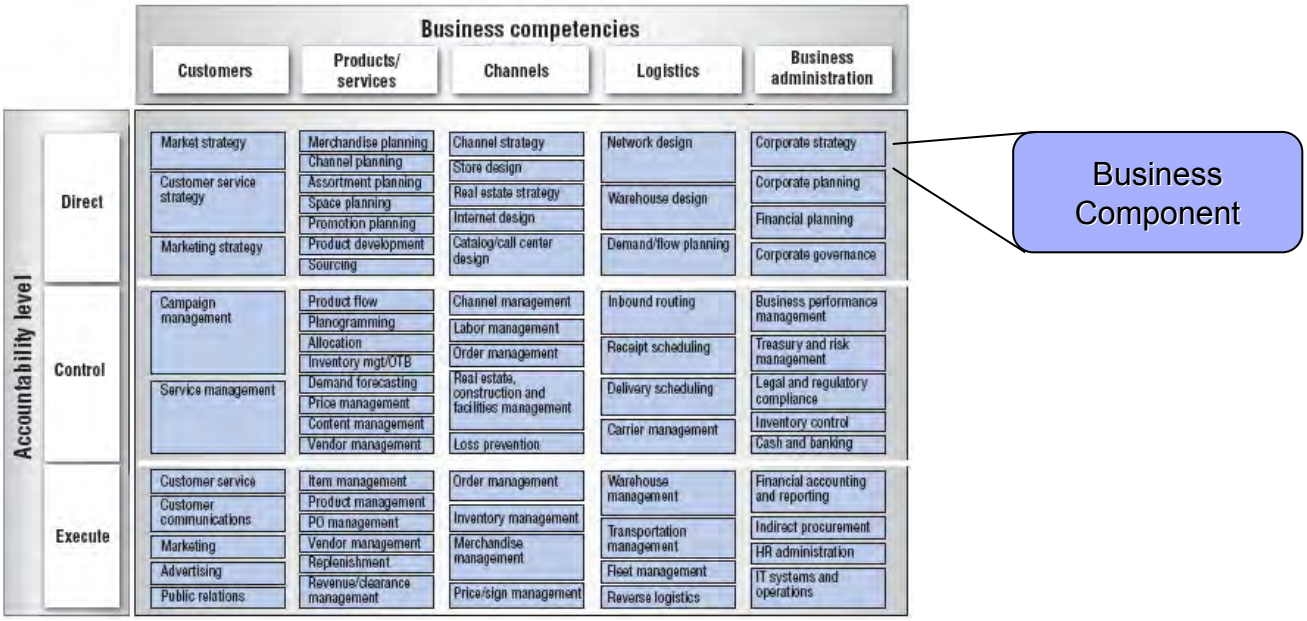
FIGURE 3: INCREASE IN CROSS-BORDER M&A DEALS



Business Components

Global markets provide opportunities for businesses to partner across national boundaries to market or produce goods and services. Consequently, many companies are transforming into Globally Integrated Enterprises (GIE). A GIE is distinguished by its cross-border collaborative innovation, integrated production and outsourcing to specialists. A GIE locates operations and functions anywhere in the world based on the cost, skill, and business environment requirements for a specific business function or component. Each business function or component can stand independently and contain all of the required processes, skills, technologies, and assets necessary to operate the enterprise, but works as a part of an integrated GIE. Figure 4 portrays a group of business components within a typical GIE.

FIGURE 4: BUSINESS COMPONENT MODEL (EXAMPLE)



The location of business components around the world has been made possible by information technology combined with advances in internet bandwidth that allows companies to reduce transaction costs and increase supply chain efficiency.

The aerospace industry provides an illustration of how India's supply of technical talent and production experience attracted a Boeing business component. To access lower priced but equally qualified production talent, Boeing partnered with Tata Industries to relocate a 787 production unit (business component) to India. Boeing invested to build a plant and then contracted Tata to produce floor beams for the 787. These floor beams use advanced titanium and composite materials to save weight and Tata possesses expertise with these materials because they manufacture automobiles. After production, Tata transports the floor beams to other 787 component businesses in Japan, Italy, and the U.S. for final assembly.

Collaborative Business Model

Companies work to combine their internal integrated business components with external partners to create collaborative business models. In fact, according to IBM's 2008 Global CEO Study, corporate executives view external collaboration as indispensable to competitiveness. Through collaborative business models, companies join networks of competitors, suppliers, customers, and partners. For instance, companies often partner with government agencies and universities to develop and leverage new technologies or talent. Companies position their business components in collaborative business model networks distributed around the globe (See Figure 5).

FIGURE 5: GLOBAL DISTRIBUTION OF BUSINESS COMPONENTS

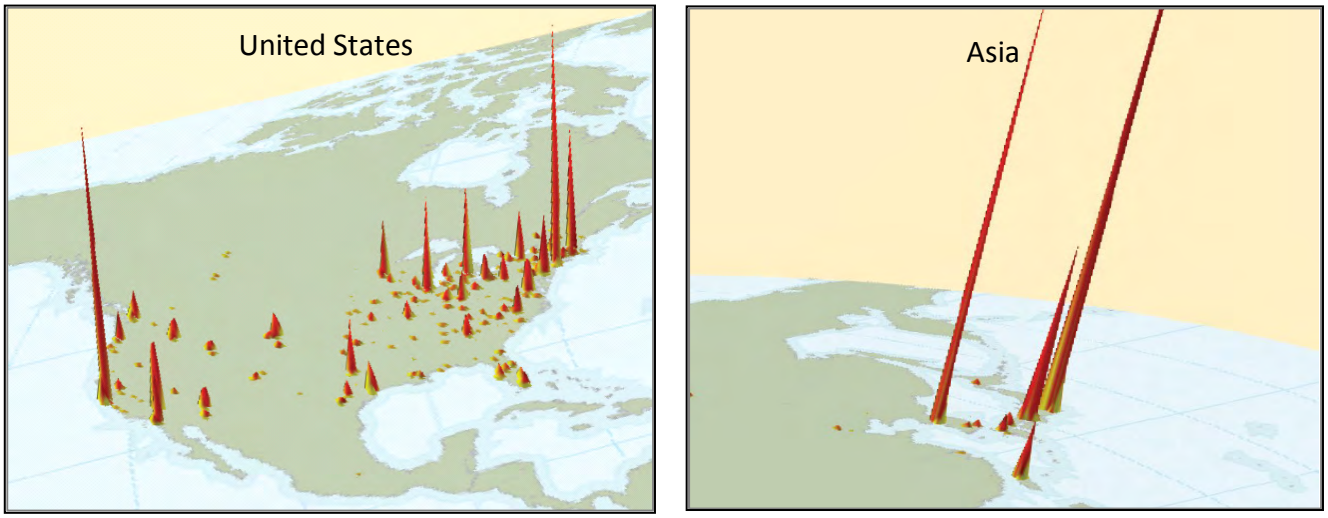
Innovation

The National Innovation Initiative defines innovation as "the intersection of invention and insight, leading to the creation of social and economic value." Companies aim to place their business components into collaborative business model networks that quicken innovation. Through these networks, company personnel learn of new technologies, improved processes, and redesigned products. Rather than the tradition of scheduled brainstorming, collaborative business models position employees in an environment to learn, create, and recombine ideas for new purposes.

Talent

While not measured on the balance sheet, the availability of talent is a key asset of increasing importance to GIEs. Companies focused on technology and innovative products require access to talented people who are educated in science, technology, engineering, and business disciplines (e.g., finance). These types of talented people are necessary for universities and industries to conduct the scientific and engineering research that is used to create new products and technologies. The path from research to patent to product is long and complex. The quantity of talent available to the GIE through collaborative business model networks increases their probabilities of success. Innovation remains difficult without a critical mass of financiers, entrepreneurs, and scientists, often nourished by world-class universities and flexible corporations. Due to the challenges associated with innovation, it's not surprising that a majority of the world's innovations are derived from just a few places (See Figure 6).

FIGURE 6: DISTRIBUTION OF PATENTS WORLDWIDE

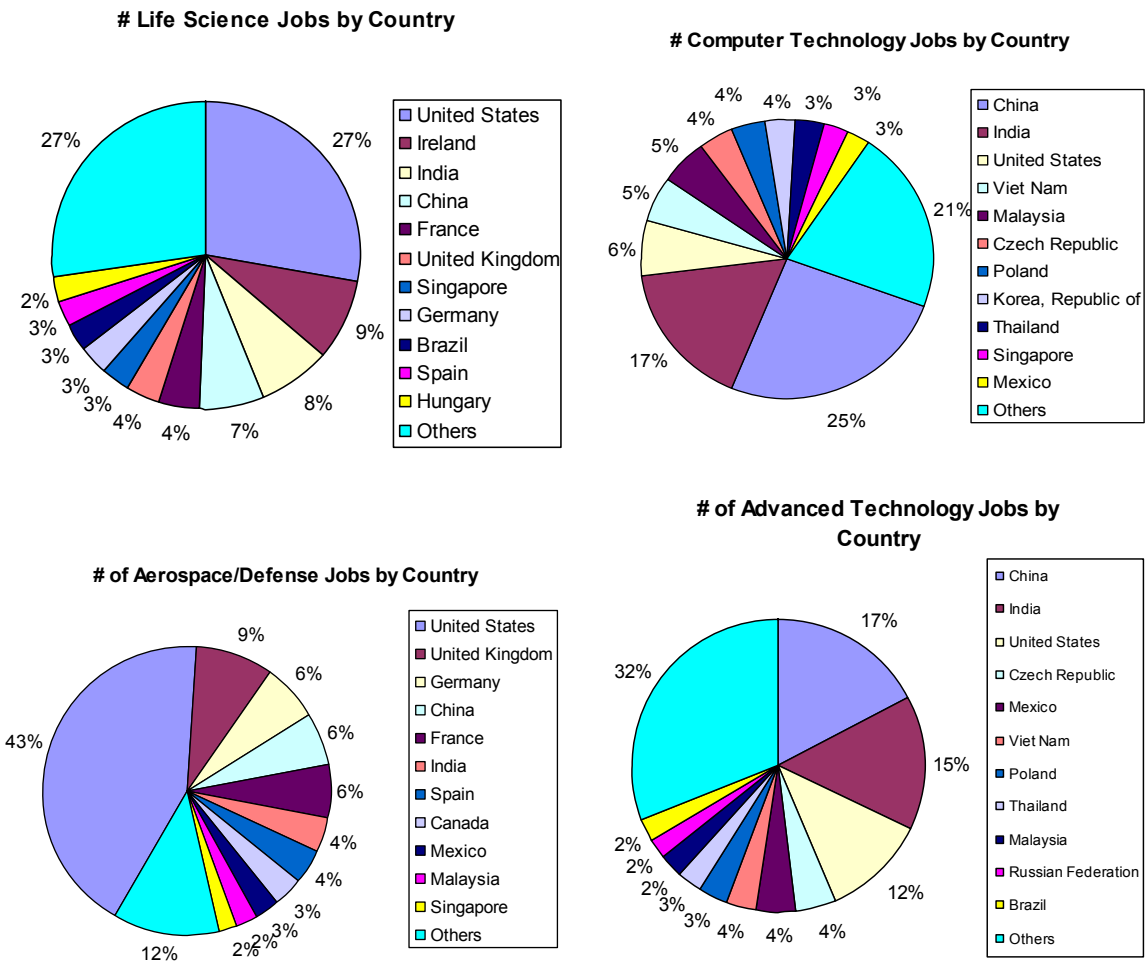


(Source: Richard Florida, The World is Spiky, The Atlantic Monthly, 2005)

Impact of the Trends

These five trends – increasing global markets, the ability to locate business components globally, and the desire to locate business components close to areas that support collaborative business models, innovation, and talent – are resulting in the mass relocation of factories, offices, and people around the world. Investment flows indicate the distribution and scale of these relocations. Figure 7 depicts the global distribution of new jobs created from 2003 to 2007 by country. These charts reflect mobile corporate expansions of start-up firms in the Advanced Technology, Biotechnology and Life Sciences and Aerospace and Computer Technology clusters. The relocation information comes from IBM's Global Location Trends report and GILD, which records investment project announcements around the world on an on-going basis.

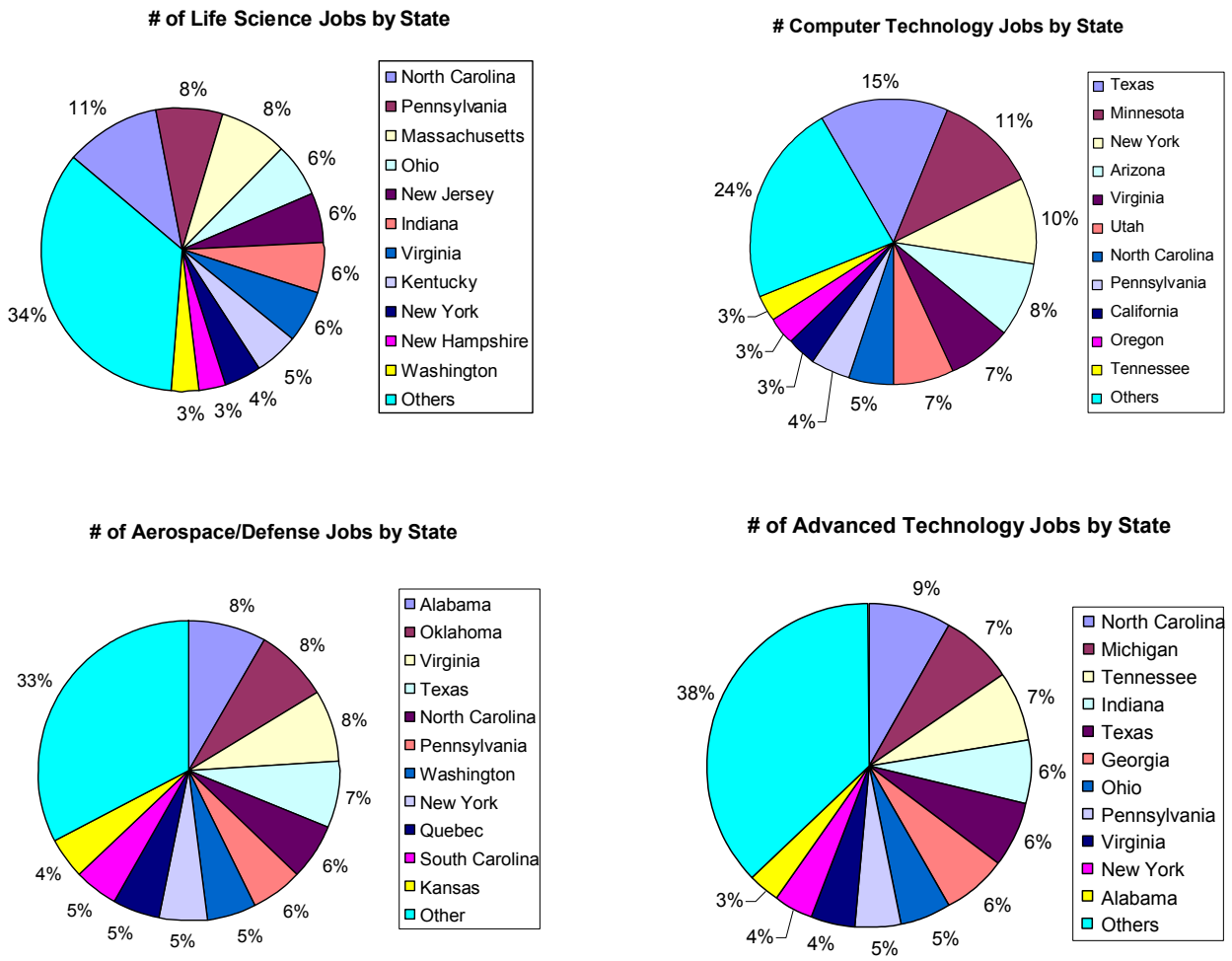
FIGURE 7: DISTRIBUTION OF NEW JOBS CREATED BY COUNTRY (2003 – 2007)



These charts show the challenges that countries such as China and India present to Texas' economic development. China received a dominant proportion of investment in Computer Technology and Advanced Technology. Moreover, India achieved greater shares than the U.S. in these same clusters. Due to the size of the U.S. Department of Defense's (DoD) acquisition needs, the U.S. dominated the share of Aerospace investment. Additionally, the U.S. dominates in Life Sciences investment with India, Ireland, and China receiving much smaller shares.

IBM's GILD also tracks foreign and state- to- state investment announcements by U.S. state (See Figure 8).

FIGURE 8: DISTRIBUTION OF NEW JOBS CREATED BY U.S. STATE (2003 – 2007)



An overview of relative job creation announcements per state indicates that Texas is receiving greater than its proportionate share based on population (8 percent) of external investment in Computer Technology job creating projects and less than its proportional share in Life Sciences projects. These figures do not include job creation in projects where alternative locations are not considered feasible (e.g., hospital expansions).

The investment flows and GILD analysis show that industries are more mobile around the globe than ever before. Looking at the relative sizes of these clusters among the states shows that labor concentration is quick to change as well. Some clusters have seen their regional distribution within the U.S. undergo dramatic shifts within the last few years. While some states have experienced significant growth, other former cluster leaders have experienced a decline.

3.3.2 Environmental Overview Conclusion

Industry forces are spreading capital, technologies and businesses around the world. Previously stagnant economies are experiencing parabolic gross domestic product growth after decades of heavy government intervention. Associated with this growth is a distributed flow of knowledge and talent that both lifts the quality of life in developing nations and creates challenges to the predominance of U.S. state economies. Texas is fortunate to possess a long history of technology- based economic growth. However, Texas' history is no guarantor of continued economic growth and high quality of life. Investments are flowing to China, India, and Latin America, which are creating their own technology clusters based on science and engineering knowledge. These nations' economies grow by using government research and education policies to catalyze private investment, entrepreneurship, and innovation. Texas holds the intellectual and material assets necessary to successfully compete; however, thoughtful planning and policies are necessary to leverage these assets effectively.

3.4 Cluster Workforce Demand and Supply Projections

3.4.1 Background

For Texas to compete successfully in the global economy and for its residents to achieve economic self-sufficiency, an effective workforce system is necessary for closing the educational and occupational skills gaps. The Texas Strategic Economic Development Planning Commission identified the challenges of globalization and the need for integrated solutions and stated in its Economic Development Plan for 1998-2008 that "Workforce development is the single most important economic development issue facing the state." Alignment of workforce development programs with economic development strategy must be a major objective of the workforce system.

In this section, projections of the demand for many occupations that are important to the growth of the four clusters covered in this report are compared to the projected supply from higher educational institutions that provide requisite training. Fifty occupations that support the four clusters were selected for analysis. These occupations were either identified in preparing the sub-sector profiles, which were used for the competitive positioning analysis outlined in Section 3.6, or other occupations associated with the clusters studied that were projected by the Texas Strategic Workforce Assessment Project (SWAP) as having 10 year growth rates of 30 to 40 percent. Many occupations (e.g. electrical engineer) are assigned to one cluster; however, in reality, some occupations support more than one cluster. Principal occupations considered by cluster are provided in Figure 9 on the next page.

3.4.2 Workforce Demand and Degree Supply Method

This analysis assesses the supply of degrees and the industry demand for occupations critical to the four clusters. To determine the degree supply, the analysis reviews the 2006 National Science Foundation's CASPAR database of degrees. For each state, CASPAR lists the number of undergraduate and graduate students by degree area (e.g., physics and mechanical engineering). For industry demand, the analysis uses the Bureau of Labor Statistics (BLS) database that projects occupation demand for each state from 2004-2014. A workforce gap is defined as a deficit between the 2006 degree supply and the average annual (2004-2014) demand for occupations that use the specified degrees. This deficit is summarized as the Supply: Demand ratio. The analysis then compares the Texas Supply: Demand ratio with those of competitor states. Based on the absolute ratio and the ratio relative to other states, the analysis determines the specific occupations in which Texas faces a workforce supply gap.

3.4.3 Historical Demand Analysis

From 2000-2004 various Texas occupations grew at both very high and very low rates (See Figure 9). Some occupations important to the Texas Cluster Initiative grew at more than 40 percent over this time frame. These occupations support two clusters in particular:

- ✯ Biotechnology and Life Sciences: biomedical engineers, medical scientists, environmental scientists, agricultural/food service technicians, surgeons and medical assistants; and
- ✯ Aerospace and Defense: mechanical drafters and avionics technicians.

This bodes well for the development of a critical mass of talent for the Life Sciences and Biotechnology cluster.

FIGURE 9: PRINCIPAL OCCUPATIONS

Biotechnology & Life Sciences	Computer & Information Technology
Biological Technician	Computer & Information Scientist Research
Medical Lab Tech.	Computer Software Eng.
Medical Tech.	Mathematician
Microbiologist	Author/Scriptwriter
Physician	Multi-Media Artist and Animator
Radiologic Tech.	Team Leader-Art Director
Surgeon	Technical Director
Medical Scientist	Technical Writer
Biomedical Eng.	Telecommunications Eng.
Medical Assist.	Desktop Publisher
Medical Records & Health Information Tech.	Graphic Designer
Medical Equip. Preparer	
Licensed Practical & Licensed Vocational Nurse	
Animal Scientist	
Ag. & Food Science Tech.	
Zoologist & Wildlife Biologist	
Registered Nurse	
Biochemist	
Advanced Technology & Manufacturing	**Aerospace & Defense**
Senior Programmer - Computer Software Eng.	Nuclear Engineers
Electrical & Electronic Equipment Assembler	Physicist
Electrical Engineering Tech.	Mechanical Drafter
Electrical Engineers	Aerospace Eng. & Operations Tech.
Electro-Mechanical Assembler	Aircraft Mechanics & Service Tech.
Electro-Mechanical Tech.	Aircraft Structure, Surfaces, & Systems Assembler
Electronics Eng.	Astrophysicist
Computer Hardware Eng.	Avionics Tech.
Computer Software Eng., Applications	Airline Pilot, Copilot, & Flight Eng.
Computer Software Eng., Systems Software	

On the negative side, some important Texas-based occupations decreased in size by more than 30 percent. Decreases occurred in the fields of computer and information scientists, telecommunications engineers, environmental engineers, microbiologists, aerospace engineers and technicians, medical records/health information technicians, and electro-mechanical technicians. This data indicates that Texas lost talent in the industries of software, hardware, telecommunications, aerospace, and medical administration.

The dot-com investment recession that began in 2001 likely led to a decrease in positions related to companies in the Internet and telecommunications industries. Many other states recorded decreases in telecommunications engineers (e.g., Virginia, Washington) and microbiologists (e.g., Alabama, Louisiana, North Carolina), which indicates a nationwide decrease unrelated to Texas policy. The decrease in aerospace-related occupations indicates the degree of globalization undertaken by that industry, as other states (i.e., California, Washington, Louisiana, and Massachusetts) recorded even greater losses. In addition, the decrease in medical administrative personnel probably indicates that Texas hospitals and doctors' offices migrated increasing amounts of patient record and scheduling data to information technology systems.

Figure 10 portrays the historical changes in occupation growth for Texas and its competitors. The data is for the period 2000-2004. Texas is the first column on the left. Orange shading indicates an occupation that decreased by more than 25 percent during this period. Green shading indicates growth of at least 40 percent over this period. This table helps portray whether Texas occupation trends were unusual or part of a larger national trend. A row with four or five data points of the same shading is indicative of a general, national trend for that occupation. For example, the first row contains the occupation of aerospace engineering and shows five states with large declines in this occupation's growth, with Florida as a clear exception. The inference is a nationwide decrease in aerospace occupations, but that something special occurred in Florida that may be worth investigating further to determine if Florida benefited from specific actions taken (e.g., policy changes).

FIGURE 10: HISTORICAL OCCUPATION GROWTH RATES FOR STATES (SOURCE: BLS DATABASE)

	2000-2004 Total Growth in Occupations									
Job	**TX**	**AL**	**CA**	**FL**	**LA**	**MA**	**NC**	**OK**	**VA**	**WA**
Aerospace engineering and operations technicians	-59%	13%	-71%	94%	-100%	-100%	0%	-21%	0%	-100%
Agricultural and Food Science Technicians	170%	-100%	52%	-18%	133%	0%	0%	75%	-58%	20%
Aircraft Mechanics and Service Technicians	-4%	-6%	-14%	-18%	54%	-26%	46%	-7%	58%	40%
Aircraft structure, surfaces, and systems assemblers	-72%	49%	-100%	16%	0%	-100%	-77%	0%	-100%	-100%
Airline Pilots, Copilots, and Flight Engineers	-15%	-9%	0%	-4%	-62%	47%	-100%	-93%	-36%	-100%
Avionics Technicians	123%	-6%	208%	36%	107%	56%	-65%	-4%	-5%	-58%
Biochemists	0%	0%	25%	-11%	-100%	0%	0%	0%	-19%	0%
Biological technician	26%	-33%	37%	75%	9%	37%	95%	57%	-60%	43%
Biomedical Engineers	44%	16%	36%	-12%	54%	-15%	-17%	-29%	81%	4%
Civil Engineers	6%	-18%	31%	7%	0%	12%	17%	57%	-1%	16%
Computer and Information scientists research	-46%	-14%	20%	-15%	0%	38%	0%	18%	20%	126%
Computer systems analyst	21%	12%	-3%	30%	16%	-9%	15%	27%	-1%	-9%
Computet software engineers	7%	21%	-1%	66%	0%	26%	5%	101%	18%	-1%
Database Administrators	2%	0%	-21%	-20%	13%	23%	-7%	16%	-18%	-36%
Electrical engineering technicians	4%	9%	-32%	-37%	-24%	-6%	-37%	-23%	-22%	-45%
Electrical engineers	-14%	72%	-27%	0%	30%	-19%	-28%	1%	-30%	14%
Electro-Mechanical Technicians	-45%	-79%	-54%	-59%	-91%	-31%	-71%	-46%	-72%	-92%
Environmental Engineering Technicians	-33%	81%	56%	-23%	50%	7%	21%	-55%	5%	-14%
Environmental Engineers	-28%	23%	4%	1%	67%	-32%	0%	31%	63%	-11%
Environmental Scientists and Specialists, Including Health	45%	30%	80%	12%	-6%	50%	44%	-63%	-6%	5%
Graphic Designer	30%	-9%	25%	16%	24%	4%	21%	31%	28%	-25%
Industrial Engineer	-15%	2%	-9%	27%	11%	-3%	7%	-30%	-13%	-24%
Licensed Practical and Licensed Vocational Nurses	4%	3%	0%	14%	18%	10%	11%	-4%	-10%	1%
Mechanical Drafters	42%	-19%	-19%	37%	-21%	2%	-7%	0%	-100%	-18%
Mechanical enginneers	-23%	-10%	-9%	-2%	23%	6%	-5%	2%	2%	1%
Medical Assistants	75%	1%	6%	-21%	9%	17%	33%	115%	148%	-5%
Medical Equipment Preparers	5%	74%	64%	27%	-2%	11%	108%	91%	34%	-7%
Medical lab technicians	-1%	7%	-32%	-23%	25%	89%	5%	27%	5%	-7%
Medical Records and Health Information Technicians	-28%	1%	10%	-14%	10%	17%	26%	5%	24%	46%
Medical Scientists	69%	0%	107%	115%	-10%	58%	66%	-15%	-100%	171%
Medical technologists	0%	3%	-22%	-9%	-2%	10%	10%	-35%	28%	33%
Microbiologist	-63%	-55%	12%	0%	-100%	-15%	-58%	25%	0%	16%
Multi-Media Artists and Animators	-16%	-24%	73%	-47%	-7%	20%	-48%	0%	-9%	-24%
Network Systems and Data Communications Analysts	37%	75%	22%	66%	229%	51%	31%	44%	77%	2%
Radiologic technologists	-9%	15%	-8%	33%	-21%	-8%	-4%	17%	13%	27%
Registered Nurses	8%	20%	10%	-13%	14%	-2%	16%	2%	17%	5%
Surgeons	163%	45%	85%	112%	0%	95%	-1%	0%	-14%	-39%
Technical Writers	-14%	-7%	-14%	14%	20%	-21%	-26%	-7%	6%	-46%
Telecommunications Engineers	-40%	76%	82%	40%	36%	64%	-24%	25%	-51%	-36%
Video and Film Editors (i.e. Desktop Publishers)	2%	0%	18%	-19%	-52%	-32%	-9%	14%	29%	-46%
Zoologists and Wildlife Biologists	12%	-27%	0%	78%	-37%	387%	69%	133%	18%	89%

3.4.4 Workforce Demand Projections Analysis

Expected occupational growth rates between 2004 and 2014 generated from BLS data are given for Texas in the first column of Figure 11. This data is a baseline projection that does not consider additional demand resulting from initiatives to improve competitiveness.

The BLS data projects high growth in Texas (10 percent higher than the average) for several occupations important to the Biotechnology and Life Sciences cluster (biomedical engineers, environmental scientists, nurses, medical and radiological technicians), the Computer and Information Technology cluster (desktop publishers) and the Aerospace and Defense cluster (avionics technicians, pilots). In contrast, BLS data indicates that Texas will have below average occupational growth for the following important occupations: computer software engineers, biochemists, medical assistants, and aircraft assemblers. Compared only to the three large competitors (i.e., FL, VA, and CA), slower growth is projected for Texas in the following occupations and clusters:

- COMPUTER AND INFORMATION TECHNOLOGY: database administrators and network systems analysts, electrical engineering technicians;
- BIOTECHNOLOGY AND LIFE SCIENCES: environmental engineering technicians, medical lab technicians; and
- ADVANCED TECHNOLOGIES AND MANUFACTURING: electro-mechanical technicians.

Figure 11 shows a number of different averages. The TX column is simply the BLS projection for Texas. The NonTX Avg is the average of the projections for Texas's competitors. The TX vs. AVG column compares Texas's projection to the average by subtracting the TX column from the NonTX Avg column. The Avg of CAFLVA is the average of the projections for the "big three" competitors of California, Florida, and Virginia. This average serves as a benchmark of large, growing states that are more similar to Texas than smaller competitor states. The TX vs. Avg CAFLVA shows the difference between Texas's projection and the average projection of these three states. Orange shaded data indicates that Texas's growth is projected at less than the competition. Green shaded data shows those occupations that Texas is projected at least 10 percent higher growth than the competition.

There are a number of ways to interpret the workforce projections data. The Florida, Virginia, and California averages represent a benchmark of Texas's largest competitors. This notional benchmark shows that the top competitor regions expect more growth than Texas in the cluster sub-sectors such as systems integration, medical/hospital equipment and devices, biotechnology development, healthcare providers, airlines and airline fleet maintenance, and digital media creation. There are occupations where slower growth is projected for Texas relative to all competitors. These occupations indicate that Texas faces unexpectedly slower growth in the sub-sectors of enterprise systems maintenance and support, software development, medical contract labs and computer hardware production. The most worrisome projections are those where projections for Texas are below average. These projections should cause policy makers to ask why other states on average are expecting higher growth in certain sectors and whether it matters to Texas' economic plans. In contrast, the best projections are those where Texas is above the Florida, Virginia, and California average, and policy makers should consider if these high growth jobs match well to Texas' economic plans.

FIGURE 11: COMPARISON OF 2004-2014 OCCUPATION GROWTH RATES

Job	2004-2014 Occupation Estimates				
	TX	NonTx Avg	TX vs AVG	Avg of CAFLVA	TX vs Avg CAFLVA
Computer and Information scientists research	24.4%	24%	0%	23%	1%
Computet software engineers	40.7%	43%	-3%	50%	-10%
Computer systems analyst	37.0%	27%	10%	35%	2%
Database Administrators	40.9%	38%	3%	46%	-5%
Network Systems and Data Communications Analysts	49.2%	48%	2%	56%	-7%
Biomedical Engineers	44.2%	31%	13%	30%	14%
Civil Engineers	22.9%	17%	5%	23%	0%
Telecommunications Engineers	22.6%	14%	9%	21%	2%
Environmental Engineers	35.6%	31%	4%	36%	0%
Industrial Engineer	23.5%	20%	3%	21%	3%
Mechanical enginneers	21.5%	18%	3%	20%	2%
Environmental Engineering Technicians	30.2%	26%	4%	32%	-2%
Biochemists	21.9%	29%	-7%	28%	-6%
Microbiologist	26.1%	21%	5%	19%	7%
Zoologists and Wildlife Biologists	21.0%	16%	5%	17%	4%
Medical Scientists	21.4%	38%	-16%	39%	-18%
Environmental Scientists and Specialists, Including Health	38.9%	18%	21%	19%	20%
Agricultural and Food Science Technicians	20.6%	14%	7%	12%	9%
Biological technician	22.8%	20%	3%	22%	1%
Multi-Media Artists and Animators	21.4%	15%	7%	14%	8%
Graphic Designer	20.3%	14%	6%	17%	3%
Technical Writers	17.0%	24%	-7%	26%	-9%
Surgeons	17.2%	20%	-3%	22%	-5%
Registered Nurses	21.4%	27%	-6%	29%	-8%
Medical technologists	35.7%	21%	15%	23%	13%
Medical lab technicians	24.0%	24%	0%	27%	-3%
Radiologic technologists	39.0%	24%	15%	26%	13%
Licensed Practical and Licensed Vocational Nurses	29.9%	18%	12%	24%	6%
Medical Records and Health Information Technicians	34.3%	25%	9%	29%	5%
Medical Assistants	35.6%	42%	-7%	48%	-12%
Medical Equipment Preparers	24.7%	20%	4%	22%	3%
Video and Film Editors (i.e. Desktop Publishers)	38.0%	20%	18%	24%	14%
Electrical engineers	19.6%	15%	5%	18%	2%
Mechanical Drafters	18.1%	10%	8%	13%	5%
Aerospace engineering and operations technicians	17.5%	13%	5%	15%	3%
Electrical engineering technicians	15.2%	14%	2%	20%	-4%
Electro-Mechanical Technicians	16.4%	15%	1%	17%	0%
Avionics Technicians	23.2%	10%	14%	5%	18%
Aircraft Mechanics and Service Technicians	26.1%	17%	9%	13%	13%
Aircraft structure, surfaces, and systems assemblers	17.7%	19%	-2%	5%	13%
Airline Pilots, Copilots, and Flight Engineers	30.0%	18%	12%	16%	14%

Projected Texas growth rates

Green: TX projected 10% higher growth than average growth rate of competitor states

Orange: TX projected lower growth than average growth rate of competitor

TX compared to average of three large states: California, Florida, and Virginia

3.4.5 Workforce Demand and Supply Balance Analysis

The supply of entry level workforce to meet the needs for the occupations analyzed was determined by using the 2006 Texas university system graduation data and the National Science Foundation's CASPAR database of degrees. For each state, CASPAR lists the number of undergraduate and graduate students by degree area (e.g., physics and mechanical engineering). To evaluate this data, each of the analyzed occupations was mapped to a degree or certification that best represented the preparation required for the occupation.

The needs and supply balance is a first assessment of where Texas needs to take proactive steps to ensure the output of the workforce development system meets the needs of the four clusters examined in this report. The table in Figure 11 displays the ratio of degree supply to occupational needs in high demand occupations. The shaded ratios indicate areas where Texas may be underperforming by not having enough degree candidates to fill occupational needs. Red indicates a deficit in terms of absolute degree supply to estimated occupation demand. Yellow indicates a ratio that is lower than Texas' three largest competitors' (i.e., California, Florida, and Virginia) supply: demand ratios. Red represents the most serious gap, as this is based on an actual, absolute deficit. However, the yellow represents gaps where Texas is not positioned as strongly as its three largest competitors to support certain occupations.

The ratios show a talent supply gap in the fields of aerospace, mechanical and industrial engineering. This implies a shortage in supplying employees for the Aerospace and Defense and Advanced Technology and Manufacturing clusters. These clusters contain the sub-sectors of Robotics, Nanotechnology Advanced Materials, Automotive Component Manufacturing, Aerospace Research, Aerospace Manufacturing, and Aircraft Maintenance.

The supply of aerospace engineers, managers, and employees is a noted, nationwide problem. According to the congressionally funded Interagency Aerospace Revitalization Task Force (IARTF), the aerospace workforce average age is 45 and approximately 26 percent of aerospace workers are eligible to retire in 2008.[5] Not surprisingly, the supply-demand ratios for aerospace are very low for Texas and California, the two states containing large shares of the aerospace industry.

Like most states, Texas may need more production and manufacturing oriented talent than it is currently generating. The evidence for this is the supply: demand deficit in mechanical and industrial engineers. In addition, Texas is underperforming in this area compared to Florida, Virginia, and California. The cause of this may be students' perception that advanced manufacturing companies are shifting overseas, and, in response, students are majoring in different engineering fields.

Besides the pure engineering supply gaps, the ratios indicate that Texas will experience a shortage in medical providers and potential shortages in medical administration and technology occupations. BLS estimates a need for 12,000 registered or licensed vocational nurses per year in Texas through 2014. This demand is probably the result of two factors. First, there will be a nationwide aging of the population as Baby Boomers retire and statistics indicate strong growth in the elderly proportion of the population. The population proportion older than 45 years of age is expected to increase from 27.2 percent in 1990 to 38.2 percent in 2030. Texas is likely to attract a high rate of these retirees because of its zero percent state income tax-rate, moderate real estate prices and large military base presence. Retiring military

5 IARTF Report, February 2008.

personnel from often choose to remain in the area where they retire from the military. Besides nurses to administer care to this growing demographic, medical administrators and managers are important to efficiently and effectively run hospitals and doctors' offices. These occupations are particularly important in lieu of increasing public pressure on both Federal programs and private insurers to contain medical costs.

FIGURE 12: WORKFORCE SUPPLY TO DEMAND RATIO

Occupations Groups	Supporting Degrees	Supply: Demand TX	Supply: Demand CA	Supply: Demand FL	Supply: Demand VA	Supply: Demand Avg CAFLVA
Computer and Information scientists research, Computer, software engineers, Computer systems analyst , Database Administrators, Network Systems and Data Communications Analysts, Electrical Engineers, Electrical Engineering Technician	Electrical Engineering, Physics, Mathematics and Statistics, Computer Science	1.86	1.73	1.69	1.04	1.49
Biomedical Engineer, Microbiologist, Biochemist, Medical Scientists, Biological Technician, Medical Technologists, Medical Lab Technician, Radiologic Technologists	Chemical Engineering, Chemistry, Biological Sciences, Other Life Sciences, Science Technologies	8.03	9.21	9.72	18.01	12.31
Mechanical Engineers, Mechanical Drafters, Aerospace Engineer Technicians, Industrial Engineer, Avionics Technicians, Aircraft Mechanics, Airline Pilots, Aircraft Assemblers, Electro-Mechanical Technicians	Aerospace Engineering, Mechanical Engineering, Industrial Engineering	0.60	0.80	1.10	3.28	1.73
Environmental Engineers, Environmental Engineering Technicians, Environmental Scientists, Zoologists, Agricultural Food Science Technicians	Earth Sciences, Agricultural Sciences	5.09	3.58	1.79	3.58	2.98
Technical Writers, Multi Media Artists and Animators, Graphic Deisgner, Video and Film Editors, Telecommunications Engineers	Engineering Technologies	4.18	0.96	2.65	4.70	2.77
Civil Engineers	Civil Engineering, Architecture and Environmental Design	3.51	3.26	2.40	4.73	3.46
Licensed Nurses, Registered Nurses	Medical Sciences, Health Technologies	0.71	0.90	0.89	2.01	1.26
Medical Assistants, Medical Equipment Preparers, Medical Records and Health Information Technicians	Health Technologies	2.70	3.43	3.41	8.15	5.00

3.4.6 Workforce Conclusion

Economics drive the challenges facing Texas' ability to meet industry demand for qualified workers. The 2001 recession drove potential students away from the telecommunications, Internet, and information technology sectors. Texas college students responded to this recession by pursuing alternative career fields. As a result, Texas universities are producing adequate supplies of graduates in the life sciences, natural science, and civil/architectural engineering fields. However, there are shortages in other engineering fields. This talent supply positions Texas to compete in the biotechnology and energy sectors, and enables Texas to modernize its infrastructure. The data indicates that gaps exist in the following key knowledge areas: aerospace engineers, mechanical engineers, industrial engineers, medical providers and medical administration. Texas should conduct further analysis of these gaps to determine their exact level and consider the solutions proposed in this report to close them. The university and workforce systems may need to provide incentives to students and higher education institutions to increase supply of these specific workforce skills. In addition, the workforce system may facilitate the marketing of positions and career potential in the undersupplied industries. Besides government actions, the pertinent industries may need to improve their recruiting processes and pay to attract students to these fields.

3.5 Cluster Mapping Project

Two commonly used measures of the competitiveness of a cluster in a given location are: (1) the total employment in the location in companies that have North American Industry Classifications (NAIC) that are included in the cluster; and (2) past growth in that employment as a share of national employment in the cluster. It is presumed that a relatively high concentration of cluster employment in a given location is indicative of competitiveness in the cluster since the area has both created employment in the cluster in the past and because companies typically look at cluster presence in making new location decisions. This type of analysis was performed by the Harvard Institute for Strategy and Competitiveness Cluster Mapping Project.

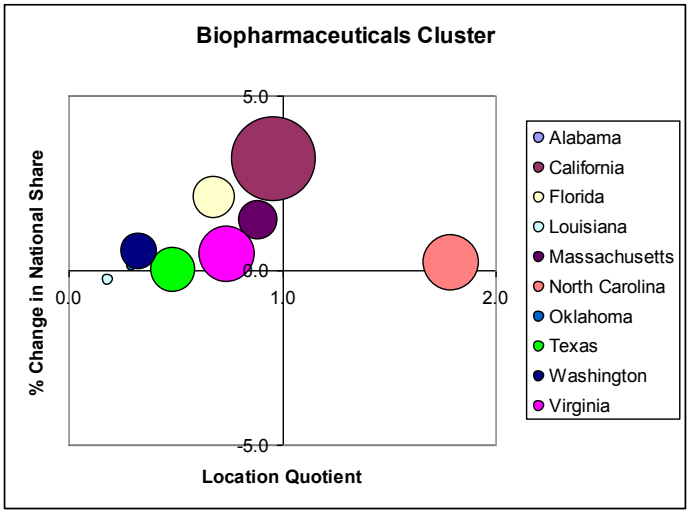
Utilizing data collected by the Cluster Mapping Project over a span of 14 years, cluster presence in Texas, and nine other states is presented in Figures 14 through 16. In addition to Texas, the states selected for analysis were selected because they represent likely competitors to Texas based on discussions with Texas economic development officials. It is important to note that Cluster Mapping Project data did not directly correspond to all clusters and sub-sectors being analyzed in this report. An alignment of the Cluster Mapping Project clusters and the Texas Industry Clusters is provided in Figure 13.

Figure 13: Cluster Mapping Project Alignment to Texas Industry Clusters

Cluster Mapping Project Clusters	Corresponding Texas Industry Cluster
Biopharmaceuticals	Biotechnology and life sciences
Information technology	Computer and information technology
Automotive	Advanced technologies and manufacturing
Aerospace vehicle	Aerospace and defense

Specifically, Figures 14 through 16 compare Texas and each additional state selected against three factors: (1) location quotient, (2) growth of the state cluster national share, and (3) cluster employment within the state. The location quotient is the state's position along the x-axis and the growth is shown along the y-axis. Employment is reflected by the size of the circle. The location quotient is calculated by taking the state proportion of employment within the cluster, divided by the national proportion for employment in the cluster. A location quotient greater than one means the relative state employment in the cluster is greater than the relative national employment. Growth on the vertical scale is a measure over time (14 years) of the change in the percentage of the cluster size in the state as a percentage of the total U.S. size of the cluster. Thus, in a single snapshot, these figures illustrate the absolute size of the specialized Cluster Mapping Project clusters as well as their relative size and change in national share over the study period. For visual clarity, Texas is represented by the green circle in each of the charts. Tables are provided to illustrate the data displayed in each chart. States best positioned in each cluster will be represented by larger circles in the upper right quadrant.

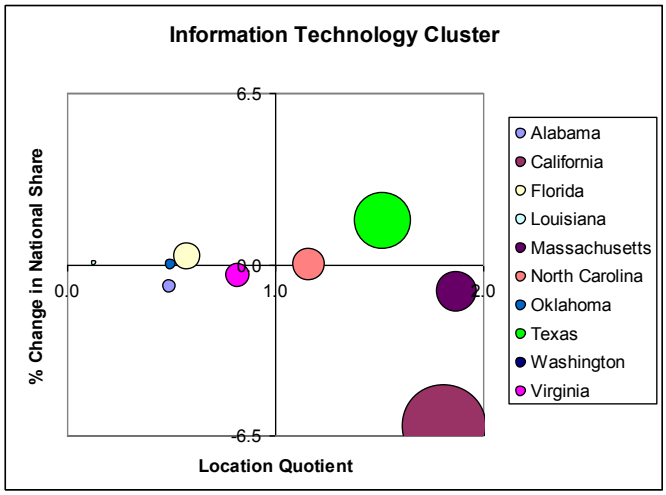
FIGURE 14: BIOPHARMACEUTICALS SUB-SECTOR OF THE BIOTECHNOLOGY AND LIFE SCIENCES CLUSTER



Biopharmaceuticals	Location Quotient	Change in National Share	Employment
Alabama	0.3	0.3	1163
California	1.0	3.2	34499
Florida	0.7	2.1	8933
Louisiana	0.2	-0.3	688
Massachusetts	0.9	1.4	7488
North Carolina	1.8	0.2	15535
Oklahoma	0.3	0.1	783
Texas	0.5	0.0	9421
Virginia	0.7	0.4	15648
Washington	0.3	0.5	6363

Texas maintains a comparatively small size in the biopharmaceuticals cluster and shows no change in its national share. As discussed later in this report, Texas has yet to capitalize on its significant advantages in this cluster.

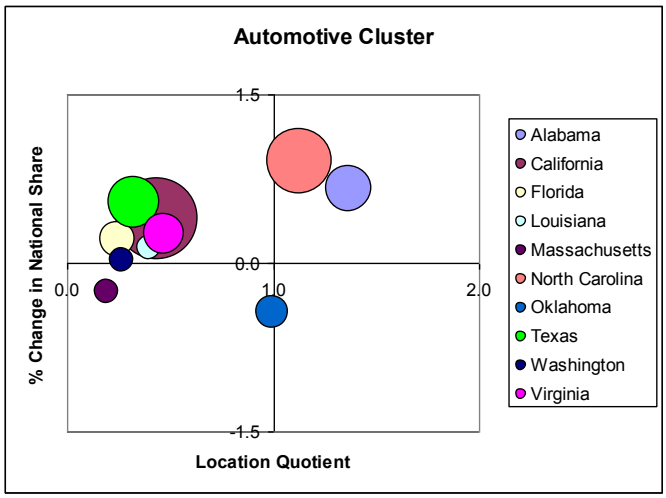
FIGURE 15: INFORMATION TECHNOLOGY CLUSTER



Information Technology	Location Quotient	Change in National Share	Employment
Alabama	0.5	-0.8	4484
California	1.8	-6.2	155323
Florida	0.6	0.3	18048
Louisiana	0.1	0.1	1136
Massachusetts	1.9	-1.0	37650
North Carolina	1.2	0.0	24043
Oklahoma	0.5	0.0	3145
Texas	1.5	1.6	69466
Virginia	0.8	-0.4	15648
Washington	3.4	5.3	6363

Of all four clusters, Texas shows the best position in the Information Technology cluster. California, shown in the lower right hand corner on the graph above, has a greater total employment in this sector; however, it saw a significant decline in its national share in contrast to Texas which had a net gain.

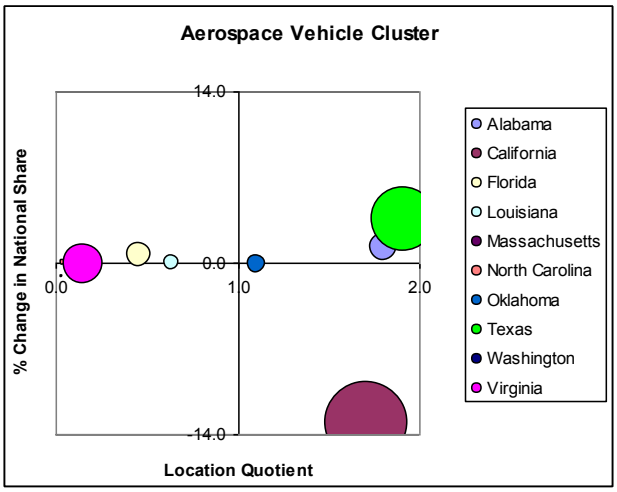
FIGURE 16: AUTOMOTIVE SUB-SECTOR OF THE ADVANCED TECHNOLOGIES AND MANUFACTURING CLUSTER



Automotive	Location Quotient	Change in National Share	Employment
Alabama	1.4	0.7	21730
California	0.4	0.4	65337
Florida	0.2	0.2	13326
Louisiana	0.4	0.1	6099
Massachusetts	0.2	-0.3	6801
North Carolina	1.1	0.9	40636
Oklahoma	1.0	-0.4	10982
Texas	0.3	0.5	25933
Virginia	0.5	0.3	15648
Washington	0.3	0.0	6363

Within the automotive cluster, Texas maintains a more middle-of-the-road position among the top U.S. states. Ranking as the third largest employer behind California and North Carolina, Texas has shown modest gain in the national share of this cluster.

FIGURE 17: AEROSPACE VEHICLE SUB-SECTOR OF THE AEROSPACE AND DEFENSE CLUSTER



Aerospace Vehicles and Defense	Location Quotient	Change in National Share	Employment
Alabama	1.8	1.3	7485.0
California	1.7	-13.1	67067.0
Florida	0.5	0.6	6551.0
Louisiana	0.6	0.0	2560.0
Massachusetts	0.0	-1.1	281.0
North Carolina	0.0	0.0	385.0
Oklahoma	1.1	-0.1	3197.0
Texas	1.9	3.6	40045.0
Virginia	0.2	-0.1	15648.0
Washington	7.3	-1.2	6363.0

As shown in Figure 16 above, Texas has a strong presence in the aerospace vehicle cluster. Texas holds a large share of the total employment and positive growth over the 14 year study period. Though second in total employment behind California, Texas continues to expand while California has experienced a significant decline in its national share within the cluster.

The Cluster Mapping Project is useful in identifying the current and past performance of the states in these clusters.

3.6 Competitive Positioning Method

In a globally integrated economy, a particular location will only be competitive for certain business components or sub-sectors within a cluster. Thus, in order to assess Texas' competitiveness, three different sub-sectors in each cluster were selected as case studies or proxies to be representative of Texas's ability to compete for various types of sub-sectors within that cluster. The three sub-sectors selected for each cluster where chosen based on market trend analysis, discussion with Texas industry representatives in each cluster and input from the Secretary of State and OOG regarding the types of companies currently considering investing in Texas. The 12 sub-sectors selected for benchmarking were:

- Biotechnology and Life Sciences Cluster
  - Biopharmaceutical Manufacturing
  - Medical Device Manufacturing
  - Nano Health
- Computer and Information Technology Cluster
  - Wireless Technology
  - Digital Media
  - Super Computing
- Advanced Technology and Manufacturing Cluster
  - Robotics
  - Nanotechnology Advanced Materials
  - Automotive Component Manufacturing
- Aerospace and Defense Cluster
  - Aerospace Research
  - Aerospace Manufacturing
  - Aircraft Maintenance

There are many types of competitive positioning analysis that can be performed to assess cluster strength. The analysis performed and relied on in this report is similar to the competitive positioning analysis that would be used to advise a corporate client trying to determine where to expand or relocate its business or a component of its business. This site selector approach has an advantage because it provides an invaluable external view of Texas' competitive position based on the external data available to site selectors and economic development consultants around the world who are making critical decisions about where to expand or relocate among many competing domestic and international locations.

In conducting the analysis for each sub-sector selected, a project profile was developed identifying the various drivers for that sub-sector to be successful. For instance, a sub-sector may value being located near its customers, raw materials or a particular kind of skilled labor. However, some of these drivers are more important to sub-sector success than others; therefore, a detailed weighted scorecard was developed assigning a relative rank to each of these drivers. In determining the appropriate weight for each driver, a variety of Texas stakeholders were consulted. An example of a typical weighted scorecard is provided in Figure 18.

FIGURE 18: WEIGHTED SCORECARD FOR THE DIGITAL MEDIA SUB-SECTOR

Location category	weight
1. General business environment	**5**
2. Local potential to recruit skilled staff	**20**
3. Presence of industry / cluster	**20**
4. Flexibility of labor & regulations	**5**
5. Infrastructure	**10**
6. Real estate	**10**
7. Living environment	**30**
	100

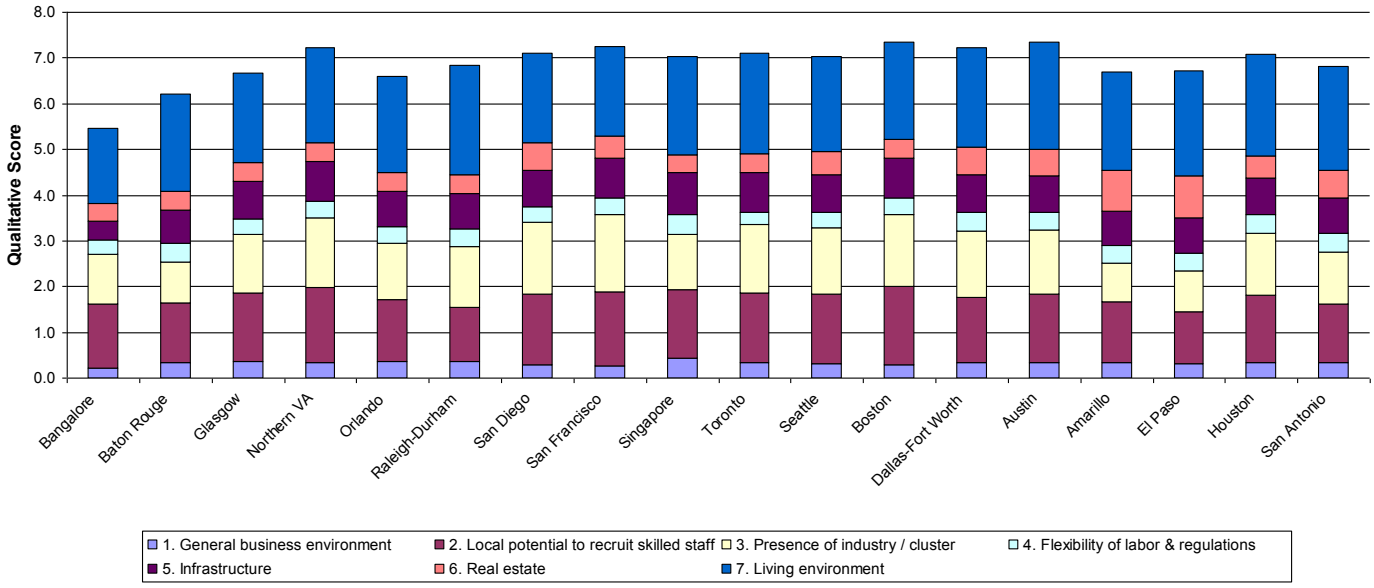
Location factors	weight	overall weight
1. General business environment		
1.1. Economic and financial stability	15	0.8%
1.2. General tax environment	10	0.5%
1.3. Quality of support from local government & development agencies	25	1.3%
1.4. Business permitting procedures	25	1.3%
1.5. Availability of financial support for setting up	25	1.3%
1.6. Risk of natural disaster	0	0.0%
	100	*5.0%*
Total weighted score		
Total category score		
2. Local potential to recruit skilled staff		
2.1. Overall size of labor market	5	1.0%
2.2. Presence of experienced scientific workers	40	8.0%
2.3. Presence of experienced industry-specific employees	40	8.0%
2.4. Presence of non-experienced staff (student population)	10	2.0%
2.5. Overall tightness in labor market (unemployment)	5	1.0%
	100	*20.0%*
Total weighted score		
Total category score		
3. Presence of industry / cluster		
3.1 Market proximity (access to customers)	20	4.0%
3.2. Proximity to raw materials	0	0.0%
3.3. Presence of industry base	40	8.0%
3.4. Importance of university / R&D	30	6.0%
3.5. Proximity to finance/regulators	10	2.0%
	100	*20.0%*
Total weighted score		
Total category score		
4. Flexibility of labor & regulations		
4.1. Working time regulations	25	1.3%
4.2. Hiring & firing flexibility	25	1.3%
4.3. Industrial relations / attitude of unions	50	2.5%
	100	*5.0%*
Total weighted score		
Total category score		
5. Infrastructure		
5.1. Air access	5	0.5%
5.2. Highway network & congestion	5	0.5%
5.3. Availability of public transport	25	2.5%
5.4. Waterways and seaports	0	0.0%
5.5. Quality & reliability of telecommunications	55	5.5%
5.6. Reliability of power supply	10	1.0%
	100	*10.0%*
Total weighted score		
Total category score		
6. Real estate		
6.1. Availability of large industrial sites	0	0.0%
6.2. Availability of office space	100	10.0%
	100	*10.0%*
Total weighted score		
Total category score		
7. Living environment		
7.1. Cost of living	30	9.0%
7.2. Attractiveness for recruits	20	6.0%
7.3. Safety	25	7.5%
7.4. Quality of schools	25	7.5%
	100	*30.0%*
Total weighted score		
Total category score		
		100.0%

Once the weighted scorecard was complete, competitive qualitative and quantitative positioning analysis was conducted by taking a sample of eight Texas metropolitan statistical areas (MSA) and comparing their weighted scorecards to the scorecards of ten domestic and eight international competitors to see which locations would be the most desirable for sub-sectors to locate. The domestic and international locations selected for comparison to Texas MSAs for each sub-sector were chosen by considering GILD data on recent investment flows and Texas' experience in competing for real projects.

The qualitative ranking was prepared for each sub-sector by considering and scoring all of the factors given in its weighted scorecard. An example of the qualitative ranking for the Digital Media sub-sector is provided in Figure 19. This figure indicates the relative contribution of each of the main categories comprising the qualitative ranking. These categories are:

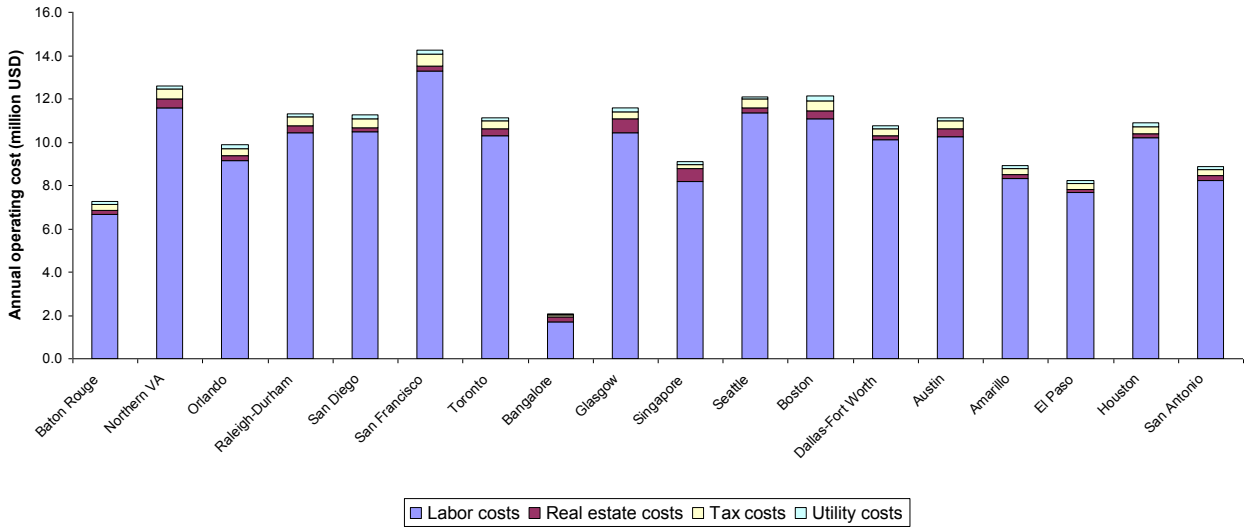
- General business environment;
- Local potential to recruit skilled staff;
- Presence of industry / cluster in the region;
- Flexibility of labor and regulations;
- Quality of infrastructure;
- Availability of real estate;
- General living environment;

FIGURE 19: QUALITATIVE RANKING FOR THE DIGITAL MEDIA SUB-SECTOR



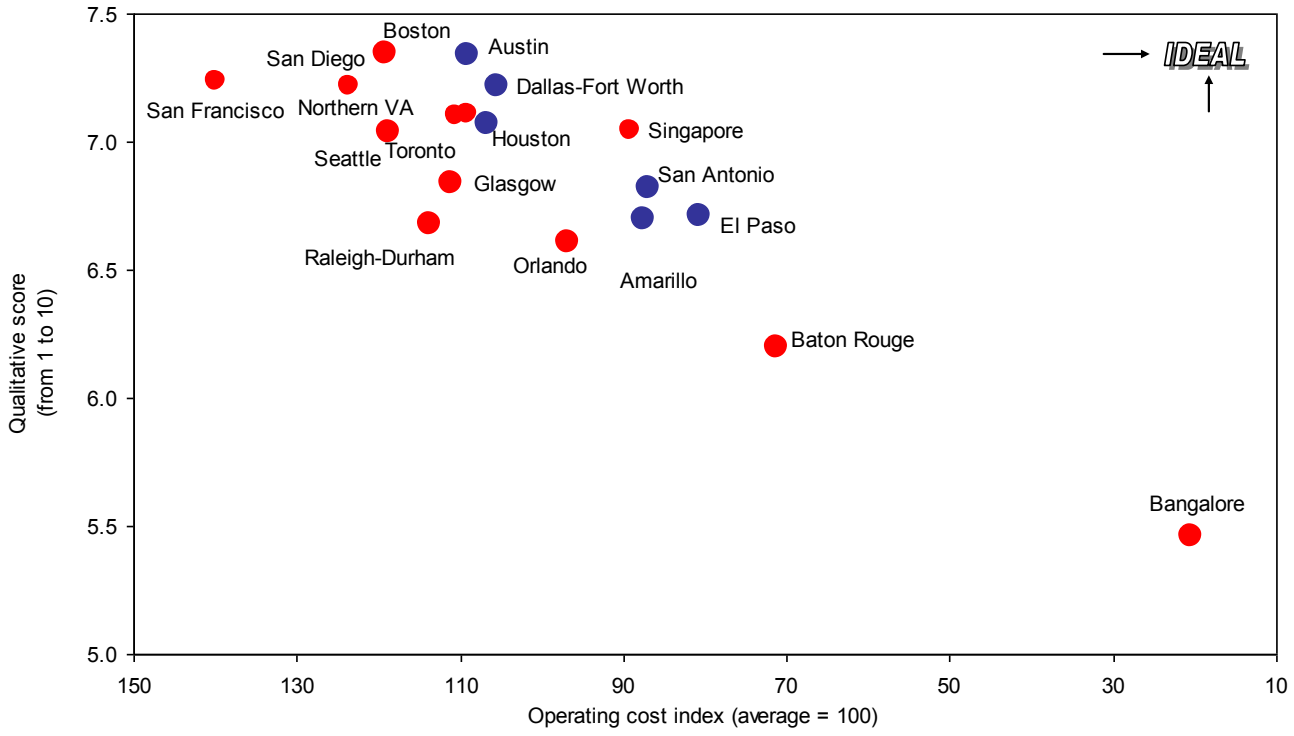
The quantitative cost ranking was prepared for each sub-sector based on the sub-sector's major location-sensitive operating costs. The cost drivers included in this analysis are labor, real estate, utilities, and taxes. An example of the quantitative ranking for the Digital Media sub-sector is provided in Figure 20.

FIGURE 20: COST COMPARISON FOR THE DIGITAL MEDIA SUB-SECTOR

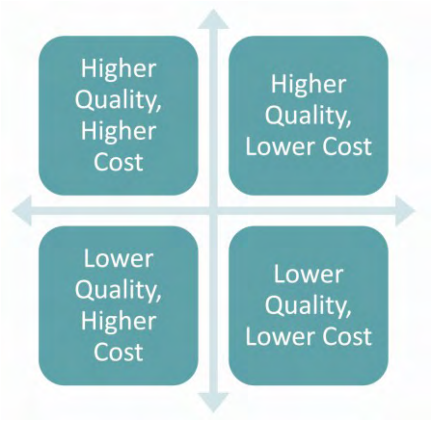


The qualitative and quantitative results were then combined in a Cost-Quality Map for each sub-sector showing the trade-off between costs and quality factors. An example of a Cost-Quality Map for the Digital Media Sub-sector is provided in Figure 21.

FIGURE 21: COST-QUALITY MAP OF THE DIGITAL MEDIA SUB-SECTOR



In reading the Cost-Quality map, it is important to consider that companies may be looking at a variety of factors in determining where to locate. In fact, different "sweet spots" exist that serve different needs. Some companies may not consider cost a factor and may look for only the highest quality. Companies with these search criteria would choose a location in the upper left quadrant. Others companies are primarily concerned with cost and are willing to trade off on quality and thus may choose a location in the lower right hand quadrant.



These Cost-Quality maps for each sub-sector were presented to stakeholders across Texas to view Texas' competitive position in the target sub-sectors based on the data available to site selectors and economic development consultants around the world. These rankings served as a jumping off point when assessing the relative strengths and weaknesses of Texas and identifying gaps and recommendations for improvement. Section 3.7 provides a summary of the competitive advantage of Texas among the target clusters and sub-sectors based on the analysis performed during the positioning phase.

3.7 Texas' Competitive Position

3.7.1 Biotechnology and Life Sciences Cluster

Key occupations for this cluster include microbiologists, biomedical engineers, zoologists, and biochemists. A complete list of the occupations supporting this cluster is outlined in Figure 9 in section 3.4.

Companies in this cluster face three major challenges:

1) Creating solutions based on complex biological processes instead of chemicals;
2) Improving efficiency at technology transfer and product innovation; and
3) Improving compliance with updated FDA regulations for production quality.

In response to these challenges, companies in this cluster are shifting components of their business to developing nations. The companies tend to shift three particular components: development, clinical trials and data management. Development is labor intensive so savings are gained by locating in low-cost labor countries. Asia and Eastern Europe, due to their medium costs and high-quality educations systems, are receiving clinical trial and data management components. For example Lilly conducts 30 percent of its trials in India and China.

A concomitant trend is the flow of investment to these same regions that receive the business components. The Singapore government channeled more than $700 million U.S. into biotechnology investments, while the Taiwanese government earmarked $1.6 billion U.S. to invest in biotechnology venture capital (VC) firms. VC investment in Indian pharmaceutical research has grown by 25 percent every year since 1999.

Clearly, the Biotechnology and Life Sciences cluster is a popular target of investment funding and government incentives worldwide. As a result, IBM and the OOG have chosen three sub-sectors within this cluster to analyze in light of Texas' strengths and global trends. These three sub-sectors are:

- Biopharmaceutical manufacturing;
- Medical Device Manufacturing; and
- Nano Health.

Texas possesses a number of competitive advantages for this cluster. Houston and Dallas-Fort Worth rank high in airport and highway infrastructure and possess large populations for subject testing. Strong research and development capabilities and commercialization potential exist in Austin with the presence of The University of Texas at Austin. However, despite significant strengths, Texas has comparatively few companies currently working in these areas, which may hinder future investment.

Biopharmaceutical Manufacturing Sub-Sector

The biopharmaceutical manufacturing operation profiled in this sub-sector was the manufacturer of large molecule biotechnology medicines developed and sold by pharmaceutical companies. This type of manufacturing requires a high degree of skill and many pharmaceutical companies are reluctant to outsource this work to developing countries. Four factors influence a biopharmaceutical manufacturing company's location decision. These types of companies require the presence of pharmaceutical manufacturing labor and life science engineers. Additionally, these companies prefer easy access to pharmaceutical support services (i.e., nearby pharmaceutical companies and research and development labs). Finally, these plants need a quality transportation infrastructure to distribute finished products.

Dallas-Fort Worth and Houston offer good quality offerings at average costs. Besides Singapore, Toronto is another international leader which offers higher quality at a slightly higher cost. A close domestic competitor is Orlando which has similar costs to Dallas-Fort Worth and Houston, but has a lower quality score.

Texas possesses some key advantages for this sector. Texas offers generally lower costs for real estate and utilities. Houston already has a biotechnology manufacturing cluster alongside a world-class group of medical centers and a top engineering university. Austin also offers a strong university and entrepreneurial environment.

However, Texas is also weak in some areas. While there are significant resources around the state, some metropolitan areas lack a world-renowned university and subsequent Federal research and development funds.

Medical Device Manufacturing Sub-Sector

Medical device manufacturers develop, manufacture, and support operations of medical diagnostic equipment and implantable devices. Five factors influence a company's location decision for a medical device manufacturing facility. These companies hire scientists and technologists to design and test diagnostic equipment and these tests require laboratories and doctors' offices. For leading edge research, medical device firms use nearby universities with programs in optics, biotechnology, and clinical chemistry. Innovation also arises from company proximity to a cluster of clinical chemistry reagent manufacturers. Finally, these companies need regular communication and access to Federal Drug Administration regulators as they manage the government approval of their tests and devices.

Texas is well positioned for medical device manufacturing. Dallas-Fort Worth and Houston offer very high-quality at an above average cost, while San Antonio offers above average quality and average cost. Singapore is best positioned on quality and low-cost, while Toronto and Boston offer equal quality at higher costs than Texas cities.

Texas' strengths center on talent, raw materials, and real estate. Texas offers many medical workers, doctors, and medical testing labs. Texas is also located near key raw materials used for plastics and chemical products. Smaller areas such as Amarillo offer low-cost real estate with potential for construction. Despite large hospitals and many important health science programs, smaller cities in Texas such as El Paso and Tyler still have relatively smaller life science industry bases. However, these cities do offer a significant labor cost savings and may still be able to draw on the resources and cluster presence of the larger metropolitan areas.

Nano Health Sub-Sector

Nano health is the home based delivery of personalized medicine through nano technology (e.g., miniature heart rate sensors). The creation and maintenance of this cluster depends on five key drivers. Nano health companies require easy access to researchers and research results at top tier medical research universities as well as hospitals and laboratories. They also need qualified, mostly life-science degreed employees. Proximity to micro-manufacturing and biotechnology clusters helps nano health companies with innovation. Finally, as with most medical related companies, they require easy communication with Federal regulatory agencies.

Texas is very competitive in nano health. Dallas offers above average quality at average costs, while Austin offers average quality and cost. Toronto and Boston are positioned as leaders alongside Singapore. Boston provides the highest quality at highest costs, while Toronto offers slightly higher quality and lower cost than Dallas-Fort Worth.

3.7.2 Information and Computer Technology Cluster

This cluster includes the wireless telecommunications, digital media, and supercomputing sub-sectors. Key occupations of this cluster include software engineers, computer scientists, mathematicians, and telecommunications engineers. A complete list of the occupations supporting this cluster is outlined in Table 9 in section 3.4.

Three separate trends are impacting this cluster:

1) Wireless companies are offering converged data services across multiple technologies due to reliable, higher-bandwidth mobile data services.
2) Digital media firms face customer demand for digital content on any device, anywhere and at anytime.
3) Supercomputing firms are challenged by their customers' ability to offload traditional supercomputer applications to midrange servers and to declines in government sponsored research and development.

Companies in this cluster are responding to these challenges. In the wireless telecommunications industry, the fixed line operators and wireless operators offer dynamic packages such as Internet access and voice. To add to the competition, cable operators are offering Internet and voice services. Digital media companies are combining or partnering to manage the product life-cycle of capturing, organizing, and distributing media content. For example, CBS acquired CNET and its portfolio of websites. Supercomputing companies innovate to offer more flexible systems to their customers who face increasingly complex challenges. Cray Inc., a global leader in supercomputing, exemplifies this by its "adaptive supercomputing" system that offers increasingly user-friendly software to manipulate the supercomputer.

In this highly competitive cluster, Singapore generally scores near or at the top of the intersection of quality and cost. Nevertheless, Houston, Dallas-Fort Worth, and Austin are strong in wireless and supercomputing, while all Texas regions compete well in digital media.

Wireless Technology Sub-Sector

In this sub-sector a software development company that specializes in applications for telecom related business was profiled. These companies specialize in developing content for mobile operators (carriers) and mobile content providers. Three factors influence these companies' location decisions. These firms require a large pool of skilled software developers as well as nearby universities to supply quality computer engineering and science graduates. These firms receive benefits from proximity to two complementary sectors: (1) advanced technology manufacturers, and (2) telecommunications companies. Companies in this sector work with manufacturers to decrease production costs and telecommunications firms provide feedback on product design and customer requirements.

While Texas was a leader in wireless in the late 90's and still remains a strong competitor in the U.S., due to the long term presence of industry leaders in Texas, the wireless technology sub-sector is extremely portable, and areas like Shanghai and Singapore have surpassed Texas in technology and quality at a reduced cost.

Texas does have advantages in this sector. As mentioned previously, the large clusters of software and telecommunication firms that exist in North Texas provide an advantage for Texas. For Austin, the presence of The University of Texas at Austin and a perceived high quality of life support its competitive position. Additionally, Texas' reliable power grid and lower utility costs provide advantages to all Texas regions.

A bulk of the software and telecommunications companies are located in the central corridor of large Texas cities. The western regions may find this distance gap difficult to bridge when attempting to attract companies concerned with cluster presence.

Digital Media Sub-Sector

Digital media companies provide entertainment in the form of downloadable and online games, animation, and social networking sites. Three factors influence a digital media company's location decision. First, they need a large pool of graphic designers and software developers. Second, nearby universities must produce graduates with degrees in animation and graphic design. Third, and especially important to the labor force of these companies, the region must offer a high quality of life in the form of entertainment, culture, and leisure activities.

All Texas cities are highly competitive in the digital media sector. In particular, smaller cities such as San Antonio, Amarillo, and El Paso offer average quality at lower costs than most competitors. San Francisco, Boston, and San Diego are competitive, but offer much higher costs. Internationally, Singapore leads and Toronto rates just beneath Dallas-Fort Worth.

Texas' low cost of living compared to other U.S. cities is a major advantage. World class telecommunications infrastructure supports smaller Texas cities against international low cost cities such as Bangalore. Houston's large base of scientists is a key advantage as well.

However, Texas does have some weaknesses in this sector. The creative industry is seeing rising labor costs in major cities. Additionally, digital media employees, especially those relocating from the East and West coasts of the U.S., Europe, and Asia, tend to favor public transportation, which is limited in all Texas cities.

Supercomputing Sub-Sector

Supercomputing companies conduct research, engineering, and forecasting that require complex mathematical algorithms and large computational capacity. Four key factors influence the decision of these companies to locate operations. First, supercomputing companies require the presence of a supercomputing center. Second, companies require research universities and centers to provide requisite talent. Third, companies benefit from nearness to Life Sciences and Information Technology clusters. Finally, their ability to research new topics depends heavily on Federal research grants combined with private investment.

The Texas "Triangle" cities of Austin, Houston and Dallas-Fort Worth make Texas a strong competitor for supercomputing. San Francisco offers the highest quality; however, they also have very high costs. Meanwhile, Toronto, and Singapore offer similar quality at lower cost than the Texas leaders.

Texas holds strong advantages such as the large presence of supercomputing facilities in Austin. Texas' strength is based on large supercomputing and telecommunications clusters, top quality airports and the large amount of research and development funds at The University of Texas at Austin.

Texas' weakness in this sector is due largely to small amounts of university funding for supercomputing outside of the largest metropolitan areas. Texas earns fewer research and development grants than both California and Massachusetts. These grants are important to this research-heavy sector. Additionally, periphery metropolitan areas in South and West Texas are distant from supercomputing facilities.

3.7.3 Advanced Technologies and Manufacturing Cluster

This cluster includes the robotics, automobile component manufacturing, and nanotechnology manufacturing sub-sectors. Key occupations in this cluster include software engineers, hardware engineers, electrical engineers, and industrial engineers. A complete list of the occupations supporting this cluster is outlined in Figure 9 in Section 3.4.

Three major trends are impacting this cluster:

1) Rising fuel costs and customer demands for luxury vehicles is driving automotive manufactures to incorporate complex software, hardware, and "green" fuel technologies.
2) Revenues from nanotechnology products are expected to reach $1.5 trillion by 2015 as a result of nanotechnology being incorporated into consumer products.
3) Labor shortages in developing nations due to an aging workforce are driving demand for robotics to increase productivity.

Companies are responding to these trends through innovation. Automobile manufacturers now offer vehicles with global positioning systems (GPS) and voice activated system controls as well as electronic, battery powered cars. Robotics companies are developing more non-manufacturing robots such as guide robots, cleaning robots and robots capable of lifting the infirm and elderly. In nanotechnology, companies such as Samsung are building small flash memory products with large data storage and these are used in Apple's iPods.

In this cluster, leadership varies for each sub-sector; Singapore leads in the robotics sector, Monterrey and Shanghai lead in the auto component sector and Shanghai, Singapore and Raleigh-Durham lead the nanotechnology sub-sectors. As for Texas, Dallas-Fort Worth and Austin rank average in all three sub-sectors, while San Antonio is competitive for automobile component manufacturing.

Robotics Sub-Sector

Robotic companies design and develop commercial and industrial robots to navigate through complex and dynamic real-world situations, from maneuvering around furniture to searching abandoned buildings. Five factors determine their location decisions. These companies require highly skilled mathematical and computer science talent, as well as proximity to university industrial engineering programs. Nearness to component suppliers and end users (e.g., first responders, manufacturers) are also beneficial to these companies. These companies prefer easy access to manufacturing technology centers.

Texas is less competitive in robotics than many of their competitors. While, many Texas cities compete well on cost, qualitative scores are low. In comparison to benchmarked cities that compete with Texas for robotics development, Texas has a more limited track record of securing venture capital investment in robotics, and the state overall has a smaller industry presence measured in number of companies partly due to the fact that Texas is not perceived as having a strong robotics workforce in place to support this industry. That said, Texas can continue to compete in robotics, as cities like San Antonio offer an average quality at much lower costs than the cluster leaders. In addition, The University of Texas at Austin gives Austin advantages and Dallas-Fort Worth benefits from a solid industry and customer presence.

Automobile Component Manufacturing Sub-Sector

Activities in this sub-sector are the production and assembly of automotive components. Five factors influence the location of automobile component manufacturers. These companies prefer locations near automobile manufacturers. Automotive research and development clusters support innovation in components and process. Automobile component manufacturers need experienced manufacturing employees and good labor relations. Proximity to plastics and coating companies is also beneficial to these companies.

Singapore, Monterey, and Shanghai are better positioned than Texas in this sector. Toronto provides the highest quality, but its costs are much higher.

However, Texas does have some advantages in this sector. Low-cost Mexico-based suppliers provide advantage to Texas. Other advantages are the state's relatively low labor costs and the existence of large numbers of skilled automotive workers in San Antonio, Houston, and Dallas-Fort Worth. Tyler-Longview provides a combination of low labor costs and suitable industrial sites.

Texas competitiveness is challenged by the relatively insufficient university research and development for automobile technology. In addition, Texas suffers because of its long distances from automobile manufacturers in Michigan and Tennessee. While proximity to Mexico provides supplier advantages, the nearby Mexican labor force also challenges Texas with its lower wages.

Nanotechnology Sub-Sector

Nanotechnology manufacturing is the production of prototypes and small lots of equipment through the use of nanotechnology, optical, biological, or non-metallic circuits. Six factors drive nanotechnology manufacturers' location decisions. These companies require highly skilled electrical engineers and material scientists and need to collaborate with universities that possess nanotechnology and optronics centers. These companies also want access to education and research findings and patents in the areas of nanotechnology, miniaturization, and molecular biology. Proximity to suppliers of circuit boards and semiconductors, as well as proximity to buyers such as government research institutes and defense contractors, are critical to their location decision. Finally, nanotechnology manufacturers prefer to locate near telecommunications equipment, medical device, and biotechnology companies.

Texas needs to improve its position in nanotechnology manufacturing if it wishes to be competitive. Raleigh-Durham is the best positioned U.S. city in this sector. Singapore leads all cities with Shanghai offering quality similar to Raleigh-Durham at much lower cost. Texas faces challenges due to insufficient university programs outside of the Central region and comparatively fewer end market customers located in Texas.

Texas does have some competitive advantages in this sector. First, Texas has available, suitable laboratory facilities. Second, Dallas-Fort Worth, Austin, and Houston have experienced workforces. Finally, this cluster is growing in Dallas-Fort Worth and Austin.

3.7.4 Aerospace and Defense Cluster

The Aerospace and Defense cluster represents a wide range of sub-sectors from research and development, to maintenance services and manufacturing. These sub-sectors primarily represent the aerospace industry, but the basic measures and characteristics are representative of other defense related industries. Key occupations for this cluster include aerospace engineers, physicists, nuclear engineers, and mechanical drafters. A complete list of the occupations supporting this cluster is outlined in Table 9 in Section 3.4.

Three major trends are impacting this cluster:

1) Shared development and production across multiple producers and systems integrators;
2) Globalization of maintenance industry to low-cost labor locations such as India, Latin America and China; and
3) Digital and networked systems demanded by militaries across the globe.

These trends result in increased production locations outside of the U.S. and collaboration amongst competitors. China and Pakistan are in joint-development of a fighter aircraft, while China and India are integral to the European Union's Galileo satellite system. Manufacturers are migrating into the maintenance space by using their engine design knowledge to restore and maintain aircraft. Boeing exemplifies this through its "Gold Care" program that provides maintenance to old B787s. Product complexity is forcing collaborative competition among firms, demonstrated by the Boeing and EADS partnership on radio frequency identification (RFID) standards and the GE and Pratt & Whitney joint development of the Airbus A380 engine.

Texas is well positioned in the Aerospace and Defense cluster, particularly in aircraft maintenance and aerospace manufacturing. Several factors position Texas as a leader in this cluster, including: Texas' ready access to low-cost suppliers via Mexico; the existing industry cluster of airlines and the National Aeronautics and Space Agency (NASA); the healthy amount of defense contracts awarded to state vendors; and the presence of a large talent pool and workforce of skilled manufacturing and industry specific employees.

Aerospace Manufacturing Sub-Sector

Aerospace manufacturing is the assembly and testing of aircraft. There are five factors that drive location decisions in this sub-sector. These companies prefer proximity to aerospace companies to share knowledge and they require special test facilities and lightly utilized and long runways. Nearness to airports and sea ports are also important as they help companies in this sub-sector with logistics.

Texas is ranked as a leader in aerospace manufacturing, while Seattle and Northern Virginia provide similar quality at higher costs. Shanghai provides average quality at a much lower cost than other competitor regions.

Texas has numerous advantages in this sector. Statewide advantages include lower real estate costs and better power reliability. Dallas-Fort Worth has a large aerospace industry presence and many cities offer runway availability.

However, Texas does have some weaknesses in this sector. Texas receives relatively low funding in the form of university research and development and homeland security funds. Texas regions with the lowest manufacturing costs also lack the required number of experienced aerospace manufacturing workers.

Aerospace Research and Development Sub-Sector

The aerospace research and development sub-sector includes companies involved in the discovery and development phases of the industry value chain. This sub-sector focuses on those companies that are perfecting and commercializing new technologies that result in how the sector operates in the future. Companies in this sub-sector are largely dependent on securing Federal research and development contracts, VC and close involvement with the defense industry in developing and bringing to market new technologies.

Six primary factors drive aerospace research and development company location decisions including proximity to a customer base of aerospace manufacturers, nearby engineering schools to provide talent, proximity to aircraft test grounds (e.g., Yuma, Edwards Air Force Base), amount of aviation activity (flights) in area, reliable power and domestic airport access

Texas cities are global leaders in this sector, while Northern Virginia offers slightly higher quality, but at higher costs. Internationally, Paris offers similar quality at extremely high costs, while Shanghai offers average quality at extremely low costs.

Texas has several advantages in this sector including relatively lower real estate and tax costs, a reliable power supply, flexible labor relations and the presence of system integrators.

Texas also faces challenges in this sector. Many smaller cities struggle to attract the skilled labor and the state government provides relatively weak support for this sector. Additionally, despite a strong cluster presence and wealth of resources, Texas is relatively weak, compared to benchmarked cities, in attracting Federal research and development dollars in aerospace.

Aircraft Maintenance Sub-Sector

Aircraft maintenance companies diagnose, adjust, repair, and overhaul aircraft engines and assemblies, such as hydraulic and pneumatic systems. Four factors drive location of these companies including proximity to Federal Aviation Administration (FAA) regulators for a Certified Repair Station, facilities that companies can modify to meet strict FAA requirements and close proximity to an aging aircraft fleet with increasing demand for repair services. Additionally, companies require skilled laborers amendable to training

Multiple Texas cities lead this sector. Orlando and San Diego are close domestic competitors. Globally, Monterrey provides average quality and extremely low costs.

Texas' advantages are numerous. Texas' tax and real estate costs are very low relative to other competitors. Moreover, Texas cities offer average or lower business costs for the aircraft maintenance sector. The presence of complementary organizations, such as Air Force bases and high-quality international airports, increases Texas' quality. Low airspace congestion in Houston and Brownsville-McAllen supports future growth opportunities.

3.7.5 Competitive Positioning Conclusion

The following "heat" map in Figure 22 portrays a simplified version of the competitive position results for the entire state of Texas compared to other global and domestic competitors. In a globally integrated environment, businesses will locate various components of their operations in different locations depending on the balance between qualitative operating conditions and desired cost. The 12 sub-sectors analyzed are classified according to where in a cluster's value chain they most aptly fall. The value chain categories used are:

- DISCOVERY – including research and early stage commercialization;
- DEVELOPMENT – including development through the prototype phase;
- DISTRIBUTION – including advanced manufacturing; and
- SERVICE – including sales, administration, and maintenance.

FIGURE 22: COMPETITIVE HEAT MAP

	Discovery	Development	Distribution	Service
Biotech & Life Sciences	Nanohealth		Bio-pharma Mfg	
			Medical Devices	
Computer and Information Technology	Digital Media	Wireless Technologies		
	Super Computing			
Advanced Materials and Manufacturing		Robotics	Auto Component Mfg	
		Nanotechnology Adv. Mfg		
Aerospace and Defense	Aerospace R&D		Aerospace Mfg	Aircraft Maintenance

Noncompetitive | Competitive | Very competitive | Most competitive

Level of competitiveness

The competitive positioning analyses indicate the Texas target clusters and sub-sectors were appropriately selected. Although competitive in all areas, Texas has relative strengths in the discovery area of the value chain and in distribution (or advanced manufacturing in the case of the profile selected) where a favorable mix of cost and qualitative factors exists for the sub-sectors benchmarked. The sub-sectors that were classified in the development area of the value chain faced more competition.

4.1 INTRODUCTION

The following section identifies gaps Texas must address to improve its competitive position in the four industry clusters. Gaps are discrepancies or shortfalls between the current results and those that are expected or desired. These gaps were identified using two different perspectives: (1) that of a business looking to expand, grow, consolidate, or relocate; and (2) that of an economic developer looking to expand the economy within their region. The gaps are organized around the following set of basic levers of economic development or areas of focus that could impact Texas' competitive position:

- Workforce;
- Research, development and commercialization;
- Venture capital and business start-up support;
- Infrastructure;
- Government services and regulations;
- Cluster management; and
- Marketing and business development.

4.2 WORKFORCE

A skilled and educated workforce is one of the primary drivers of any successful industry. Existing Texas companies and those relocating rely on a constant stream of available human capital and labor markets that can quickly fill their needs. Moreover, companies are looking at the current pool of available workers in a given location and increasingly at the availability of future skills. In the four clusters identified, these needs most often include skilled technical workers and graduates with strong acumen in the science, technology, engineering, and mathematics (STEM) fields. The skills and availability of workforce were analyzed by looking at the following areas:

- quality of K-12 education;
- quality and number of graduates in higher education;
- availability of specific skills; and
- interaction of schools and government with industry leaders in meeting the demands of labor.

Education data metrics are important in assessing an area's competitive position. Affecting both the quality and skill of the available workforce and the quality of life of employees and their children, K-12 education measures were examined both by state and by specific metropolitan areas. While not prescriptive of the specific challenges facing individual communities, the data serves to identify strengths and weaknesses of Texas compared to its competitors.

Low graduation rates. Overall, Texas has a low high school graduation rate. While the Texas Education Agency (TEA) estimates graduation rates of 84 percent in 2003, the Houston Chronicle and the Center for Education at Rice have estimated that the actual rate is closer to 67 percent; certain demographics are even lower[6]. Specifically, Hispanics graduate at a rate below 60 percent[7], and are the fastest growing segment of the population—already ranking as the majority in many regions within the state. Ranking 35th[8] in the country in terms of overall graduation rates, Texas has an opportunity and needs to improve.

STEM education in K-12 varies widely across the state. Currently there are 38 Texas-STEM (T-STEM) Academies operating in the state. These high schools develop innovative methods to improve math and science education. They are supported by seven T-STEM Centers, designed to connect the public school system with higher education and companies within the STEM fields. The Centers also provide professional development to teachers across Texas. These programs, while relatively new, are showing promise. Daily attendance and dual credit enrollment rates in the Academies are higher than traditional high schools, and some schools have waiting lists with more than 250 students.

However, many districts and regions across the state do not see the benefits of these specialized programs. Math and science skills vary widely among teachers and students. Many regions have expressed a need for better communication of the curriculum and successful practices of the T-STEM Academies and Centers throughout the state to allow every child to benefit from these programs.

Lack of college readiness standards. Similar to STEM education, college readiness varies widely across the state. Stakeholders from Texas community colleges and universities indicated that there are high rates of students taking remedial college algebra and other core courses. In fact, some schools reported that the remedial needs of students are so high that many grow discouraged and drop out before completing a full degree program. Uniform college readiness standards are not yet in place across the K-12 system in Texas. The Texas Higher Education Coordinating Board (THECB) has adopted college readiness standards, but they have not been incorporated into the state curriculum used by high school teachers.

The lack of uniform assessments in higher education also contributes to disparities in college readiness. Colleges and universities each have different placement tests given to incoming students that require inconsistent baseline skills in basic subjects, such as college algebra. The lack of uniformity among placement exams results in confusion for teachers and students.

6 Radcliffe, Jennifer. "Confronting the Graduation Crisis in Texas." Houston Chronicle, June 21, 2006, <http://centerforeducation.rice.edu/Research/dc/CRPdropout2006.pdf>

7 Green, Jay P. "High School Graduation Rates in the US," Manhattan Institute, < http://www.manhattan-institute.org/html/cr_baeo.htm>

8 Texas on the Brink; How Texas Ranks among the 50 States; 2007; USMBHC, <http://64.233.169.104/search?q=cache:8yA4T3kai0EJ:www.borderhealth.org/files/res_880.pdf+%2Btexas-on-the-brink&hl=en&ct=clnk&cd=1&gl=us>

Misalignment of community college priorities. Texas has not adequately aligned community college activities with economic development priorities such as increasing critical field graduates and college transfers. While Texas expects community colleges to create much of the educated and employable workforce, the state funds community colleges based upon overall enrollment with limited emphasis on job placement or the number of students completing programs in critical needs areas.

Limited certification programs in community colleges. According to IBM's PLI data, Texas community colleges provide limited certification programs relative to international counterparts. Many comm. unity college students enter the workforce prior to receiving a two-year associate's degree. A comparably insufficient number of certification programs focus on meeting cluster needs. While Texas is having success in creating community college alternative teacher certification programs for public school teachers,[9] they have yet to address certification programs for the priority industry clusters.

Limited state governance over higher education. Texas relies heavily on higher education institutions to create an educated workforce. However, there is limited alignment with targeted cluster needs. Further, neither university research nor the development of new academic programs is directed to cluster priorities. THECB is tasked with new degree program approvals and could emphasize programs and focused research that promotes economic development. However, THECB action is often circumvented by contrary legislative action.

One of the more common examples of how the State's lack of control over higher education institutions adversely affects economic development is the lack of communication between higher education institutions and industry. Many stakeholders expressed disappointment in the cooperation of colleges providing and/or creating training programs to meet specific industry needs. If an institution does not wish to create a program (even at the expense of the state), industry often has no redress in securing or educating a workforce to meet specific needs.

Texas underutilizes its available tools to influence institutions to deliver a more focused workforce to the State.

- The THECB has nearly $80 million[10] in research grant money to award but does not do so based on cluster needs.
- The legislature created a $100 million fund to provide incentives to community colleges and universities. The rules for allocating this funding have not yet been determined, but interviews indicate that the primary factors for delivering incentive funds will likely be graduation rates, especially in critical fields.
- State funding for higher education institutions is tied to enrollment with little weighting or inclusion of success metrics that drive economic development or cluster needs.
- No funds are provided by the legislature directly to the institutions for commercialization of research. Only a portion of monies from the Emerging Technology Fund go to this purpose.

9 Texas Higher Education Coordinating Board; Strategic Plan for Texas Public Community Colleges 2005-2009
10 IBM Meeting Notes with HECB, April 14, 2008.

Lack of collaboration among higher education institutions in standardizing degree and certification programs. Higher education institutions have limited success in standardizing degree and certification programs. Texas would benefit if community colleges and universities shared quality degree programs. Interviews with Texas employers and regional economic development officials indicate that there are pockets of excellence in community colleges that have created curricula to meet the needs of state employers, but successful curricula have not been adopted statewide. As a result, institutions are either incapable of meeting employer needs (due to lack of sufficient certification and degree programs based on the region) or inconsistently provide the same level of preparation among graduates.

Limited funding for adult skills transference education. The state directs a very limited amount of funds to adult basic education. Texas receives a larger pool of federal funds for adult education, but those funds may only be used to support adult literacy programs. Texas needs to improve the cooperation between federally funded adult literacy programs and state funded adult skills transference and training dollars in order to increase the effectiveness of adult education programs.

TEA, THECB and TWC Alignment. Interviews with the TEA, the THECB, and the TWC indicate poor alignment and communication between education and workforce entities, particularly regarding:

- WORKFORCE NEEDS STATISTICS: There is limited sharing of future workforce demand statistics with the TEA and the THECB and limited incorporation of these statistics into their planning.
- CURRICULUM DEVELOPMENT: TEA does not have a process to ensure industry stakeholders, including the THECB and the TWC, have opportunities to provide input during state curriculum development, especially for career and technology courses.
- INDUSTRY PARTICIPATION: When given the opportunity to participate in educational decision making, industry stakeholders often do not provide input.
- ADULT EDUCATION: the TWC and the TEA have not aligned their agendas and funding for adult non-college education. TEA is focused on improving adult literacy while the TWC is focused on skills transference and training.

4.3 RESEARCH, DEVELOPMENT, AND COMMERCIALIZATION

There is a direct linkage between successful commercialization of technology and job creation. Texas start-ups are responsible for the creation of more than 800,000 Texas jobs in the past 20 years.[11] Typically commercialization gaps are driven by a combination of three factors: (1) insufficient levels of research and development funds; (2) insufficient provision of private investment; and (3) a university system that is unsuccessful in creating commercialized start-ups. Texas universities receive a large share of Federal research and development dollars (second only to California) and over $80 million in research and development grants given out by the THECB and other state agencies. Because Texas fares well in comparison to competitors in securing research and development funding, the gaps in commercialization are primarily focused on private investment and the university system. (Private investment is discussed in Section 4.4.)

11 PricewaterhouseCoopers Money Tree Report, 2005.

The Milken Study, which ranks the top 135 U.S. and Canadian institutions for technology transfer and commercialization, found that no Texas university ranks in the top 25 for technology transfer and commercialization. Only The University of Texas at Austin ranks in the top 50. The University of Texas medical centers, Rice and Baylor all fall in the lower half of the top 135. Texas' flagship universities' technology transfer/commercialization rankings lag behind those of smaller public institutions like the University of Utah (14th), North Carolina State (20th), and University of Sherbrooke, Canada (26th). A number of gaps exist in Texas' commercialization efforts.

Limited success in commercializing university research. Texas university systems have limited incentives for commercializing research and development. While other institutions have a tradition of commercialization and focus efforts to cultivate this tradition, Texas has not (on a large scale) provided incentives to universities to commercialize research. Texas universities lag behind other public institutions in crafting incentives, policies and an infrastructure supporting commercialization.

Limited success in commercializing patents. Texas succeeds in creating patents but not in commercializing them. IBM's PLI analysis indicates that Texas is second in the nation in patents created. The University of Texas at Austin ranks 43rd (out of 135) in licensing income – a measure indicating the success in revenues of start-ups resulting from patents.[12]

4.4 Venture Capital and Business Start-Up Support

State economic development is rooted firmly in the health of its VC investments. By analyzing the top 15 states in job and revenue creation by venture-backed companies, the importance of VC is clear. In these states, from 1970 to 2003, venture capitalists (VCs) invested $290 billion. For every $27,000 invested by VCs, a new job is created. Over the course of 33 years, it is estimated that each of the top 15 states had an average of 567,000 jobs created by VC-backed firms. Average state revenues from these firms are $99.8 billion per year.[13]

A strong and focused VC community is key to Texas' continued prosperity in a global economy. A number of gaps which threaten Texas' ability to use VC to promote economic development have been identified.

Too Few VC Firms. Texas lags behind other states in total numbers of in-state VC firms. Texas needs to be on par with or better than its primary competitors for VC dollars. Of the nine states profiled in this report's competitive positioning analysis in Section 3.6, Texas ranked higher than only two states - Oklahoma and Alabama - in the number of VC firms located in the state. Texas falls behind many states with far fewer resources, including Washington, North Carolina, and Massachusetts. By having an under-represented VC community, Texas is also under-performing in jobs created and revenues secured relative to this activity.

12 Milken Institute Technology Transfer and Commercialization Index, 2006.
13 PricewaterhouseCoopers Money Tree Report, 2005.

Texas businesses are losing market share in securing VC funds. In addition to having a fewer number of Texas based VC firms, the trend in VC dollars invested in Texas is decreasing. Between 1970 and 2003, Texas ranked third among the states for cumulative VC investment. Texas-based businesses had a 6 percent market share of all VC dollars invested over this period. Since 2003, Texas has averaged a 5.1 percent market share of VC dollars whereas states like Washington have increased approximately 1.5 percent. When you consider the VC investment in the U.S. between 2003 and 2007 of $122.3 billion dollars, this 1 percent drop in market share over the past four years is extremely significant, accounting for over $1 billion in investment.

Limited incentives to attract VC. Texas has limited incentives to attract VC and Angel investors to invest in Texas businesses. One potential reason for declining VC investment and few firms located in Texas is that other states are offering tax credits to VC firms and Angel investors. According to the National Governor's Association, the typical credit offered by states ranges from 20-30 percent of the amount invested. Texas currently offers no credit.

Long time required for Emerging Technology Fund to review and approve funding. Recent surveys indicate that four of five VCs had closed a deal in less than 60 days. In addition, nearly two-thirds of respondents said the average time to close a VC deal is less than three months. Texas' primary VC funding source, the state funded and run Emerging Technology Fund (ETF), takes an average of 10 to 12 months to evaluate and provide funding to Texas start-ups. While the ETF funds very early stage companies which have unique requirements that may extend the approval time, VC firms, such as Opus, successfully fund similar seed and Series A companies with a turnaround time three to four times shorter than the ETF. Awards made from the ETF require the approval of three trustees – the Governor, Lieutenant Governor, and Speaker of the House of Representatives. Because of the significant lag time, some promising start-ups do not apply for funds through the State of Texas or they seek funding from VC firms in other areas not tied to Texas.

Too many unqualified companies reaching the ETF office for review. Regional Centers of Innovation and Commercialization (RCIC) are responsible for pre-screening start-ups for the ETF. However, they appear to play an inconsistent role in encouraging innovation and use different metrics to determine which applicants are passed along to the ETF.

Unbalanced ETF portfolio. The ETF pays limited attention to the types of businesses it offers funding. Unlike private VC funds that manage the size and balance of their investment portfolios closely, the ETF has limited planning and focus on the industries of the companies in which they invest – beyond the requirement that all are emerging companies and have disruptive technologies. As a result of the limited focus on the types of businesses they fund, more than half of all ETF funding is awarded to businesses in the Life Sciences and Biotechnology clusters. The majority of the targeted clusters are being underrepresented.

ETF reaching capacity. While VC and Angel investor groups typically limit their portfolio to approximately 15 ventures (depending on size), the Texas ETF currently manages more than 100 investments among four staffers. Managing this large portfolio results in a reduced amount of time the fund can offer to existing companies and increased length of time to evaluate new applications. Additionally, this work load limits time available to evaluate and develop conclusions from the companies in which they've invested.

Limited Angel investment network. Texas does not currently have a statewide Angel investment network in place. Angels are typically high-net-worth individuals and "cashed out" entrepreneurs who are interested in mentoring other entrepreneurs and are actively engaged with the ventures they fund, both pre-funding and post-funding. Recently, an increasing number of Angels have joined together to form Angel groups around the United States to pool resources and investment expertise. There are an estimated 200 Angel investor organizations in the U.S. alone. Angel networks have replaced traditional VC firms as leaders in promoting early stage start-up businesses. In fact, Entrepreneur magazine has listed three Angel groups among its top 15 U.S. VC firms. In Texas, existing Angel networks are regionally based in Houston, Dallas, Austin, and San Antonio. Texas should take better advantage of the wealth that resides in the state by promoting networks of individuals to invest in Texas businesses and continue recently initiated efforts to encourage collaboration among existing networks.

4.5 INFRASTRUCTURE

State investment in infrastructure typically consists of large publicly owned or regulated capital-intensive projects. Highways, airports, seaports, utility distribution systems, railways, water and sewer systems, and communications networks are examples of projects that require public investment and regulation to build and maintain. These projects provide the core of the distribution system for any economy.

Traditional infrastructure projects (e.g., roads, ports, and rail) are critical to attracting new business and ensuring transporting goods remains cost efficient for existing businesses. An adequate infrastructure also affects quality of life. Air quality, congestion and access to public transportation all weigh heavily in business' and a talented workforce's desire to stay or relocate to a particular location. In addition, the existence of new technology and communications infrastructure is becoming increasingly important to both business development and site selectors, particularly in the four clusters evaluated. The importance of maintaining and continually updating infrastructure must be an integral piece of Texas' economic development strategy.

Texas has made significant investment in developing its infrastructure over the past 10 years; however, gaps exist in providing Texas businesses with an infrastructure aimed at attracting an educated workforce, impressing site selectors and providing low costs for existing businesses to operate and transport goods.

Large regions are underrepresented in air transportation. The majority of Eastern Texas has limited air transport, both commercial and private. The limited runway space is typically a deterrent to site selectors when considering locating medium to large businesses. Business executives have difficulty getting in and out of these locations and importing and maintaining top talent to operate the business is challenging.

Unbalanced transportation portfolio. Texas has limited emphasis on public transportation compared to competitors. The impact of public transportation on improved air quality, quality of life, and attracting top talent has become increasingly important in recent years and is a growing factor in site selector rankings.

Lack of funding options for infrastructure improvements. The Texas legislature has severely restricted private-public funding models for infrastructure improvements. With rapid inflation in the cost of infrastructure projects and decreasing budgets, the elimination of a large funding source creates a significant gap in Texas' ability to improve and maintain infrastructure. Recent legislation disallowed comprehensive development agreements (CDAs) in Texas after 2009. Texas may proceed with projects that have already begun, but may not embark in negotiations with private entities to begin new public/private infrastructure campaigns. Texas is one of the few states in the U.S. to disallow private investment in public infrastructure programs.

Limited transportation planning authorities. Texas Department of Transportation (TxDOT) has limited authority over non-highway transportation, including ports. While TxDOT has some authority to address rail relocation issues when the project involves the construction of a highway, they have very limited authority to embark on rail relocation projects independent of highways.

Limited funding for transportation improvement projects. The Texas Legislature has not provided TxDOT with a funding allocation source for rail relocation. All Texas metropolitan areas have rail problems which add to congestion and air quality issues. While the legislature has expanded TxDOT's authority to address rail relocation projects, they have not provided the agency with funding sources.

TxDOT will likely have other major funding issues in upcoming years. Federal funding is beset with uncertainties, and state highway fund money continues to be diverted to non-road purposes. Inflationary construction costs and rapid population growth highlight the urgency; more funding for transportation infrastructure is needed.

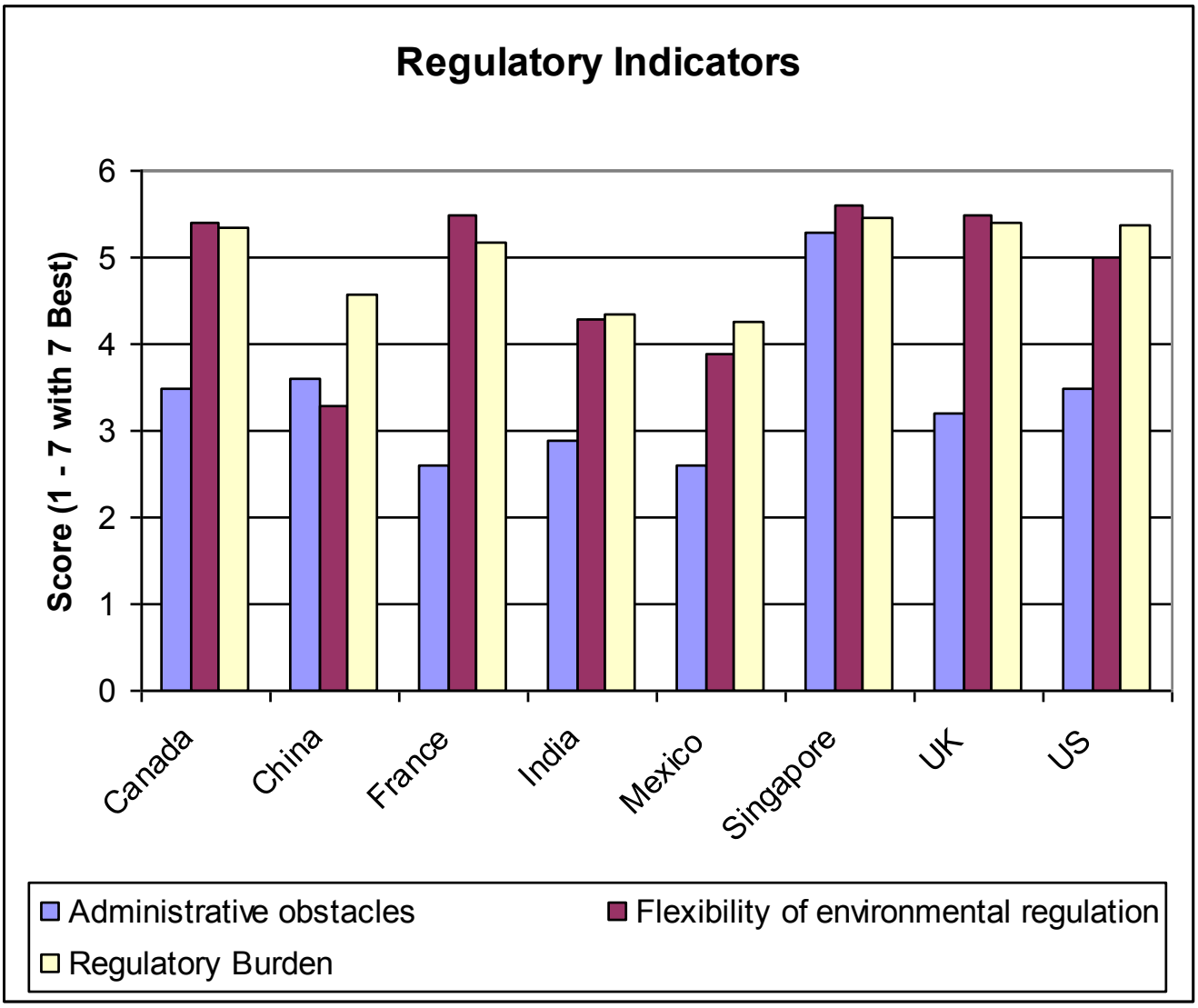
Disjointed inter-modal transport system. Texas benefits from access to a developed port system in the Gulf of Mexico. However, it has a disjointed inter-modal transportation system to deliver items to and from ports like Galveston. This disjointed system limits global trade to inland areas and drives up costs for inland businesses that require access to goods from Texas ports and/or using ports to export and ship goods.

Texas airports facing shrinking budgets. Traditional methods for Texas airports to earn funds from airlines (e.g., landing fees, gate leases) are shrinking as airlines reduce routes, fleet size and as they go out of business. If Texas airports do not address dwindling budgets and investigate alternate sources of income they may be forced to reduce future efforts to expand and improve and/or offer incentives to secure additional airlines and routes.

4.6 GOVERNMENT SERVICES AND REGULATION

The transparency of regulatory requirements and the time and cost required to comply with them have a strong effect on economic competitiveness. The Global Competitiveness Report, published by the World Economic Forum, ranks countries on three criteria: (1) the extent to which administrative requirements are obstacles, (2) flexibility of environmental regulation, and (3) burden of regulation. As shown in Figure 23, the U.S. fares rather well in these rankings with only Singapore showing clear superiority.

FIGURE 23: REGULATORY COMPETITIVENESS INDICATORS



These rankings fail to account for some of the consequences of lax regulation in the developing world that contributes to poor environmental quality or unsafe products. Nevertheless, assuming common standards, the rankings are a measure of the difficulty bureaucracy adds to meeting these standards, particularly for the clusters on which this report focuses which generally have limited environmental impacts.

While the rankings do not distinguish the U.S. by state, this report has identified several gaps for Texas:

Limited online business services. Texas can improve its capacity and shorten the time required to issue state and local permits for new businesses, expansions, and renewals. Stakeholders frequently noted the time required to obtain both state and local permits in Texas. Texas' state competitors have advanced business portals allowing for the registration of new businesses, application for online permits, conducting daily, monthly, and annual operations with the state, researching and sharing ideas and connecting to other businesses across the state from any location with around the clock Internet access.

Inventory tax hindering competition. Texas has an overall healthy tax picture including no state income tax; however, the fact that Texas applies property taxes to inventory while competitors do not is a disadvantage particularly for clusters that have significant inventory (e.g., aerospace).

4.7 Cluster Management

Like most states, Texas experiences many challenges in cluster management. These challenges arise from the need to organize the broad range of people, funds, missions, ideas, and organizations that support and interact with explicit economic development and ancillary programs. While Texas has made strides by implementing the Texas Cluster Initiative, there is room for improvement in ensuring that the many agencies that support the Initiative are aligned with the common goal of focusing their efforts to promote Texas' competitive position in these clusters.

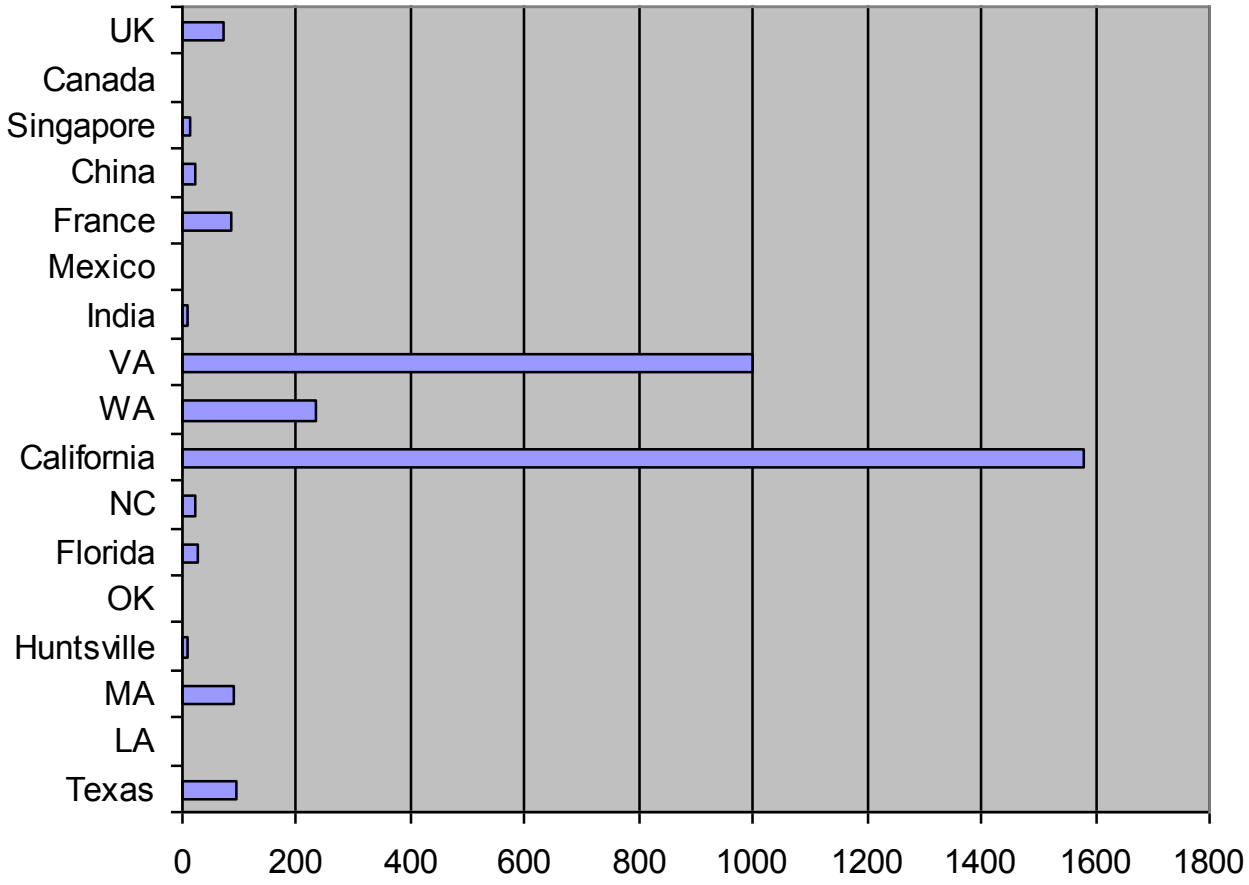
Lack of cluster specific planning for public/private incubation services. Texas does not have an overall plan for public/private incubation services focused by cluster and does not organize incubators by cluster. The success of incubators in California has shown that close proximity of like-minded start-ups often translates to success. Texas has a limited number of incubation services and even fewer that are cluster specific. The lack of focused cluster incubators limits Texas' capacity for success in assisting start-ups to succeed at the next level.

Cluster expertise diluted across many agencies. Specialists in clusters reside in many different Texas agencies. There is no state office that aligns these experts.

Lack of cluster focused research and development and commercialization strategy. Texas does not have a state research and development and commercialization strategy aligned with targeted clusters. Texas' success in patent creation is commendable and sets the groundwork for a successful commercialization strategy; however, when viewed through the lens of the Texas Cluster initiative, Texas is not as successful.

Only California produced more patents than Texas in 2006; however, Texas produced fewer key technology patents (e.g., nanotechnology, artificial intelligence, and computer graphics) than its competitors in Washington, California and Virginia (See Figure 24). Texas needs to secure university involvement in developing a research and development and commercialization strategy aligned with clusters as these will be the patents that will likely be the most successfully commercialized.

FIGURE 24: NUMBER OF PATENTS IN KEY TECHNOLOGY AREAS (SOURCE: US PATENT AND TRADEMARK OFFICE 2004)



4.8 Marketing and Business Development

Stakeholders indicate that Texas is not being adequately marketed as a place to do business. Marketing and business development are critical to growing and expanding foreign investment and improving Texas' image as an attractive place to do business and for the creative class to live.

The focus of the Texas Economic Development Division appears to be assisting prospective businesses which have already identified Texas as a candidate for a significant business expansion. Moreover, the focus of existing marketing efforts appears to be attracting businesses to relocate to Texas with little emphasis on attracting talent. There are several principal factors that contribute to Texas' gap in marketing and business development:

Limited focus on international business development. Texas does much less international business development than many competitors. Texas has the opportunity to improve its international presence and marketing focus by leveraging existing regional overseas offices (e.g., San Antonio's offices in Tokyo and Mexico). In addition, Texas could create an international presence by establishing overseas offices or entering into other arrangements that enhance international business development.

Lack of international marketing materials. Information to facilitate an investment decision, particularly in foreign languages, is less easily accessed from Texas' main business development portals than other competitor portals.

Less than positive brand image. Texas' brand is not necessarily associated with creative characteristics necessary to attract businesses and individuals required to grow in the target clusters. Anholt's State Brand Index[14] ranked Texas 10th among all U.S. states based upon its overall global brand recognition. However, Texas' brand is not strongly associated as an economic leader in the four targeted industry clusters. Many of the images that lead to a state's brand are largely linked to well-worn clichés, and many of them may be untrue, unfair, or out of date. However, these brand narratives can have a major impact on the decision-making processes of individuals and businesses in whether to do business or locate in a given state. Texas' brand image varies greatly internationally. While Texas ranked among the highest states for potential for finding employment (along with North Carolina and Nevada) among domestic panelists, foreign panelists ranked Texas 16th among all states. Moreover, when asked the question "How welcome do you think people in general would make you feel in the state?" foreign panelists in the survey ranked Texas last among all states. This brand image challenge may result from perceptions rooted in the manner Texas has been historically portrayed in film and other media.

Limited aftercare support programs/services. Strong business aftercare or business retention programs in competitor regions have advanced from assuring newcomers have a smooth entry into the region to using those investors as an asset in attracting other companies in their industry. Many competitor states use industry partners to serve as advocates for growing industry clusters. Additionally, many foreign competitors have extensive business retention or business aftercare programs coordinated at the state level. Texas efforts in this area have been locally driven.

14 The Anholt State Brands Index, 2006.

5.1 INTRODUCTION

Leading practices of global competitors and potential solutions to address the specific strategic gaps recognized for Texas have been identified. These solutions are focused on improving the metrics that site selectors value, as well as incorporating leading practices from global competitors. Solutions have been organized around the following set of basic levers of competitive economic development. These levers represent areas where Texas can focus to improve its competitive position in these industry clusters:

- Workforce;
- Research, development and commercialization;
- Venture capital and business start-up support;
- Infrastructure;
- Government processes and regulation;
- Cluster management; and
- Marketing and business development.

5.2 WORKFORCE

Texas has the advantage of being one of only a few states with a growing youth population. While Texas' U.S. competitors like Pennsylvania and Florida trend older, Texas has a burgeoning youth population. Texas should improve its performance in educating this population and making them workforce-ready. With an overall high school graduation rate in the bottom tier of all states and a lack of math and science graduates from its higher education institutions, Texas can make progress in creating a more focused and educated workforce to support existing and future Texas industry.

Better prepare Texas students to be college- and workforce-ready through improvements in K-12 curriculum standards and increased accountability. Texas has made progress in this area with the creation and adoption of uniform college readiness standards. However, more work needs to be done to fully incorporate these standards into the curriculum.

The November 2007 report by the Commission for a College Ready Texas (CCRT) outlined several recommendations that are crucial to improving the workforce and college readiness of Texas' students. Specifically, the CCRT recommended that the expectations in the classroom should align with expectations in college and the workforce and that K-12 curriculum standards including standards for college readiness, should include core skills for each grade level. The CCRT further recommended that curriculum standards should include grade-level curriculum standards that provide for sustained increases in content knowledge, reasoning skills, communication skills (oral and written), and ability to use these skills effectively in real settings through each grade until graduation. Moreover, the CCRT recommended that metrics be developed to clearly measure students progress toward college readiness starting as early as the sixth-grade.

Texas should pursue these recommendations and develop clear curriculum standards for K-12 that are focused on workforce and college readiness. Additionally, Texas should ensure that metrics and mechanisms are in place to measure student progress against these standards and to hold schools accountable for preparing students to be college- and workforce-ready.

Improve educational alignment by creating a Director of Education and Workforce Competitiveness to coordinate the economic development impact of universities, community colleges, and K-12 schools. The State of New Jersey recently completed a study recommending the complete overhaul of the K-12 system to meet the demands of higher education. The principal issue addressed was one familiar to Texas – high rates of remedial classes in universities and community colleges. Compiled over two years by both public and business leaders, the report recommended greatly expanding the math and science offerings of New Jersey schools, including a mandatory economics component. The needs of business and industries in the state were considered in recommendations of the study.

Texas may not need to follow the same path as the state of New Jersey, but it could create an official post to coordinate the needs of businesses and economic development with the state education system. States such as Massachusetts and Ohio have recently acted to create alignment offices in an attempt to rein in disparate functions of state government in education. This alignment coordinator could act as the chief strategy officer in fulfilling the needs of industry, improving the ability of students to be college and work ready, reducing remedial education rates in higher education and coordinating programs such as the STEM related initiatives.

The office managed by the coordinator would have measurable goals, not just in terms of student performance, but also whether the education system is serving the needs of businesses and higher education.

Consider including economic development metrics in funding formula for higher education. Texas should align its economic development objective – producing an employable and educated workforce – by changing some or all of the way Texas provides basic funding to institutions of higher education.

While most states fund community colleges and universities in the same way Texas does – based on enrollment – some states are using other measures to assess performance and allocate funding. Tennessee uses performance metrics to allocate state education funds. Texas should also begin to change formulas allocating general operating funds for education to improve Texas' alignment of the goals of higher education and economic development, which include graduating a workforce that will be hired by and choose to be employed by Texas industries.

The Texas Legislature has authority to change the funding mechanism that allocates state dollars for education. Texas should include career placement in Texas industry, especially in critical fields, as a factor in allocating funds. By directly tying placement to state funds, universities and community colleges would be more likely to work with industry in meeting workforce needs. Further, general operational funding should be used to encourage the incorporation of more certification programs that lead to increased direct hires by Texas industry.

Align state research and higher education grant funding to economic development activities. The THECB has limited control over research at institutions of higher education; however, it should exert influence through grant funding. The state offers $80 million in higher education research grants each year, and the THECB selects proposals and awards these funds. The THECB should do two things to better align institutions with economic development:

- Align funding of research initiatives with cluster needs or, if necessary, seek statutory authority to do so. By awarding research grants to areas in which Texas is most competitive, educational institutions may also focus more on these sectors; and
- Make technology commercialization an important criterion in its selection process. By choosing research projects that have a commercialization component, everyone would benefit.

Align incentive funding to higher education institutions with economic development goals. In addition to the $80 million[15] in research grants outlined in the previous recommendation, the Texas Legislature with the support of Governor Perry created a $100 million incentive fund for higher education. The Governor formed a Task Force to draft recommendations for incentive fund allocation, presenting an opportunity to align the incentive dollars with increasing graduates, awarding commercialization and job placement especially in critical fields.

To succeed in creating incentives that drive both organic industry growth and workforce development, Texas should consider addressing the following for the new $100 million incentive program:

- AWARD COMMERCIALIZATION: In interviews with the committee developing the criteria for incentive awards, it appears that commercialization will not be a factor. However, rewarding commercialization could be an effective incentive for creating new companies.
- ALIGN INCENTIVES WITH INDUSTRY CLUSTERS: An available workforce with well-developed math and science skills is essential for success in the targeted clusters. Texas should adopt any Task Force on Higher Education funding proposals that succeed in graduating math and science students. By tying incentive dollars to graduates with math and science degrees, Texas will be better prepared to compete based on talent.
- ALIGN INCENTIVES WITH CAREER PLACEMENT, ESPECIALLY IN CRITICAL FIELDS: Texas should provide incentive dollars to those institutions that succeed in placing graduates in Texas industries. The incentive fund should reward Texas institutions for success in having graduates go directly from the Texas institution to work for a Texas-based employer. From an economic development standpoint, higher education plays a key role in educating a workforce and the institutions that work closely with Texas based recruiters to place their graduates locally (in the state of Texas) should be rewarded and incentives should exist to encourage other higher education institutions to follow suit.

15 IBM notes from meeting with HECB, April 14, 2008.

Dedicate additional state funds to enhance the adult education system. Texas needs to improve its ability to coordinate skills transference and training with federal adult literacy programs, making better use of the limited funds available. Texas needs to initiate a complimentary state initiative that has the flexibility to merge existing adult literacy programs with skills training in order to increase the overall effectiveness of adult education. This problem should be addressed in two ways:

- DEDICATE MORE STATE FUNDS: Texas has a workforce with easily transferable skills. The declining superconductor industry workforce has abundant skills that could be easily transferred to other industries. Additional state dollars need to be given to adult education programs that focus on skill transference.
- ALIGN THE TWC AND THE TEA ADULT EDUCATION PROGRAMS: While the TEA's literacy programs must specifically focus on literacy, the TEA's programs could be focused on teaching adult literacy while also teaching job skills through course materials. In order to truly create a benefit, the state would need to supplement these programs with applied training. If Texas paired literacy programs with applied TWC training programs, funding would be stretched by delivering hirable skills. Stronger coordination with the THECB and community colleges should also be developed.

Enable both teachers and students to learn and explore emerging technologies and industries with the highest career growth potential. The shortage of Texas high school students graduating with rigorous courses in science, technology, engineering and math leads to high remedial rates in colleges and universities, as well as a general weakening of workforce quality.

Texas has made commendable efforts to improve STEM education with the creation of T-STEM Academies and Centers. Additionally, the new state requirement for high school students to complete four credits of math and science is being implemented. Despite these efforts, STEM courses are still relatively weak, and the successes of existing programs need to be replicated across the state.

The Dallas-Fort Worth area workforce development agencies have begun a program to introduce teachers in local schools to new and emerging industries. This program is intended to give teachers information in fields such as aerospace and nanotechnology and to incorporate real world examples of how math and science relate to exciting careers into the classroom. This adaptive approach is increasing awareness of the future job market and sparking interest in STEM fields and should be replicated as regulations allow.

TEA should partner with local school districts to highlight emerging technologies and possible careers. Giving students real-world insights into potential careers has been shown to improve their capacities in traditional math and science classes. For example, Chicago Public Schools implemented an initiative called the Chicago Math and Science Initiative (CMSI) that promotes "instructional coherence" across math and sciences classes in the district. The program includes an expert-developed set of training materials and classroom curriculum designed to standardize the instruction of math and science across all schools. In addition, the program offers university based teacher training in exchange for tuition credits for teachers to receive additional training from area universities thereby improving teachers' skills. To support parental involvement, CMSI offers family math classes designed to involve parents in tutoring their children in math and science subjects. Established in 2002, CMSI has proven results of higher tests scores and teacher satisfaction.

By borrowing the CMSI concept, the TEA should encourage similar initiatives. Additionally, the TEA could become inventive with the application of adult education and literacy classes to include the entire family and/or create courses for parents to mimic the coursework of their children, particularly in the math and science fields.

Expand the T-STEM program to educate more students in emerging technology and industry careers in STEM fields. Texas should build upon its recent success in STEM education by creating quality linkages between local districts across the state to better communicate the successes of T-STEM programs. Texas should enhance its STEM internet portal to improve delivery of:

- Successful curriculum models;
- Web-based learning tools to aid in basic skills instructions;[16]
- Social networking style community development for teachers to better communicate successful practices;
- Interactive content for industries to share knowledge and inspire excitement in teachers and students;
- A resource page for parents to learn about careers, events and curriculum; and
- Data driven metrics for teachers and administrators to track progress and forecast development needs.

These enhancements could eventually be expanded to other areas such as English as a Second Language (ESL), foreign language learning, and English language arts.

16 In cooperation with the Concord Consortium, The Hockaday School in Dallas is currently pilot testing a program that uses software applications to teach basic math and science concepts to middle and high school students. If successful, these programs are intended to be used in districts lacking sufficient teacher talent.

5.3 Research, Development, and Commercialization

As detailed in Section 4, Texas has gaps in technology commercialization. Fortunately, Texas has taken initial steps toward closing the gaps. Texas is already a market leader in securing research and development dollars, with only California securing more funding in 2006. Research and development funding success and success in filing patents sets the stage for Texas to succeed, but in order to take the next step and succeed in commercialization, IBM has provided Texas with four approaches geared at closing the current Texas gap of transforming technology research into commercial ventures.

Following are four approaches to close gaps using the university system to attract funds and produce research.

Enhance Eminent Scholar activity to attract more Federal research and development funds and venture capital. Texas should ensure that Eminent Scholar recipients, under the Research Superiority component of the ETF, receive adequate funding and are required to bring world class researchers and their research teams. Texas should also examine approaches to secure funding from private sources.[17]

In creating an eminent scholar program, Texas should follow some basic principles:

- Any Eminent Scholars program should focus on attracting talent with expertise in targeted clusters thereby attracting VC, research and development funds, and ultimately spurring economic development.
- Eminent Scholars should have a track record of securing research and development funds as well as success in commercializing research and spawning successful start-ups.
- Recruiting efforts should include research teams, and not simply leading researchers. Leading researchers may have established teams of researchers that are critical to ongoing research efforts.

Texas should promote university-private partnerships to attract research and development funds and implement technology transfers. By pairing industry with university researchers the state can capitalize on a commercialization opportunity. Industry is often open to working with university research organizations to aid them in developing research leading to commercialization. In fact, corporations are working with universities across the nation, including The University of Texas at Austin, to partner in securing federal research and development funds for a number of research initiatives. While Texas' ETF fund was originally created to promote private partnership through large "E grants", the State dissolved this partnership due to difficulties in managing the grants. The State should revisit the concept of promoting university-private partnership using an alternate model.

17 Texas was successful in the past in securing private funding for an eminent scholar program. The program was never fully implemented and the funds were returned, but it speaks well to the opportunity for the State to supplement eminent scholar funding with private funds.

Continue to create Commercialization Centers and Technology Transfer Offices supported by universities to formally manage commercialization. Technology commercialization is an excellent means of attracting more private capital. Commercialization Centers require project managers to market to and coordinate with VC funds. For example, the California Technology Office of Technology Transfer (OTT) works closely with commercial companies. The OTT negotiates license agreements with industry and works with companies to develop university inventions. The OTT believes that investment capital and entrepreneurs need assistance finding patents and inventions that support their business plans.

Another example of leading technology commercialization is the Massachusetts Institute of Technology (MIT). The 4,000 MIT-related companies employ 1.1 million people and have annual world sales of $232 billion[18]. MIT's Deshpande Center works with students, researchers, and entrepreneurs to commercialize inventions. Deshpande issues innovation grants to benefit projects with an established proof of concept and identified research and development path and intellectual property (IP) strategy. MIT imposes certain requirements upon grant recipients: they must conduct research at MIT laboratories and only faculty members may submit the grant requests. These requirements encourage collaboration between business and the Center. Another way the Deshpande Center's efforts support commercialization is that the grants support faculty researchers to complete proof of concepts for their technologies, which attracts VC.

While Texas is working to improve upon commercialization through the construction of commercialization centers, it would benefit from directing more resources and following these best practice models.

Consider a research and development tax credit. Texas should consider re-instituting research and development credits to encourage greater research and development spending and promote investment in innovations. With several options available, Texas should investigate ways to offer incentives to assist companies in expanding the overall research and development coming out of Texas.

Texas would benefit from following these examples.

18 Deshpande Center for Technological Innovation website, http://web.mit.edu/deshpandecenter/

5.4 VENTURE CAPITAL AND BUSINESS START-UP SUPPORT

Through the 1990's and early 2000 Texas was a leader in securing private VC (ranking 3rd among all states) and had great success nationally in revenues and jobs created by VC firms. VC funds declined after the dot-com bubble burst in 2001, but even after VCs began investing again in early 2003, Texas suffered a loss of VC investment.

As previously discussed, Texas lost one percent of the total U.S. market share of VC investment in the past five years, translating to nearly $1.2 billion. Texas recognized the recent downward trend in VC and created the ETF to fund Texas start-ups to commercialize early and disruptive technologies. The following solutions are intended to improve the metrics that site selectors value and incorporate global best practices in VC and start-up support.

Incentivize investment entities to encourage creation of VC firms. Texas does little to encourage VCs to settle in the state and does not take advantage of the vast individual wealth of state residents. As Texas' market share in securing VC dollars is threatened by other states, Texas should study ways to provide tax incentives to VC firms and Angel investors given its unique tax structure (i.e., Texas does not have a personal income tax).

Because a direct tie exists between the number of VC firms located in the state and VC invested in state businesses, Texas can follow in the footsteps of other states that have successfully mobilized private VC funds. Indiana, Vermont, and West Virginia have mobilized successful private VC firms by providing individual Angel investors, with a track record for investing in start-up businesses, additional tax incentives, and business start-up support to form traditional VC partnerships located in the state.

Create statewide Angel networks. Beginning in the mid-1990s in California's Silicon Valley, networks of Angel investors began to assemble. The oldest of these loose groups of individual investors is Silicon Valley's "Band of Angels." With about 100 members, the Band of Angels meets monthly and invites two or three companies to make presentations each meeting. Typical individual member investments are about $50,000; totals raised range from $100,000 to $2 million. This loose-network model has been replicated with success in New York City and several states, including Minnesota, New Mexico, North Carolina, Pennsylvania, South Carolina, and Virginia.

In New York City, Minnesota, New Mexico, North Carolina, and other locations, Angel networks were formed by private investors. Some states such as Iowa did not have an existing Angel network, but dedicated state funds to aggregate, educate, encourage, and mobilize Angel networks. After three years, Iowa successfully organized independent Angel Investors into a loose network investing millions into state start-ups.

Texas could better coordinate regional Angel networks by following Iowa's lead and developing a statewide Angel network dedicating funds and resources to facilitate networks and invite independent investors and start-ups to focused workshops to encourage investment.

In addition, a focused statewide Angel network could assist the ETF in filling in gaps in providing seed capital to very early stage start-ups. The ETF mission typically provides larger grants to more established start-ups whereas Angel networks can provide capital to a good idea in its earliest stages.

Improve state matchmaking services. In addition to encouraging state Angel networks, other states have begun brokering capital networks. These programs match start-up companies with suitable investors through computer databases. Both potential investors and companies seeking financing are charged a fee; when a suitable match is found, the parties are introduced. The amount of support is negotiated and varies with the program. The first of these brokering programs was started in New Hampshire in the late 1980s. Other successful programs can be found in Kansas and Austin, Texas.

Texas can build and expand the matchmaking service into a statewide initiative run through the Governor's Economic Development division. Texas also has the added benefit of an active, but underutilized database which includes research initiatives in every academic institution. By pairing a state brokering program with the database, Texas can leverage and promote matchmaking and additional private investment. In addition, Texas can look to organizations like the Small Business Administration, which is promoting a nationwide version of a capital network called ACE-Net.

Create state-sponsored incubators. Texas has limited state services aligned with start-up "aftercare." Pockets of incubation services exist in the state and Austin has a particularly good incubator aligned with Clean Energy. However, in relation to competitor states, Texas should improve early-stage support of start-up businesses.

Texas is now competing with states and cities that have joined forces to create a next generation of incubation services. The next generation of incubators provides tenants with the traditional networking and below market rent, but also provides them with consulting services and incentives and flexibility to expand. The next generation of incubators is pairing with existing state matchmaking and Angel investors to link state-sponsored VCs and Angel investment networks with tenants of incubators[19] and to focus incubator services to very specific industry segments. Examples include:

- Berkeley, California's $500M Biofuels Incubator;
- Austin, Texas' Clean Energy Incubator; and
- San Jose, California's Cleantech Incubator and VC Group.

In addition, incubators are expanding beyond providing traditional office space, consulting and shared secretarial services. States have begun offering large warehousing incubation space to companies to facilitate advanced manufacturing as well as laboratory space to help facilitate bio and nano-businesses.

19 Karlenzig, Warren. "Top US Cities for Cleantech Incubation Clusters," SustainLane Government, February 2007, http://www.sjbiocenter.com/news/news.2007.02-SustainLaneGovernment.pdf

If Texas wishes to continue creating successful start-ups, it needs to establish state-sponsored incubators that are focused on targeted clusters. Government owned/contractor operated (GoCo) buildings, airline hangars and laboratory and manufacturing facilities would assist Texas start-ups and build upon the growth and capital provided by the ETF. The Regional Centers for Innovation and Commercialization (RCIC) are well positioned to provide many of these incubation services.

Focus and align ETF with Texas Cluster Initiative. The Texas Cluster Initiative has identified six industry clusters on which to focus economic development resources. Competitive positioning analyses confirm Texas' competitiveness in these clusters; however, Texas can do more to focus resources to encourage continued success in these clusters. One of the easiest ways to ensure development of the targeted industry clusters is for the state to partner with the most promising start-ups in these clusters.

The ETF is doing a good job of providing funds to promising start-ups, but could improve on management of its portfolio to ensure healthy growth in each of the targeted industry clusters. The ETF is currently heavily invested in the Biotechnology and Life Sciences cluster. While these are certainly important and included in the Texas Cluster Initiative, the ETF is very underrepresented in funding other clusters.

To protect the state's portfolio of investment, Texas should create a more balanced investment portfolio aligned with the targeted industry clusters and actively recruit promising start-ups in clusters outside of Biotechnology and Life Sciences.

Incorporate private investment resources into ETF to build capacity. As the ETF portfolio continues to grow, the ability of the limited staff to manage the portfolio of companies becomes more challenging. Unless Texas wants to devote more full-time resources to assisting in managing the portfolio, the amount of work created will threaten the future success of the fund. By allowing private firms and individuals to partner with the state and share in the profits and success of invested partners, Texas could secure additional resources and expertise to help address the inevitable growing pains of managing a fund which invests in more than 60 start-ups throughout the state.

Reduce the time necessary to select start-ups and award funds. As previously outlined, the Texas ETF takes longer than industry benchmarks to vet and fund start-ups. This timeframe can be reduced by incorporating private resources into the process and by improving the rigor of the recommending regional bodies (RCICs). The procedures RCICs use as a first line of review should be improved, providing the state ETF with a more focused and limited number of startups to investigate. Additionally, Texas should consider changing its approval process to allow approval by two of the three trustees.

5.5 INFRASTRUCTURE

As Texas continues to grow by encouraging expansion of existing businesses and attracting new businesses to the state, the importance of infrastructure increases. The following infrastructure solutions, if implemented, could succeed in placing Texas in a very successful position from an economic development perspective.

Convert underutilized freight rails into light rails for public transport. Texas cities are lacking in public transportation. Other states have addressed lack of public transport, congestion, and air quality issues by converting freight rails into light rails for public transport. Texas has a spider web of underutilized rails in populated areas like Houston and Dallas that should be transformed into a light rail passenger solution. By "relocating" underutilized freight rails to more suitable locations to ease congestion, Texas should use existing rails to create light rail passenger transportation services that are intended to decrease congestion. In addition to decreasing congestion, the conversion of underutilized freight rails to light rails also serves to improve air quality and quality of life while also serving as a source of income and attracting site selectors who weigh public transportation heavily when determining suitability for business.

Colorado's Front Range Rail project was particularly successful. Like Texas, Colorado had an aging rail system that was largely underutilized by existing rail companies in the state. Colorado converted existing freight rails to mass transit and light rail systems.[20] Texas can use the Colorado example or others, like Salt Lake City, to create public transportation solutions at reduced costs to benefit residents and attract and retain industry.

Expand Inland Ports. Texas has a number of excellent ports, but the state is large and transporting goods to and from these ports to other areas in Texas is relatively difficult. The additional development of inland ports could meet Texas' growing need to improve congestion in some areas, while providing inland businesses with more cost effective methods of transporting goods to and from Texas water ports. Texas should study the economic impact of using inter-modal inland ports to increase shipping efficiencies by transferring certain logistical functions – such as receiving, inspecting, and customs processing of sea-borne cargo – to these inland sites. Large states that have access to water ports and are faced with disjointed inter-modal transportation models have instituted Inland Ports with great success.

One of the more successful models is the Virginia Inland Port (VIP).[21] VIP created a port of entry designated for customs at a central inland location. The VIP linked Virginia ports (including Norfolk) by inter-modal container trains. The VIP serves as a seamless satellite port through coordinated truck, rail, and marine inter-modal transportation, generating:

- Cost savings for small, medium and large businesses;
- Improved congestion due to coordinated transportation of goods;
- Improved environment and air quality; and
- New economic development in under-represented inland regions like Appalachia, due to easy access to ports.

20 Texas Transportation Institute Report: Rail Relocation Projects in the U.S.: Case Studies and Lessons for Texas Rail Planning, Nov 2006.
21 Virginia Port Authority website,<htto://www.vaports.com>

Secure funding for rail relocation efforts. The state legislature, and the people of Texas through a Constitutional amendment, created a mechanism for funding rail relocation, but funding not been provided for any rail relocation initiatives. The state needs to fund initiatives for rail relocation or conversion into light rail. Texas should provide funding to capitalize the Rail Relocation fund. Alternatively, some cities and states, such as Salt Lake City, have secured private funding to relocate rail. Texas could consider this model by redeveloping land previously occupied by rail routes.

Salt Lake City was able to negotiate the sale of excess properties upon rail removal to businesses and real estate developers for redevelopment. The influx of private support helped fund the relocation, decreasing congestion and promoting economic and urban development.

Re-examine private-public funding initiatives. State Highway 130 Sections 5 and 6 are an example in which the State secured private funding to build an expanse of highway with the construction occurring at no cost to the state. The funding model came under public scrutiny since the state's partner is a consortium that includes a Spanish company, and the legislature banned any new private highway infrastructure investment (CDA) after 2009. Texas needs to revisit the CDA funding model as the use of private investment for public infrastructure construction is a valuable tool with proven results. Absent these public-private partnerships, it is likely Texas will fall behind in transportation infrastructure requirements.

Encourage alternate sources of revenue to pay for airport improvements. Leading airports are generating greater percentages of operating revenues from non-aeronautical sources by creating "sky cities." By leveraging technology like registered travel programs and passenger self tagging, airlines have seen increased passenger time in airport shops by an average of one hour per passenger.

For example, Hong Kong and Singapore have created successful sky cities in which they expanded terminals for shopping – which requires less funding and legislative restrictions than increasing runway space – to generate additional funding. Dubai and Beijing are creating state-of-the-art "skytropolises." The most successful airport cities are courting businesses including business and industrial parks, hotel and entertainment, bonded warehousing and information technology corridors to neighboring areas in which close proximity to the airport is a benefit. New skytropolis cities include:

- Amsterdam;
- Seoul;
- Detroit;
- Hong Kong;
- Campinas, Brazil; and
- Dallas-Ft. Worth.

While Dallas-Ft. Worth is joining the new age of airport travel, the state should encourage other major airports including Houston to follow suit.

5.6 GOVERNMENT PROCESSES AND REGULATION

Many public agencies, such as those responsible for motor vehicles and health and social services, have sought operational efficiencies by outsourcing operations to private contractors. In economic development, Connecticut, through its Smart Start program, contracted with the Connecticut Economic Resource Center (CERC), a private, nonprofit, economic development organization, to provide both licensing information and direct assistance.

Short of outsourcing services entirely, the primary means of achieving operational efficiencies in the permitting process is to provide transactions via the web on state portals.

The National Governors' Association lists the following as best practices in using information technology to make permitting more efficient:

- Clearly articulate the process for new businesses to follow before they begin operations.
- Display information on the business registration process prominently on the state web site and link all appropriate agencies to the site.
- Allow directions and forms to be downloaded or printed from the site.
- Prominently display phone numbers for those who have questions or need additional assistance.
- Provide an easily understood, structured interview, or set of questions, that can help the applicant identify the permits most likely required.
- Cross-train state agency staff to understand the permitting process and requirements of other agencies.
- Continuously review whether permits are obsolete or there are unnecessary forms.

Develop a comprehensive Economic Development Portal. A key factor in securing new and maintaining existing industry is improving the ease with which business can operate in the state. One of the most useful ways states are improving the ease of business is by creating an online portal to assist in securing permits, registering as a new business and expanding and accessing information ranging from best practices to investor matchmaking.

Texas has all of the tools to create a comprehensive business portal. With more than 800 online applications for businesses and individuals, exhaustive data gathering, active public-private portals like Texas One and a live end-to-end online permitting application for retail and convenience stores, the state is in an excellent position to assemble the resources and re-engineer the way Texas interacts with businesses from permitting to information dissemination.

Washington's Office of Regulatory Assistance uses an interactive questionnaire on its website to collate a customized list of permit requirements. North Carolina has a Business License Information Center in the secretary of state's office that serves as a clearinghouse offering one-on-one consultation, federal, state, and local referrals, and a master license application system for certain types of businesses. In Oregon, the secretary of state's office, in cooperation with five other state agencies, has set up a Business Information Center designed as a "first-stop," in contrast to a one-stop, for new applicants. The center handles phone and mail inquiries and mails out appropriate information and forms. Its staff also provides information on whether a business is required to have a particular permit and makes the appropriate referral.

While Texas does have online permitting, the process cannot be completed "end-to-end" on the web, and many of the permits are hard to find within Texas Online, the state's website. For example, links to building permit renewals and oil and gas drilling reside at the second level, and links to the Commission on Environmental Quality at the third level.

5.7 Cluster Management

To improve cluster management, Texas needs to focus on attracting capital and research to the targeted clusters, promoting Texas as a great location and efficiently marshalling resources to perform these tasks. A number of capital attraction solutions are concomitant to technology commercialization approaches.

Organize research parks around clusters to attract investment and entrepreneurs for those clusters. Research parks or similar variants are tools of cluster management. In other states, research parks are typically private-public ventures with a state-to-industry investment ratio of 1:3.

The Georgia Advanced Technology Development Center uses Georgia Tech to attract investment and link research findings to commercialization. Experienced entrepreneurs advise new entrepreneurs on business and marketing plans. The Georgia Tech faculty researchers coordinate with entrepreneurs to create commercially viable products. Some organizations do not use universities for research parks, but instead use industry and government partnerships.

Research parks are particularly successful in attracting both large and small industry and encouraging their relocation to the state. The Massachusetts Biotechnology Park in Worcester takes advantage of its proximity to Boston and related cost advantage. This biotech-focused park attracted German chemical giant BASF as an anchor tenant, which then induced twenty smaller, complementary biotech firms to locate at the park. The city funded construction of the park, but then an industry-supported non-profit organization funds the operations and manages the cluster of firms.

Promote, fund, and provide incentives for university-related incubator programs. In addition to research parks which may or may not be affiliated with a university, specific university-related incubator programs are also particularly successful in attracting investment. These incubators fund early-stage ventures until they are mature enough for investors to take risks. Texas institutions of higher education would be well served by developing initiatives that encourage research and development of cluster-related technologies. In addition, to promote larger incubators in areas like Houston which have a number of universities in close proximity, Texas should restructure the methodology for awarding state research grants to require cross-university partnering on research that supports the clusters (e.g. require grant recipients to use faculty from another university). By requiring universities in one city to collaborate rather than each having their own small incubator, a critical mass could be achieved and synergies exploited allowing for increased collaboration and mentoring.

Create cluster-centric offices staffed with technical expertise. Cluster management is a challenge for every state. While most people can determine which clusters are important, very few states organize their resources efficiently to build the clusters. Texas should create cluster-centric offices staffed with technical expertise. These types of offices focus on investigating complementary industries and technologies, marketing to cluster-focused investors, and advising the state government on resource needs and new opportunities. Some of Texas' strong competitor states hire retired or experienced investment bankers and VCs for these offices. These states recognize the importance of personal relationships and trust in attracting capital.

A cluster-focused office is not unusual among international competitors. In Germany the Bavarian Ministry for Economic Affairs promotes the advantages of their location. The Bavarian Ministry offers a large quantity of free information to investors and companies including free data about local economy, key industries, university research programs, trade show schedules, advice on business laws such as incorporation and patent protection and publication of special tax policies by cluster.

In the Guangdong province of China, the city of Shenzhen actively promotes its policies and advantages to investors in specific clusters. For example, Shenzhen created and manages numerous cluster-focused industrial parks and trade zones. The economic development agency publishes cost information to encourage investors to consider Shenzhen. The city government also markets its tax incentives and education production. Typical costs of concern to investors such as real estate, construction and utility costs are made public and clear. Shenzhen manages incentives to attract very specific types of companies. For example, the city offers "certified" manufacturing enterprises that use state-of-the-art technologies a reduced tax rate of 10 percent for three years. Other industries and types of businesses receive different tax exemption periods and rates.

5.8 Marketing and Business Development

In 2003 Governor Perry signed legislation transferring responsibility for economic development to the Office of the Governor and within that office established the Office of Economic Development and Tourism. In addition to Texas Business Development, this office has departments for Texas Tourism, Texas Economic Development Bank, Aerospace & Aviation, and Emerging Technology.

While this Office works hard to actively promote Texas' advantages, certain gaps between what Texas is currently doing and what are the best practices of competitors in business development and marketing do exist. Potential solutions and best practices can be organized into the areas listed below.

- International investment promotion;
- Branding of Texas;
- Investor aftercare;
- Business development organization; and
- International investment promotion.

Provide resources for international investment promotion. The Commonwealth of Pennsylvania has a marketing budget of $11 million, with $3 million dedicated to international marketing managed by a European-born director of international marketing. They have 15 overseas offices and 15 locally hired staff. Enterprise Florida, a public-private partnership serving as Florida's primary organization devoted to statewide economic development, has 13 overseas offices with an operating budget of almost $2 million to attract foreign investment and to promote trade. A survey of nine investment promotion agencies, including New Zealand, Singapore, Ireland, and Korea indicated an average of 23 overseas offices per agency.

In addition to business development and providing materials and maintaining web sites in native languages, other states' overseas offices promote international business in indirect ways. For example, they collaborate with the U.S. Commercial Service in promoting exports from home state companies, they maintain relations with U.S. consulates in order to help investors with visa problems, and they coordinate and distribute literature prepared by regions within the state.

San Antonio's economic development agencies maintain three offices in Mexico and one in Japan. Austin has also identified Mexico as a source of foreign investment and is attracting companies by providing them incubator space. Other regions of Texas are also interested in international investment. Texas should establish foreign economic development offices or enter into other arrangements in priority overseas markets in order to secure direct foreign investment.

Conduct a more comprehensive Texas branding campaign. Many of Texas' marketing dollars are spent promoting tourism. Texas One, the official non-profit arm of the state's economic development division, markets Texas for new jobs and promotes the benefits of doing business in Texas. While these efforts are coordinated, industry stakeholders believe Texas' perception in international and domestic markets is outdated and needs to be improved. IBM's PLI – Global Location Strategies consultants who have worked with a large number of foreign companies considering investment in the U.S. have also noted an uninformed impression of Texas, particularly among recent university graduates.

For the activities and clusters that Texas is targeting, the ability to attract and retain talent is very important. A recent study by the Research Triangle Foundation in Raleigh-Durham assessed strategies to maintain its image as a leader in innovation. The study concluded that a full strategy includes attracting and retaining companies and also attracting and retaining talent. In the competitive positioning analysis in Section 3 of this report, the qualitative factor, "Living Environment" was accorded substantial weight in many of the sub-sector profiles.

Richard Florida and his research on the "creative class" is the best known proponent of attracting knowledge-based workers for economic development. Now, places such as Michigan are campaigning to improve their image and attract a growing number of well-educated, creative workers who increasingly make location decisions based on more than just employment opportunities. The Greater Baltimore Alliance has also worked with the futurist, Faith Popcorn, and developed a campaign to retain the many students graduating from its universities by creating an attractive environment to retain more graduates.

Thus international business development programs and Texas' tourism campaigns should be expanded and should place greater emphasis on branding Texas as a great place to live and work.

Expand state efforts to coordinate and support regional services to existing Texas companies. Investor aftercare services are programs and activities developed by economic development departments that help foreign and domestic companies establish and grow in a region.

The origins of so called "aftercare" programs set up by economic development organizations are traceable to the United Kingdom and Ireland in the late 1980s and early 1990s. Aftercare was introduced as a standard service supporting investors during the establishment of their business and helping them solve problems related to infrastructure and permitting. In regions suffering economic downturns, these programs built relationships with companies to ensure that upcoming threats were detected early and proper action could be taken. The original objectives of aftercare programs were mainly defensive.

However, aftercare also provides opportunities for identifying possible expansions or re-investment by existing companies. Frequently, subsidiaries of foreign companies compete among each other for such investment and the economic development offices work with local entities to win the investment for their region. Similarly, the potential to attract suppliers to original equipment manufacturers (OEMs) and develop linkages between those OEMs and local suppliers was recognized. Various United Kingdom regions developed such supplier programs for the automotive industry and linked them to the aftercare programs they had established.

These examples show that aftercare is not only about providing financial incentives to retain jobs, but about proactively identifying and eliminating barriers for companies to do business in the state – often at little cost to the state.

With the emergence of cluster based inward investment strategies, some economic development offices have used aftercare programs to build a wider spectrum of services, which aim to further develop and improve the local business environment ("product development") for the targeted companies, as well as expand the targeted cluster.

Currently, responsibility for aftercare in Texas is at the regional level. However, many companies, particularly with headquarters outside of the state, have multiple locations in Texas which can present challenges not easily addressed by different regions. The degree and scope of regional business retention efforts vary and coordinating them at a state level may result in a more customer-centric approach to aftercare.

One model for providing and measuring aftercare services includes having an account manager responsible for a targeted company or key account. Most account managers work with many accounts; typically these accounts are in the same industry or have strongly similar needs and concerns. One account manager typically has between five and 15 key accounts and makes regular visits to the companies. The frequency of meetings is agreed upon with the company to assure they are helpful rather than bothersome.

To measure the effectiveness of these programs, the following metrics should be considered:

- Number of target companies involved;
- Number of "key" accounts;
- Companies served per staff;
- Number of visits per year;
- Re-investment and additional jobs by target company;
- New investment and jobs by related companies (suppliers and others); and
- Involvement of target companies in investment attraction marketing efforts.

Add cluster management responsibilities to the Texas Economic Development Office. As stated above, the Texas Economic Development Office runs a lean operation. Its main business development activities include working with investors that have notified the state or one of the regions of interest in investing in Texas and participating in a few marketing events supported by Texas One.

Many of the economic development organizations of key competitor regions, including Singapore, Ireland, and Maryland have trained business development advisors as specialists in a target cluster with greater understanding of the state's assets and challenges within a cluster.

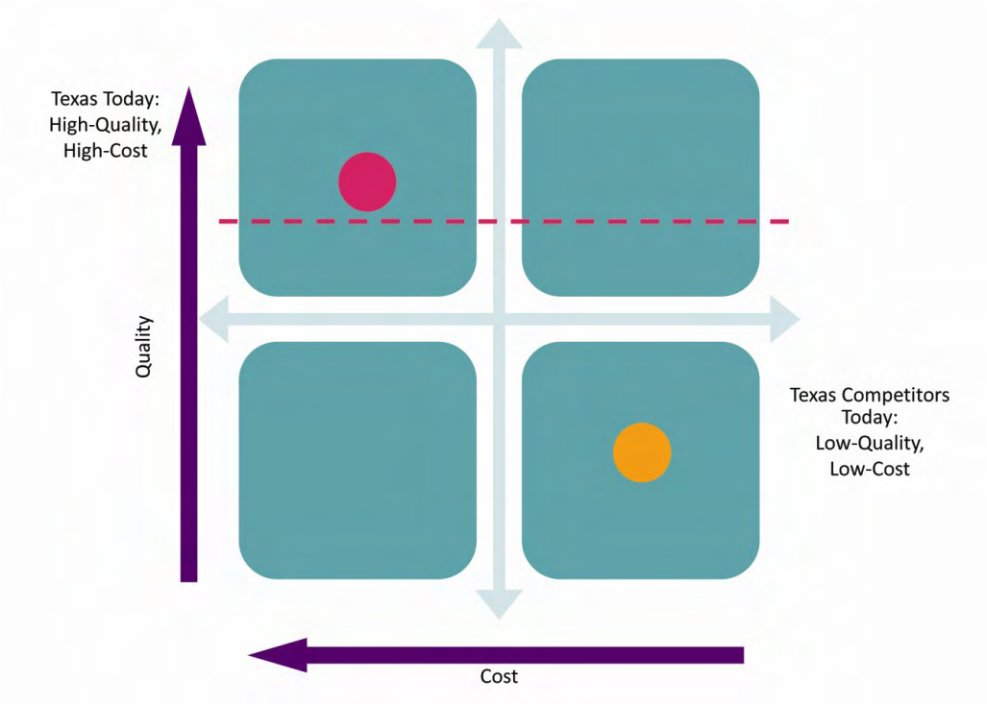
Businesses in targeted industry clusters identified in the Texas Cluster Initiative would benefit from having cluster specialists in a central location – within the state's Economic Development Office.

6.1 GLOBAL COMPETITION WILL ACCELERATE RAPIDLY, CREATING VERY HIGH STAKES FOR TEXAS

Today, Texas competes primarily on the basis of high-quality business conditions. The competitive positioning analysis in this report shows that when Texas' regional clusters are compared to competitive regions around the globe, they rank competitively for industry projects requiring high-quality business conditions that are willing to pay a premium for quality.

Today, Texas does not face direct competition from some emerging global competitors with lower costs because those regions (Bangalore and South Korea, for instance) do not offer the high-quality conditions that an industry such as biotechnology requires. The difference in quality and cost is primarily related to the talent available in Texas' workforce. (See Figure 25)

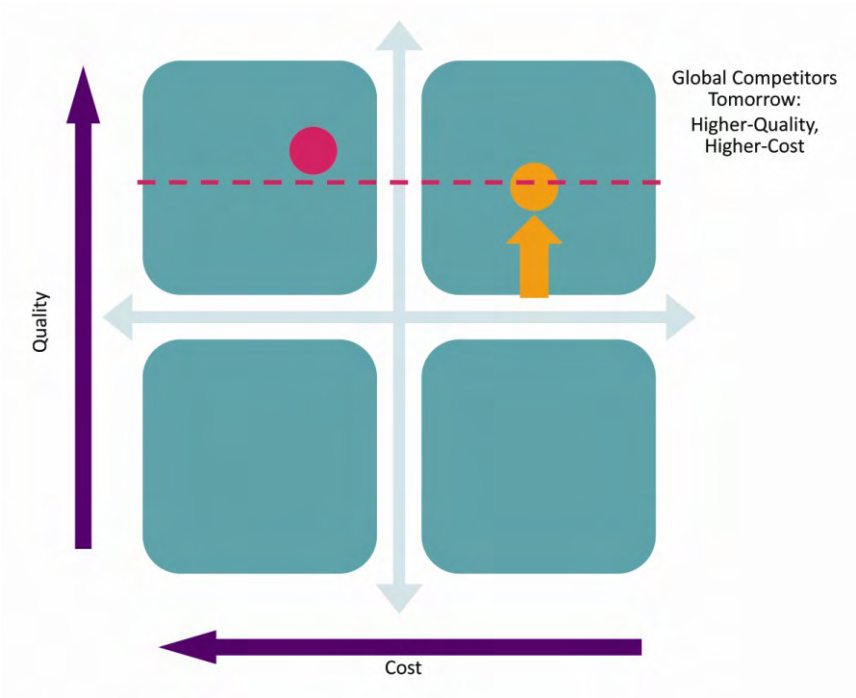
FIGURE 25



Texas should anticipate that global competition for industry cluster leadership will increase sharply over the next five to 10 years. The trends that have driven global economic competition thus far are not only still active, they are accelerating. IBM's recently completed CEO Survey 2008 shows that CEOs around the world will dramatically increase their investment in different countries and become "globally integrated enterprises." And in a complementary but disturbing trend, the best talent in emerging economies such as India and China is beginning to stay home instead of migrating to America; globalization is creating attractive opportunities and a more favorable quality of life in their home countries.

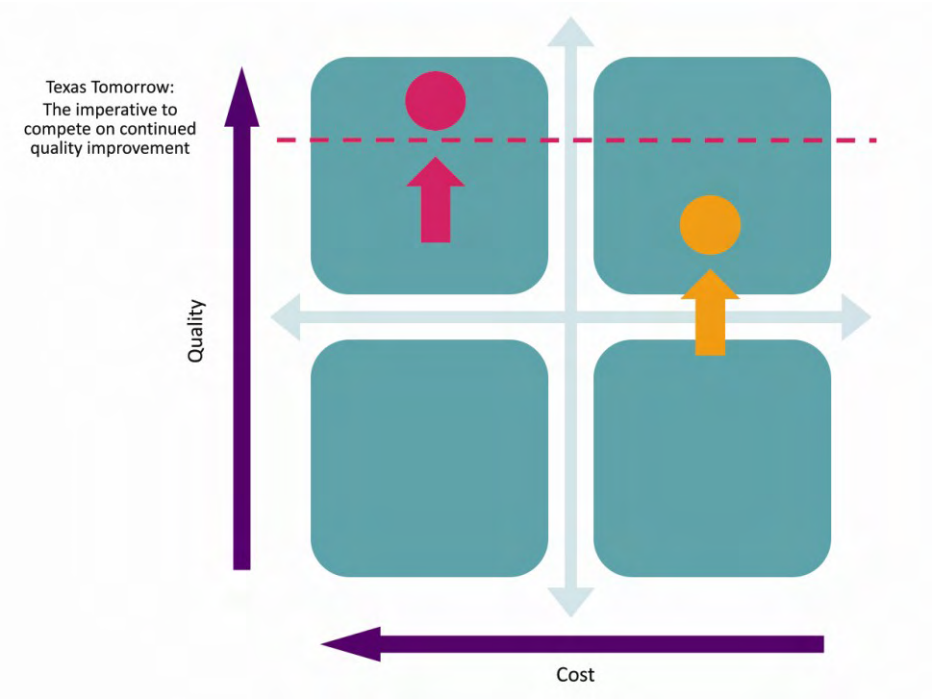
As emerging competitors retain more of the talent that their state-run technology academies produce, the relative business quality of those regions will improve without a significant increase in cost, permitting emerging economies to migrate into a high-quality, low-cost "sweet spot." This territory is currently unoccupied by clusters in developed economies, where a high standard of living forces a trade-off between quality and cost. (See Figure 26)

FIGURE 26



Unfortunately, Texas (and leading U.S. regions in general) does not have a viable strategy for migrating towards the high-quality, low-cost quadrant; it could only do so by dramatically lowering the cost of the workforce. Therefore, for Texas to remain highly competitive, the only remaining open space on the playing field is increasing on the quality dimension. (See Figure 27)

FIGURE 27

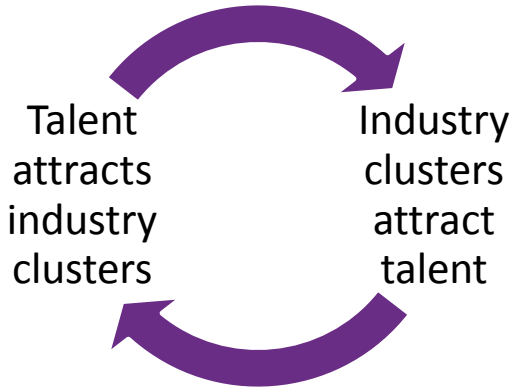


While there are a number of ways to improve quality further, the strongest lever will continue to be the level of talent in the workforce; the same pool of talent that global competitors are producing and pursuing today. Talent is the foundation for the next generation of emerging industries that will be indicators of prosperity in the coming decades. This market for talent is about to become incredibly competitive.

Network effects could accelerate competitive pressures even further. "Network effects" is a term the Internet industry today uses to describe how social networking sites such as Facebook work. The basic idea is that the value of a product or service is a direct function of how many other people use it. An Internet site such as Facebook is not valuable to a user if only a few people use it, but it could become very valuable if all of the users' friends – and millions of potential friends – have created Facebook profiles.

Network effects are not new. Fax machines, for instance, were not of much use when only a few people had them; the same was true for telephones. However, each of these new technologies reached a "tipping-point" where, after a certain point, enough people used the new technology to make it worthwhile for others to use it. After that point, growth was explosive, and competing technologies were abandoned in favor of the new standard.

A similar dynamic could affect the immediate future of economic development. Data clearly show that industry clusters and the talent they depend upon are unevenly distributed. Every high-growth industry shows "spikes" of concentration in a relatively few regions of the world. Once these leading regions achieve a certain degree of concentration – a critical mass of industry and talent – more talent migrates to those regions, because they offer the individual worker better career opportunities.



To individuals who represent the available pool of talent, the value of a region is a direct function of the number of similar workers already in that region. As they migrate to the leading regions for their specialty, the increased supply of talent attracts more industry participants who require a high-talent workforce. The increased mass of industry attracts more talent, and a virtuous cycle develops.

The evidence of network effects in economic development has been clearly demonstrated in mature, but talent-intensive, industries such as financial services and advertising. Where do aspiring investment bankers go? New York City and London are the leading choices, with regions such as San Francisco and Chicago occupying a distinctly lower second tier. Once the market for talent has tipped in favor of the leading regions, it is nearly impossible for other regions to break into that market. Like the Olympic Games, many regions may compete, but only a few will win medals.

The likelihood of network effects in Texas' target industries should create a sense of urgency. Regions that are competitive in those industries today could quickly be demoted to a minor role tomorrow. Conversely, the few most competitive regions will win big. The risks and rewards become very significant.

6.2 Sustained Competitive Pressure Demands Business Model Innovation

Over the past few decades, America's leading businesses have had to transform the way they operate in order to cope with sustained global competitive pressure. Companies that have not transformed have not fared well, as shown by the high rate of turnover in the Fortune 500.

Today, the primary basis of competition has become business model innovation: changing the fundamental elements of what organizations produce, how they produce it, and how they create value. Apple Inc., for instance, has prospered by entering a fundamentally different business via the business model innovation that delivered the iPod and the iTunes service. Dell revolutionized the personal computer business by changing the business model for how PCs were manufactured and sold. IBM's CEO Survey 2008 shows that CEOs forecast unprecedented changes in their organizations over the next five years, and that business model innovation will be central to those changes.

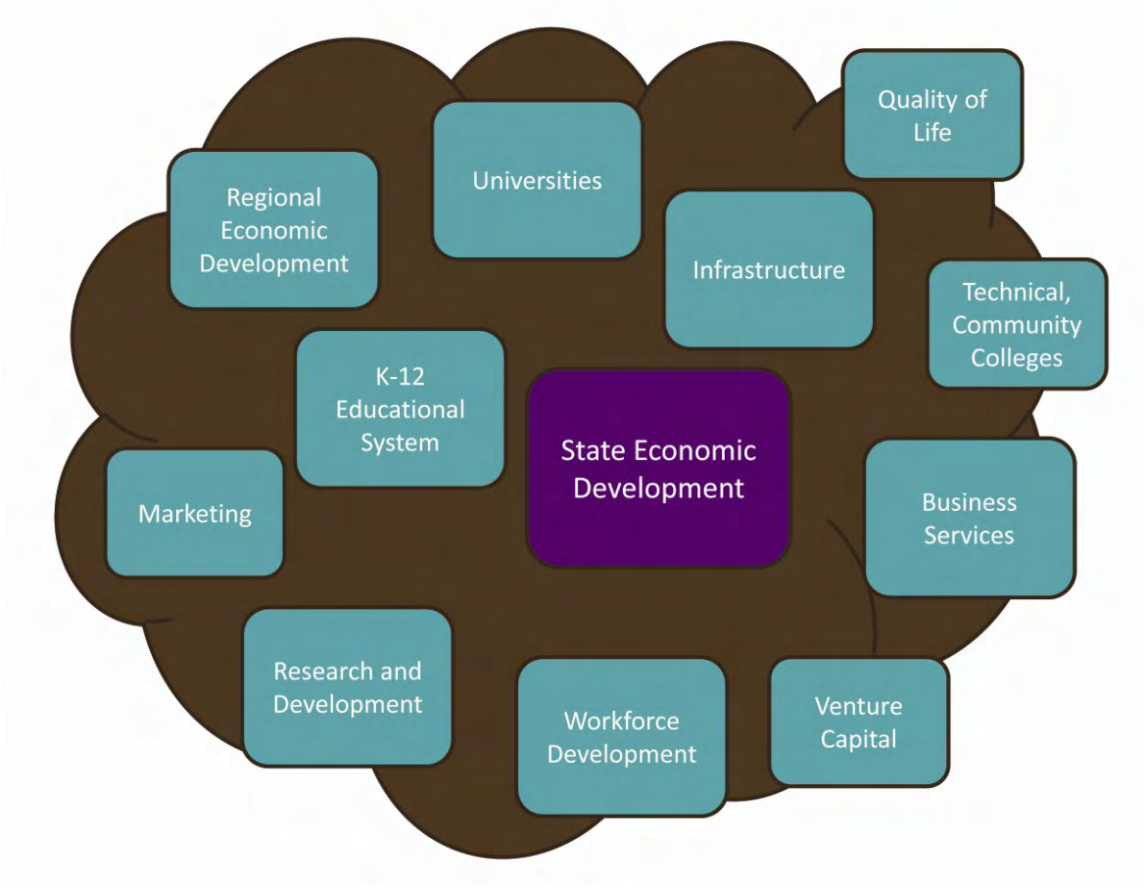
Leading organizations turn to business model innovation when they have exhausted more conventional means of improving performance (e.g., process reengineering). Chronically stagnant or declining growth rates and profit margins are signals that the current business model is "played out." In that situation, business model innovation can be the most potent response to competitive pressure, and can create the most sustainable competitive advantages. While no competitive edge lasts forever, successful business model innovations are relatively difficult to replicate.

6.3 Most States and Regions in the U.S. Today are Employing a Similar Business Model for Economic Development

While some states and regions have been more successful than others, and while some have adopted leading practices to a higher degree, their fundamental business model for economic development is generally the same. Their economic development is the outcome of similar activities (e.g., marketing, cluster development, tax incentives) coordinated across a broad set of independent actors (e.g., regional development authorities, state agencies, universities).

In the current model, no single agency is responsible and accountable for the relative success or failure of economic development across the regions of a state. Some of the actors that are critical to the success of economic development do not even cite economic development as their primary mission. (See Figure 28)

FIGURE 28



This model has worked well in states like Texas that have effective leadership, sound management practices, relatively collaborative working relationships, and valuable assets including leading universities, a favorable business climate and a legacy of prosperous industries. As the balance of this report indicates, this model – and the dedication to execute it – has served Texas well to date.

However, is this "loosely coupled collaboration" model built to survive a sharply more competitive environment? Could it survive, for instance, dramatically reduced tax revenues? Could it rapidly double the rate of highly educated professionals required to fuel an emerging industry? Could it cut in half the number of high school dropouts that create a critical shortage of qualified employees? Could it double the current rate of technology transfer and commercialization? Could it resolve the significant challenge of citizens in danger of being left behind in a changing economy?

6.4 The Current Business Model has Drawbacks that are Very Relevant to a More Competitive Environment for Economic Development

As new competitors begin to migrate towards the "high-quality, low-cost" segment of the competitive landscape, the drawbacks of the current model for economic development will become apparent. For instance:

Economic development resources and executive power are highly distributed, making it difficult to concentrate resources and make strategic decisions. Since industries are looking to locate in regions and cities, it makes sense for regional and local economic development authorities to have independent streams of funding and a high degree of autonomy. However, highly distributed power and resources make it difficult to change course quickly and aggressively in response to competitive threats. This is one reason U.S. regions are more concerned about China and India than they are about France and Germany; the highly distributed structure of the European Union makes its member nations less formidable competitors.

States and regions tend to focus on marketing the current product (business conditions), not on improving the product itself. Since resources are highly distributed, actors in the model must invest in initiatives that represent "low hanging fruit" the investments that promise the most impact for the least money. Marketing initiatives usually meet this requirement – they are affordable, address a need, and promise some impact on economic development objectives. However, this creates a problem: over time, the product (actual business assets and conditions) do not improve and do not become more competitive.

Evidence of this drawback may be found in the hundreds of state, regional, and local economic development "strategic plans" that are published on the web. Each plan makes recommendations for improving competitiveness, and these recommendations address the real issues: talent, the workforce, education, infrastructure, quality of life, etc. But the recommendations that are most likely to get executed are the marketing initiatives. The region benefits from better marketing, but the value of the product has not changed. If this dynamic were applied to the computer industry, Dell and Hewlett-Packard would be still be marketing PCs with slow chips and big beige CPUs and monitors.

The Texas educational system (K-12 and higher education) has an "arms-length" relationship to the economic development agenda. This is a conundrum: sources of the talent that underpin the industries of a 21st century economy, schools, colleges, and universities are central to economic competitiveness. And yet, for reasons that are widely unquestioned, the education system is not a functional component of the economic development enterprise (such as the training and development department of a large corporation) or even a full business partner (such as an independent training and development organization that has negotiated a contract to provide service to the corporation).

Imagine an automobile business where the engines were produced at a different site under different managers who were not only unaccountable to the auto factory, but also were reluctant to see themselves as being in the automobile business at all. In order to keep the factory running, management for both parties would meet from time to time to discuss how their goals might be aligned in some way, without compromising the fundamental independence of either party. Could this business compete with Toyota and Honda?

This vignette illustrates a fundamental challenge with the current model for economic development: Texas success depends upon the collaboration of parties not accountable to each other and with, at minimum, slightly different agendas. When all of the competitors (states and regions) use the same model, the playing field is level and the better teams (like Texas) win. But what happens when new competitors use a different model?

6.5 Emerging Global Competitors are Using a Different Business Model that Lets Them "Play by Different Rules"

The current "loosely coupled collaboration" model for economic development in the U.S. is based on a few key dependencies. First, it is heavily dependent on leadership from elected officials with relatively short terms of office. Bold and visionary leadership can get a great deal accomplished but only because it bridges the structural gaps in the loosely-coupled model. Unfortunately, bold and visionary leaders are circumstantial and even they face competing objectives and scarce public resources.

In the U.S., we are unlikely to give up democracy or the benefits of a liberal, independent education system, regardless of what happens with economic development. However, emerging economies are not playing by the same rules.

The BRIC countries (Brazil, Russia, India, and China) and the Asian Tigers (i.e., Korea, Taiwan, Singapore, and Hong Kong) pursue economic development as a fundamental nation-state objective. The Chinese, for example, are not hoping to encourage cooperation between industry and higher education; they have significant control over both. When their leaders decide to make huge investments in economic development programs, they do so without worrying too much about being voted out of office. If our model is characterized by loosely coupled collaboration, theirs is more akin to a military operation: a clear chain of executive command, a clear mission, and full control over the resources required for success.

6.6 High-Performing Business Models Illustrate Opportunities for Improving the Current Model for Economic Development

The differences between the current model of economic development and industry models that have been "hardened" by sustained competition are striking. Organizations with highly competitive business models share many common features that are not typical of the current model for economic development:

A single strategy that guides execution and decisions on resource allocation. Organizations that have applied highly competitive business models must be very efficient in their use of scarce resources. These organizations employ a strategy development process that covers all actors in the business model, specifies a plan for executing the strategy, and ensures that all resources expended offer the best means of delivering the measurable outcomes defined in the strategy.

Clear decisions about core components of the enterprise. Competitive organizations have had to ask: "Which components of our business are critical to our business model?" The core components are managed actively and purposefully; non-core components are outsourced or abandoned entirely.

Clear inputs and outputs for each element of the value chain. All highly competitive business models involve collaboration across a value chain of suppliers, partners, and customers. However, each actor performs a role that is core to its mission (not a sideline or secondary function), and each actor's performance can be clearly measured.

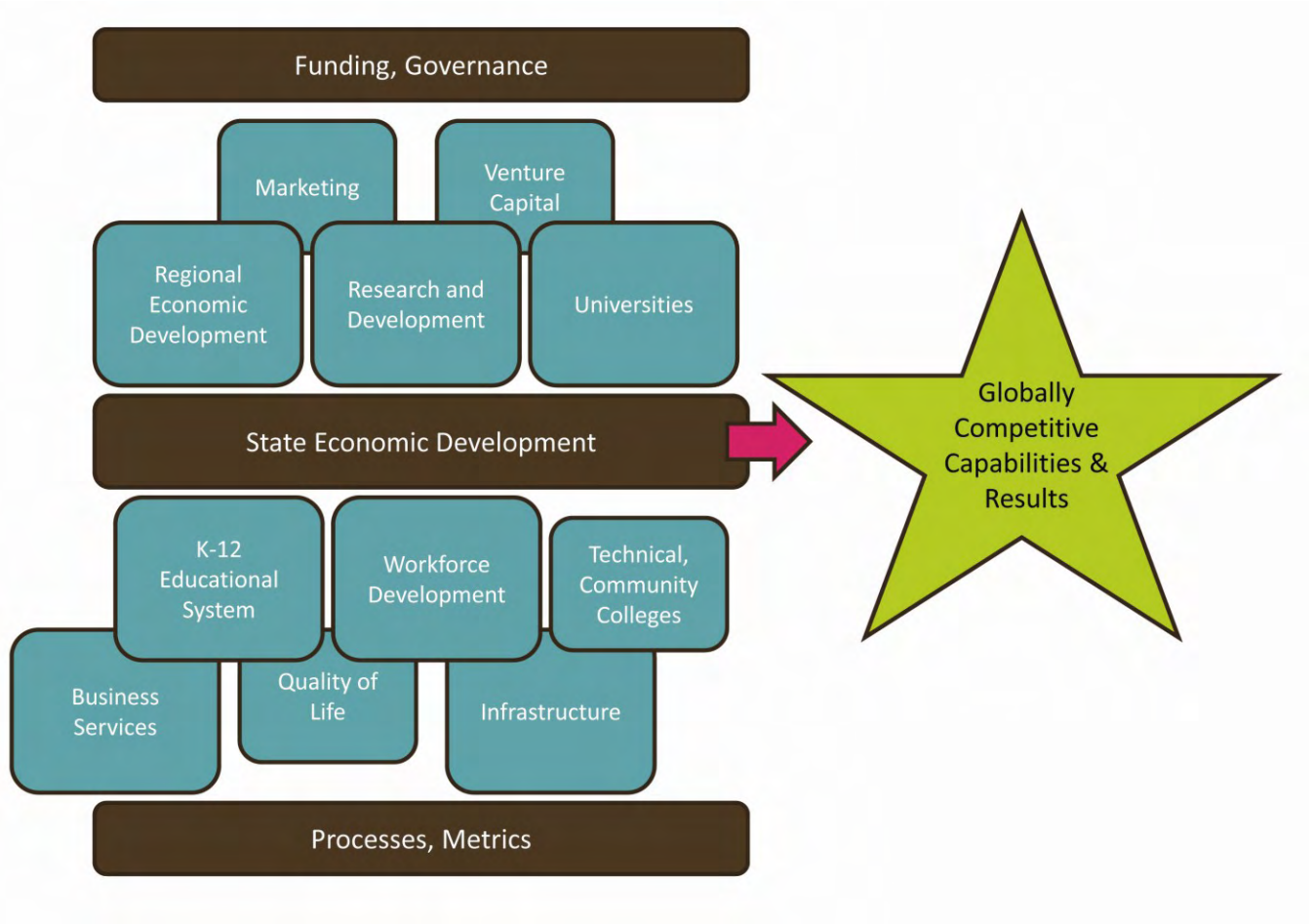
Little to no service redundancy. Organizations that have applied highly competitive business models do not necessarily centralize and standardize all processes and functions. Business units serving different customers can typically tailor their approach at a local level. But most internal services (IT, HR, marketing, finance) have been standardized across the enterprise, to maximize efficiency at a lower cost.

Well-defined business processes. Business model innovation is much more than process redesign, but processes are still a fundamental element of any business model.

Standard performance metrics and reporting methods. The individual actors in a business model may not like being compared to each other, but it is hard to be competitive without being able to compare performance and to shift resources to higher performers. If each actor is permitted to measure performance in a different way – or not measure performance at all – improvements are left to chance.

This does not mean that organizations with highly competitive business models are well-managed and that organizations that have not adopted highly competitive business models are poorly managed. The point is that highly competitive business models have evolved as an effective response to the most competitive business environments. If the global playing field for economic development becomes as competitive as trends would suggest, the current model for economic development may need to migrate towards a more integrated model that would deliver better performance.(See Figure 29)

FIGURE 29

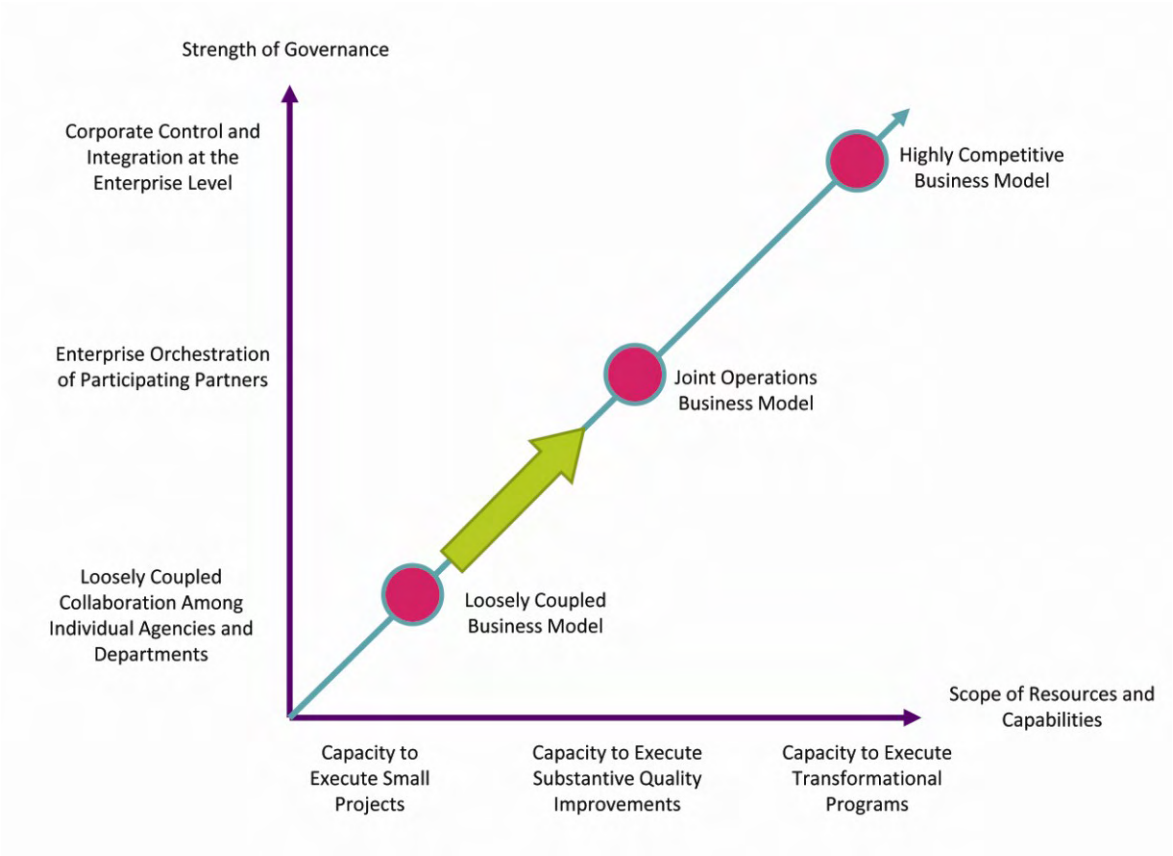

Funding, Governance
Marketing
Venture Capital
Regional Economic Development
Research and Development
Universities
State Economic Development
K-12 Educational System
Workforce Development
Technical, Community Colleges
Business Services
Quality of Life
Infrastructure
Processes, Metrics
Globally Competitive Capabilities & Results

6.7 Changes to the Current Business Model Could Produce Significant Benefits

Today, it is not feasible for Texas to adopt fully a highly competitive business model for economic development. The current business model for economic development is well-accepted and has produced satisfactory results. Therefore, completely redesigning and reorganizing the current model – so that it more closely resembles a core function of a competitive global business – would be prohibitively difficult.

This does not mean that a leading state could not make real progress towards a more potent and competitive model. The graphic below shows a "competitiveness scale" where the vertical dimension measures the strength of enterprise governance (concentrated authority over the economic development agenda) and the horizontal dimension measures the scope of programs being governed (modest marketing campaigns on the left, full-blown development programs on the right). (See Figure 30)

FIGURE 30



Texas could employ business model innovation by implementing recommendations as described in this report that would result in a more competitive business model for economic development. By implementing these business model innovations, Texas could very feasibly move towards a "joint operations" model. With this model, regions and agencies would remain autonomous, but the state would play a more central and active orchestrating role in order to expand Texas' capacity to execute substantive improvements in the quality of business conditions.

6.8 Recommendations for a More Competitive Business Model for Texas

Enterprise Strategy: Charter the Governor's Competitiveness Council to develop an enterprise strategy and roadmap for developing globally competitive business quality. Many of the critical ideas and initiatives for this strategy and roadmap are already in place, but only as the result of many different strategies among Texas' state, regional, and local agencies. An enterprise strategy for globally competitive economic development would deliver a single, unifying strategy, and would propose the most effective ways to allocate resources across the many actors in the current model. Additionally, the OOG should consider implementing a "competitiveness scorecard" to assess the competitiveness impact of all legislation before signing it into law. Such an assessment will ensure that the Texas business climate and the prosperity of Texans are enhanced by future legislative actions.

Texas Triangles: Manage critical triangles of the economic development ecosystem. In a highly competitive business model, every element of the model (every agency, region, and authority) would be integrated by common processes. This would be difficult for Texas to do today, but the state could benefit from more actively coordinating and managing the interaction of two critical areas of the economic development ecosystem:

- The innovation triangle: collaboration among Texas' universities, research and development assets, and the entrepreneurial community. This triangle has a significant effect on Texas' capacity to generate organic growth in its clusters and to drive network effects in the competition for talent.
- The talent triangle: collaboration among Texas' workforce agencies, industry clusters, and higher education system (including community colleges, technical schools, and universities). This triangle has a significant effect on sustaining growth among Texas' leading clusters by ensuring a ready supply of qualified workers.

The goal of triangle management would be to establish clear performance outcomes and metrics, common processes for collaboration, and an effective means of sharing information across the organizational boundaries in place today. The innovation triangle, for instance, could develop a means of connecting buyers and sellers in the market for technology transfer. The talent triangle could develop a means of capturing and communicating a clear workforce demand signal from industry clusters, as well as a means of establishing a common core curriculum that would raise the system capacity for responding quickly and effectively to changes in demand.

Today, of course, some of this is collaborative activity is already being addressed. The purpose of this recommendation is for the state to take a more active orchestrating role in order to rapidly improve outcomes in both areas rapidly.

Portals: Use the web as a platform for "lightweight integration." In the current model, there is relatively little process integration across the many autonomous actors. Even so, the state could use an expanded web portal to deliver a much higher level of integration. And by using the portal to manage processes and transactions among the actors in the model (not just to deliver "static" information), the state could jumpstart some measure of real integration. Using portals to deliver "business unit integration on the desktop" is a mature best practice in the private sector and would be relatively inexpensive to implement.

SECTION SEVEN: ACKNOWLEDGEMENTS

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GCC Chairman: Michael Williams, Chairman, Texas Railroad Commission
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Don Cain, President, AT&T Texas
The Honorable Susan Combs, Texas Comptroller of Public Accounts
Deirdre Delisi, Chairwoman, Texas Transportation Commission
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Austin Regional Briefing

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