



TEXAS COMPETITIVENESS & RESILIENCY STRATEGY

Investing in Texas' Foundations of Strength at Home

Building a More Innovative and Resilient Economy for Texas



The Texas economy is currently strong: high rates of employment, rising per capita income, rapid population growth, and growing economic outputs across a variety of industries. According to the US Bureau of Economic Analysis, the state has a 2022 GDP of \$2.36 trillion, which if it were a nation would rank Texas the world's ninth largest economy. Not only is Texas a vibrant and competitive economy, it is positioning itself to adapt to massive technological change and to create new marketplaces, thus not just keeping pace with the competition, but outrunning them.

The continuing global economic disruption has demonstrated that neither China nor the US and its allies currently possess strict economic self-reliance. China's comprehensive economic and supply chain strategy includes state-owned and state-driven tactics to dominate resources, purchase foreign infrastructure, and take the lead in emerging and scaling technologies. To compete with this, private industry is diversifying supply chains and risk. The US Department of Defense, federal agencies, and allied governments have mapped critical supply chains and Congress has been deliberating and enacting new strategic investments, specifically in critical emerging technologies.

With this context in mind, the Texas Association of Business and Chambers of Commerce Foundation (TABCCF) has produced a compendium of data to answer the question "Why Texas" for companies contemplating investment in the United States. We enumerate Texas' differentiated capabilities and the impact of current public and private investments in critical industries.

Further, the TABCCF has here produced an initial set of Texas strategies—grounded in unleashing free enterprise—to increase Texas' economic self-reliance, enhance our place among the world's great powers, and ensure that Texas will more directly chart the future of technology and commercial success in additional industries. Many of these recommendations align with the legislation passed by the 88th Texas Legislature and signed by Governor Greg Abbott.

These recommendations cover how Texas can improve its ability to surpass other states and nations in relevant research and development technologies and commercializing assets to grow small, high-growth companies in emerging tech sectors, catch up and add capacity to infrastructure and connectivity, enhance opportunities for Texans, enhance tax regulatory competitiveness, and create economic opportunities for every community in Texas. The TABCCF believes that Texas is beginning a new leadership role in which entrepreneurialism, free enterprise, and freedom will play critical roles in present and future success.

TABCCF will work with the Texas business community; the state, regional, and local chambers of commerce; and our leadership to support enactment of these strategies and to build a stronger and more resilient Texas economy for our people.

Sincerely,

Massey Villarreal

2023 Chair, Texas Association of Business

Immediate Past Chair, Texas Association of Business and Chambers of Commerce Foundation



Chambers of Commerce Foundation

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TIP Strategies, Inc., is a privately held Austin-based firm providing consulting and advisory services to public and private sector clients. Established in 1995, the firm’s core competencies are strategic planning for economic development, talent strategies, organizational development, resiliency planning, and equity initiatives.

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SECTION

1

Executive Summary

Texas has consistently ranked highly in various "best of" lists due to its pro-business regulatory climate, growing population, and abundant assets, which include renowned research universities, a strategic international border, robust transportation options, and dynamic metropolitan areas. Texas has experienced strong economic growth, ranking among the top states in average annual real gross domestic product (GDP) and population growth. The state has diversified its economy and is a global leader in sectors like aerospace, healthcare, biotechnology, professional services, manufacturing, information technology, and logistics.

Yet despite its impressive performance, Texas, like states and nations around the world, remains vulnerable to forces that are often beyond its control. These vulnerabilities were brought into sharp relief by the COVID-19 pandemic, which shuttered many small- to mid-sized businesses, created massive disruptions to global supply chains, and sent families and communities scrambling to cope with the financial consequences of stay-at-home orders. Along with its abrupt and immediate effects, the pandemic also accelerated several trends that are likely to have long-lasting implications for the state's economic competitiveness.

Approach

To address these challenges and capitalize on opportunities, the Texas Association of Business and Chambers of Commerce Foundation (TABCCF) pursued and was awarded a grant from the US Economic Development Administration (EDA) to prepare a statewide analysis of Texas' economic competitiveness and vulnerability to supply chain disruptions and to identify business development and reshoring strategies that benefit communities throughout the state. TABCCF engaged Austin-based TIP Strategies, Inc., (TIP) to conduct the economic analysis, engage in stakeholder outreach, and assist in the development of recommendations. A 22-member statewide steering committee of experts and stakeholders guided the planning process.

To inform the strategy, the project team conducted a wide-ranging stakeholder engagement effort with business representatives, industry experts, workforce development organizations, and economic developers throughout the state. The project team utilized various engagement activities, including industry roundtables, focus group meetings with local economic development and workforce development officials, and regional town hall meetings to gather insights and feedback on the state's strengths, vulnerabilities, and opportunities. The engagement process also involved an online survey of business decision-makers in Texas to gather views and data on supply chain resilience.

The stakeholder outreach was accompanied by a comprehensive data analysis of Texas' competitive position. This baseline assessment was presented in an interactive data visualization that is available on the TABCCF website. In addition to ranking Texas against 49 other states on a variety of indicators, the *Baseline Economic Explorer* examined broad supply chain trends across the state through the lenses of employment patterns and investment in innovation over recent decades. Highlights from this analysis, coupled with qualitative input from stakeholder engagement, informed and guided the direction of the strategic plan.

The resulting *Texas Competitiveness and Resiliency Strategy* provides recommendations in two key areas. First, foundational recommendations aim to improve the state's competitive position by enhancing the talent pipeline, strengthening critical infrastructure, establishing a comprehensive toolkit, and equipping local economic development organizations (EDOs) to handle future disruptions. Second, sector-specific recommendations focus on fostering growth in innovative industries through cross-cutting actions, such as expanding research and development (R&D) capabilities and attracting top talent, as well as tailored approaches for specific sectors.

Competitive Context

While Texas has a large and growing population, its performance in education and training indicators is relatively lackluster. Concerns arise from lower rates of degrees awarded in science, technology, engineering, and mathematics (STEM) fields and a lower proportion of four-year degree holders among prime earning workers. However, Texas offers relatively affordable undergraduate education compared to other states.

Texas boasts several research universities and innovation centers, attracting advanced degree graduates and fostering R&D activities. However, the state lags behind California, New York, and Massachusetts in venture capital (VC) investments, indicating room for growth in this area. Texas performs well in total R&D expenditures but falls to the middle of the rankings on a per capita basis.

The TABCCF Resilience Survey provided valuable input from business decision-makers familiar with the Texas business environment. Skilled worker shortages and transportation and logistics bottlenecks were identified as major disruptions in the supply chain. Respondents expressed receptiveness to localizing or nearshoring production and suppliers as a means of mitigating risks.

Texas' geographic advantages, such as its central location and extensive border with Mexico, offer businesses access to diverse resources and markets. The state's ports and transportation systems are vital to manufacturing and production but require consistent investment for maintenance and modernization. Infrastructure concerns, including delays at land ports of entry, need to be addressed for sustained competitiveness.

Overall, Texas possesses significant competitive advantages but faces hurdles in areas such as education, innovation, infrastructure, and supply chain resilience. Addressing these gaps and leveraging opportunities will be crucial for maximizing Texas' competitiveness and attracting investment and reshoring activities.

Foundational Strengths

Texas is home to one of the most dynamic and resilient economies in the world. The state is a premier destination for jobs, investment, talent, and innovative technologies. Maintaining Texas' competitive edge requires new initiatives and investments that address barriers and challenges related to the state's talent pipeline, infrastructure, regulatory environment and incentives toolbox, and local supply chains. During the 88th Texas legislative session, the Texas Legislature and Governor Greg Abbott took substantive steps to enhance Texas competitiveness in several of these areas.

The recommendations in this plan are designed to strengthen the underlying foundations of the Texas economy, which in turn will make the state more competitive for reshoring opportunities. They consist of four goals under the heading of Competing on Texas' Strengths.

Talent. Fortifying the talent pipeline for Texas employers is the focus of the first goal. Stakeholders emphasized the critical need for finding and retaining skilled workers, which has become an even more pressing concern in recent times. To meet the current and future demand for a skilled workforce, it is imperative to deepen and expand talent development programs through coordinated efforts and additional resources at the state and local levels. The 88th Legislature created the \$3 billion Texas University Fund and realigned community college funding around outcomes and workforce alignment. The recommended strategies and actions encompass various areas, such as aligning workforce plans with Texas competitiveness priorities, improving educational outcomes, expanding dual credit and technical education programs, and supporting entrepreneurship education.

Infrastructure. Rapid economic growth and population expansion have strained the state's transportation networks, airports, seaports, rail systems, water systems, electric grid, and telecommunications infrastructure.

Ensuring that Texas has infrastructure capable of meeting the demands of a 21st-century economy by addressing these vulnerabilities and preparing for the future economy is the subject of the second goal. The strategies and actions proposed include advocating for increased capacity at border ports of entry, enhancing transportation infrastructure funding, improving utility and telecommunications infrastructure, and supporting energy resiliency and water infrastructure initiatives. Infrastructure investments appropriated by the 88th Legislature included \$1.5 billion for rural broadband, \$1 billion for a Texas Water Fund, \$5 billion for surface transportation, \$400 million for Texas ports, and \$5 billion for electric generation funding.

Regulatory and Incentive Tools. The significance of Texas' pro-growth, business-friendly regulatory environment and competitive tax incentives in driving economic success is highlighted in the third goal. To maintain and enhance the state's advantages in these areas, it is crucial to revamp tax limitation agreement policies for large capital investments, replenish the Enterprise Fund to attract strategic corporate headquarters, maintain competitive R&D tax credits, and continue tax limitation agreement capabilities at the local level. The 88th Legislature passed important legislation to protect and enhance Texas' business climate. This includes authorizing a new statewide incentive limiting taxable value of certain property (House Bill 5) and passing the Texas Regulatory Consistency Act.

Local Economic Development Playbook. The fourth goal outlines a set of strategies designed to assist EDOs in supporting businesses to become more resilient in the face of supply chain disruptions. The strategies include the following.

- Utilizing business retention and expansion (BRE) efforts to gather information on supply chain issues, suppliers, customers, and potential gaps;
- Collaborating with local manufacturers to map the existing supply chain ecosystem;
- Engaging in targeted recruitment and retention efforts to fill supply chain gaps and diversify the base of suppliers and customers;
- Partnering with industry, government, workforce entities, and education to develop strategies for attracting, retaining, and developing the state's workforce; and
- Working with universities, community colleges, manufacturers, and entrepreneurship organizations to promote supply chain innovation and technological advancements for resilience.

Innovative Sectors

The strategy presents both cross-cutting and sector-specific strategies designed to foster innovation and support small business and industry growth. It also incorporates the actions of the 88th Legislature that targeted innovation. The state of Texas can leverage its competitive advantages, such as its growing microprocessor and information technology (IT) sectors, a large number of certified cyber professionals, a strong defense industry, energy expertise, a prominent medical and biotech complex, and a presence in the space industry, to compete globally and accelerate new industries while strengthening existing sectors.

Cross-Cutting Strategies

- Update and expand Texas' research capabilities to identify key areas for commercialization potential. This involves providing state funding, building complementary functions, and convening annual conferences. It is also critical for the state to ensure endowment funding for both the Permanent University Fund and the newly established \$3 billion Texas University Fund.

- Position the Texas Academy of Medicine, Engineering, Science and Technology (TAMEST) as a strategic leader among research institutions to improve coordination and collaboration in critical technology research. This leadership role would include developing industry clusters, creating proof-of-concept and R&D strategic research funds, and enhancing university commercialization and innovation programs.
- Expand future investment in the Governor's University Research Initiative (GURI) to attract star researchers and foster R&D projects with commercial potential. The 88th Legislature maintained GURI funding at \$40 million.
- Increase future Defense Economic Adjustment Assistance Grant (DEAAG) funding to attract strategic investments in key technologies and industries. The 88th Legislature maintained DEAAG funding at \$30 million.
- Create a deal-closing funds for research consortia to secure leading-edge projects in innovative sectors. The 88th Legislature provided substantial R&D funding for critical sectors, especially microelectronics.
- Deepen Texas-focused angel and venture capital by strategically investing a small increment of state liquid assets into Texas-based alternative investment funds.
- Solidify trade offices and marketing initiatives with strategic international partners to improve trade and investment relationships. As a first step, the 88th Legislature provided \$880 thousand in funding to establish a Texas trade office in Taiwan.

Sector-Specific Strategies

- **Semiconductors/Microelectronics.** Semiconductors and microelectronics play a critical role in advanced technologies, and the US currently leads in chip design and patents. The bipartisan passage of the Creating Helpful Incentives to Produce Semiconductors and Science Act of 2022 (CHIPS Act) demonstrates the industry's importance. The act directs significant investments toward enhancing US competitiveness, innovation, and national security. To capitalize on this investment, the 88th Legislature allocated state funding (\$698 million for Texas Semiconductor Innovation Consortium) to attract a national semiconductor research consortium. Additional recommendations include updating current analyses of Texas' research excellence and forming a semiconductor technician workforce training program.
- **Batteries/Energy Storage.** In the realm of batteries and energy storage, the global lithium battery market is projected to experience significant growth; unfortunately, the US lags China in its manufacturing and supply chain capabilities. Texas has the potential to become a center for battery R&D and production, given its historical significance in lithium-ion battery development and Tesla's presence. However, the state needs to invest in economic development initiatives, incentives, and collaborations to attract battery manufacturing investments. Additionally, Texas should prioritize energy storage capacity expansion to support its renewable energy sector and enhance grid reliability.
- **Energy.** Texas remains the nation's leading energy producer, both in oil and gas as well as renewable energy, particularly wind and solar. To maintain its energy leadership, Texas should invest in next-generation energy technologies, take steps to ensure a favorable regulatory environment, and provide financial incentives to attract new energy investments and jobs. Toward this end, the 88th Legislature funded a \$5 billion loan program for generators to build dispatchable power plants in the state.

- **Biotechnology.** Texas has established itself as a leader in medical R&D, with renowned research universities and a robust biotech industry. To further strengthen its position, Texas aims to enhance its ability to translate research into high-growth enterprises. Key strategies include establishing a biotechnology cluster initiative, mapping supply chains for pharmaceutical and medical device manufacturing, and supporting the efforts of the Cancer Prevention and Research Institute of Texas (CPRIT) in implementing the *Texas Cancer Plan*.
- **Commercial Space Technologies.** Texas is the leading state in the nation for aerospace. With a growing presence in the commercial space sector, Texas aims to cement its position as the epicenter of space exploration. Recommended strategies involve creating the Texas Space Commission, mapping key space technologies to research capabilities, attracting and developing key suppliers, and ensuring adequate investment in NASA Johnson Space Center. Recognizing the growth potential of the commercial space sector, the 88th Legislature allocated \$150 million to create the Texas Space Commission and the Texas Aerospace Research and Space Economy Consortium.
- **FutureG.** FutureG wireless technology, which builds on 5G capabilities, is identified as a critical area for maintaining national security and economic competitiveness. Texas plays a prominent role in the development and deployment of 5G and FutureG technologies. Key actions include mapping critical supply chains, exploring permitting changes to accelerate deployment, and expanding Texas-funded research clusters and educational programs. The 88th Legislature appropriated \$1.5 billion for rural broadband infrastructure development.
- **Cybersecurity.** Vital for national security, cybersecurity employs a significant number of Texans and contributes substantially to the state's economy. Texas should ensure it remains a center of cybersecurity technology development and workforce training. Strategies include encouraging the use of the statewide cybersecurity framework, ensuring a strong talent pipeline, and supporting the Texas Cybersecurity Council.

Implementation

The *Texas Competitiveness and Resilience Strategy* offers an ambitious and comprehensive framework for strengthening Texas' position as a global economic power and fostering the technologies of the future. Successfully implementing these recommendations will require a broad-based effort involving many stakeholders from the public, private, and nonprofit sectors. Coordination and alignment will be key. The 88th Legislature and the Office of the Texas Governor (Governor's Office) have already committed significant long-term investments in several critical areas. Ensuring these investments are coordinated toward a common vision is imperative.

Therefore, this strategy proposes that a Texas Council on Competitiveness be established to provide recommendations to the Governor's Office and the Texas Legislature on the strategic alignment of existing and future state economic development investments. The leadership of this new entity should include and be largely comprised of representatives of the private sector and state and local economic development organizations. The TABCCF can play a key role in helping to organize the council and connecting it with the state's elected leadership.



SECTION

2

Introduction

Texas consistently places at the top of many “best of” lists. The state’s favorable ranking often reflects its pro-business regulatory climate, growing population, and wealth of assets, which include top-tier research universities, an international border, multimodal transportation options, and several of the nation’s most dynamic metropolitan areas. Figure 1 summarizes some of Texas’ essential advantages and reflects key aspects of the state’s value proposition.

Yet despite its strong performance, Texas, like states and nations around the world, remains vulnerable to forces that are often beyond its control. These vulnerabilities were brought into sharp relief by the COVID-19 pandemic, which shuttered many small- to mid-sized businesses, created massive disruptions to global supply chains, and sent families and communities scrambling to cope with the financial consequences of stay-at-home orders. Along with its abrupt and immediate effects, the pandemic also accelerated several trends that are likely to have long-lasting implications. These include increasingly flexible working arrangements, the growing use of automation and artificial intelligence in business processes, and continued interest in consolidating business operations to minimize supply chain and talent challenges.

To ensure Texas is better able to respond to future disruptions and leverage associated opportunities, the TABCCF pursued a grant from the US Economic Development Administration (EDA) to prepare a statewide economic development strategy. The initiative sought to analyze Texas’ economic competitiveness and vulnerability to supply chain disruptions and identify business development and reshoring strategies that will benefit markets of all sizes across the state. TABCCF is uniquely positioned to lead a coordinated statewide planning effort. As a nonprofit operated by the Texas Association of Business (TAB), and with a focus on research and educational objectives, TABCCF was able to leverage TAB’s decades of experience, private sector leadership, robust partner network, and statewide membership. TAB cultivates relationships with a range of business owners and CEOs, economic developers, community college presidents, mayors, and elected officials throughout Texas’ 254 counties. TAB’s network of

Figure 1. Overview of Texas’ Competitive Advantage



Source(s): TIP Strategies, Inc.

partner organizations, which includes 230 local chambers of commerce, provided a mechanism to increase participation and help foster buy-in for the resulting strategies.

Following a competitive process, TABCCF was awarded funding and engaged Austin-based TIP Strategies, Inc., (TIP) to guide the process. In partnership with a 22-member statewide steering committee, TIP and TABCCF spent 16 months analyzing reams of Texas economic competitiveness data and engaging industry experts, workforce development organizations, and economic developers around the state. Engagement activities conducted over the course of the project included two dozen small group gatherings: eight industry focus groups, eight economic development professional, and six regional town hall meetings. The project team used these sessions to explain the purpose of this project, present economic data, and solicit input and feedback on the strengths and vulnerabilities of the Texas economy in developing these strategies for enhancing Texas competitiveness and critical supply chains. The organization’s 140-member board of directors offered crucial insight into key trends. An overview of the team’s engagement activities is provided in Figure 2.

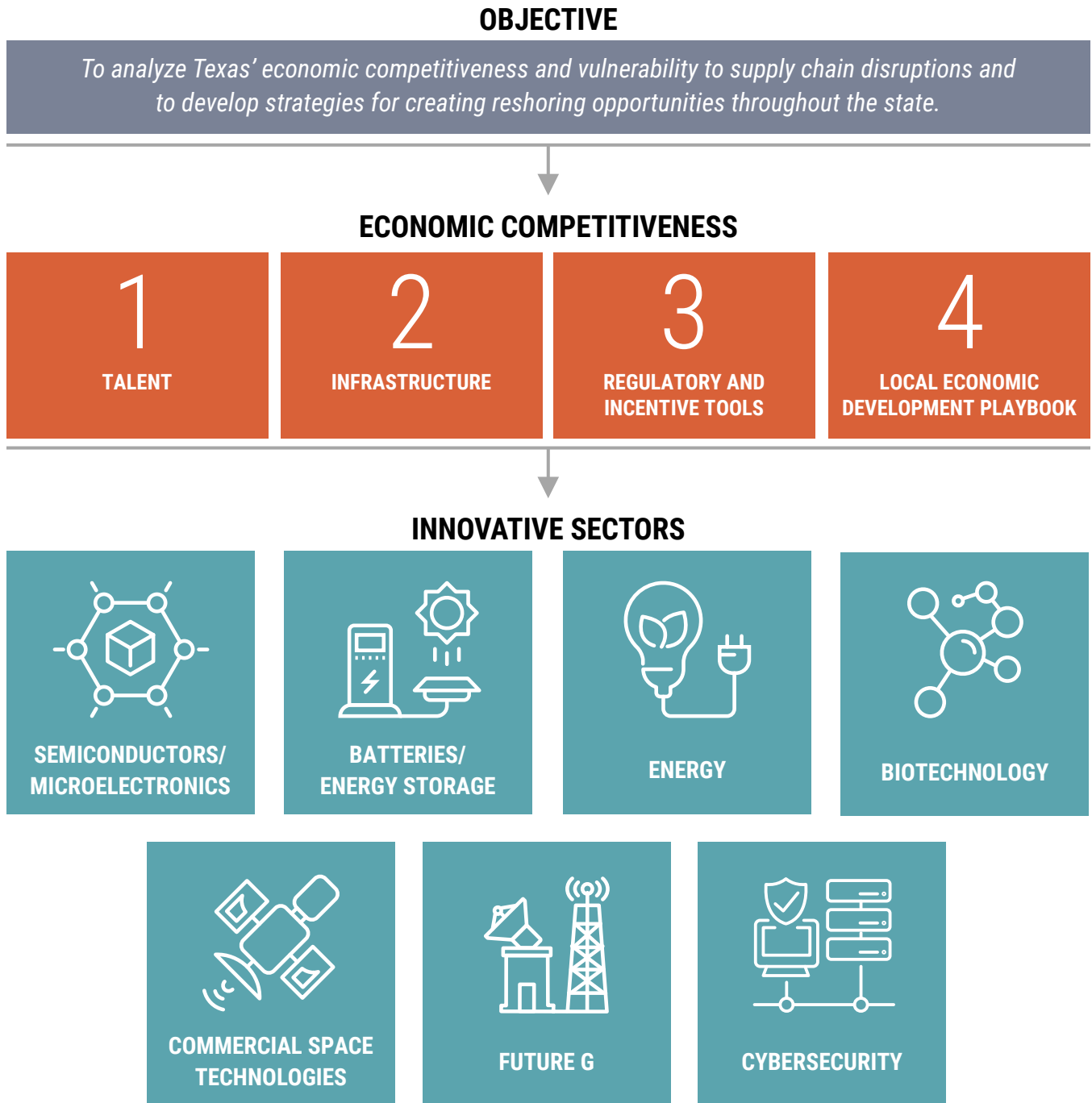
Figure 2. Statewide Engagement Overview



Source(s): TIP Strategies, Inc.

The recommendations outlined in the *Texas Competitiveness and Resiliency Strategy* reflect the team’s findings from a comprehensive analysis of the state’s economy, a study of factors affecting reshoring, a review of supply chains for targeted sectors, and an extensive statewide outreach effort. As illustrated in Figure 3 (page 10), they are organized under two broad efforts, which must be tackled concurrently. The first is a set of foundational recommendations aimed at improving the state’s competitive position. Competing on Texas’ Strengths encompasses goals and strategies for strengthening the state’s economic foundations by building a strong talent pipeline, increasing the resiliency and capacity of its critical infrastructure, defining a comprehensive toolkit, and ensuring that EDOs are equipped for future disruptions. The second set of recommendations focuses on actions that support the growth of a range of innovative sectors. Investing in these critical technologies will require both cross-cutting actions, like expanding the state’s R&D capabilities and attracting leading edge talent in critical fields, and sector-specific approaches. An overview of the plan framework is provided in Figure 3 (page 10).

Figure 3. Texas Competitiveness and Resiliency Strategy Framework



Source(s): TIP Strategies, Inc.



SECTION

3

Laying the Foundation

Understanding Texas' competitive position was the foundation for the planning process. An examination of quantitative and qualitative data points to a number of advantages for the state, including its central location, robust network of infrastructure, rapidly growing young talent base, and largely pro-business regulatory environment. These attributes and others position Texas to compete favorably for new investment and for reshoring opportunities. This section examines Texas' performance on a range of indicators relative to other US states, outlines the assets that underscore the state's value proposition for reshoring, and examines gaps in building the innovation ecosystem that will be essential to the state's future success.

National Context

At the outset of the planning process, TIP compiled a range of data to illustrate Texas' competitive position. This baseline assessment was delivered to the TABCCF in an interactive data visualization. In addition to ranking Texas against 49 other states on a variety of indicators, the *Baseline Economic Explorer* examined broad supply chain trends across the state through the lenses of employment trends and investment in innovation over recent decades. Highlights from this analysis, coupled with qualitative input from stakeholder engagement, informed and guided the direction of the strategic plan.

TIP's State Comparison Tool was a key component of the baseline assessment. This proprietary analysis indexed available data from a wide range of sources for all 50 states and the District of Columbia on 49 indicators arranged under eight categories.

- People and Households
- Economy
- Early Education
- Higher Education
- Infrastructure
- Environment
- Innovation and Investment
- Taxes and Spending

The tool enables useful comparisons among states by controlling for size and by putting the rankings in a meaningful context. The analysis controls for size by maximizing the use of rates, percentages, location quotients, and other calculations that compare relative performance without the biases inherent in size rankings (which tend to favor the large states, such as California, Texas, and New York). The list of indicators is led by population size to underscore the issue of a skewed distribution and to ensure users have a common understanding of where each state falls with regard to this characteristic. It adds meaningful context by showing the results relative to an expected distribution.¹ If a state does not lie within this "normal" range, it is either a high outlier or a low outlier.

A discussion of findings from selected categories is provided here. The full results were delivered as an interactive element in the *Baseline Economic Explorer* and will be included in the final web product at the conclusion of this project, in partnership with TABCCF.

¹ TIP analysts approached this problem by applying a modified version of a statistical technique called a normal distribution. A normal distribution is calculated as one standard deviation from the mean or average. In the State Comparison Tool, the reference point is the median, or midpoint, of the data distribution, so the corresponding calculation was the median absolute deviation.

Indicators: Economy

There is no question that Texas has had one of the nation’s highest performing economies in recent decades. Texas’ average annual real GDP growth ranked third in the nation over the 23-year period from 1997 to 2020. Moreover, when adjustments are made to account for the volatility (i.e., boom-and-bust cycles), Texas ranked second in GDP growth. This demonstrates the state’s success in diversifying its economy, since the 1980s, away from an overreliance on oil and gas. Texas has emerged as a powerhouse for high-growth sectors, such as aerospace, healthcare, biotechnology, professional services, computer and electronics manufacturing, information technology, and logistics.

Two export indicators included in this section are also worth emphasizing. Texas ranked second in the nation in terms of total goods exports per capita. However, Texas was a low outlier for manufactured exports as share of total exports. These numbers likely reflect the outsized importance of the state’s energy sector related to exports.

Figure 4. State Comparison Indicators: Economy

Indicator	Texas	Median for All States	Texas' Rank		
			Low Outlier	Normal Range	High Outlier
Per Capita Personal Income (\$), 2020 ⁽¹⁾	\$55,129	\$55,675		28	
Per Capita Real GDP (\$), 2020 ⁽²⁾	\$59,069	\$50,195			14
Average Annual Real GDP Per Capita Growth (%), 1997–2020 ⁽³⁾	1.28%	0.95%		16	
Average Annual Real GDP Growth (%), 1997–2020 ⁽³⁾	3.04%	1.78%			3
Risk-Adjusted Annual Real GDP Growth (%), 1997–2020 ⁽⁴⁾	0.69%	-0.63%			2
GDP Volatility, 1997–2020 (Standard Deviation of Annual Growth Rates) ⁽⁵⁾	2.35	2.35		25	
Goods Exports Per Capita (\$), 2020 ⁽⁶⁾	\$9,583	\$3,540			2
Manufactured Exports as a Share (%) of Total Exports, 2020 ⁽⁷⁾	55.19%	74.57%	44		
Capital Expenditures as a Share (%) of Sales in the Manufacturing Sector ⁽⁸⁾	3.11%	2.90%		18	

Source(s): **US Bureau of Economic Analysis** [Per capita personal income (dollars), Table SAINC1; Real Gross Domestic Product (millions of chained 2012 dollars), Table SAGDP1; BEA Mid-Year Population, Table SAINC1]; **US Census Bureau** [Annual Survey of Manufactures: Geographic Area Statistics: Summary Statistics for Industry Groups and Industries in the US and States: 2019, Table AM1831BASIC02]; **TIP Strategies, Inc.**

Note(s): (1) The BEA calculates personal income from all sources divided by the state's population. The number represents a per-person average rather than a household measure. (2) Real gross domestic product (GDP) per capita represents a per-person average rather than a household measure. (3) The real GDP per capita growth rate is compounded annually for the 23-year period measured. (4) Risk adjusted growth is a theoretical metric that attempts to filter out the impacts of instability. It represents the difference between the average annual growth rate and its calculated volatility score (the standard deviation of annual growth rates) over the 1997–2020 period. (5) The volatility of the real growth rate is calculated as the standard deviation of annual growth rates from 1997 through 2020. Higher outliers imply more cyclical economic volatility. (6) Calculated as a state's total exports divided by its population in the same year. State exports are tabulated using an origin-of-movement methodology that attempts to determine the state in which goods began their journey to the port of export. (7) Non-manufactured exports may include agricultural, forestry, fishery products, mineral commodities, scrap, waste, and used or second-hand merchandise. State exports are tabulated using an origin-of-movement methodology. (8) Calculated as total capital expenditures in the manufacturing sector in a given year by the sector's total sales, value of shipments, or revenue.

Indicators: Talent Pipeline

Texas places in the top three among US states in terms of the size of its population (second) and its growth rate (third). Between 2010 and 2019, Texas was among the top tier of states in drawing in people from other parts of the country, ranking 12th in domestic migration rates per 100,000 residents. All of which contributes to the state’s young and dynamic talent pool. However, when viewed from an education and training perspective in Figure 5, the state does not fare as well. On a range of indicators related to investments in public education and educational attainment rates, Texas’ performance is considerably more lackluster. Of particular concern for the state’s future growth and competitive position are the rates of degrees awarded in STEM-related fields and the level of four-year degree holders among those workers in the prime earning years. One bright spot is that Texas continues to be a relatively low-cost choice for undergraduate education (32nd), with the average cost of attendance at a public four-year university falling well below similarly sized state like California (15th) and New York (14th).

Figure 5. State Comparison Indicators: Talent Pipeline*

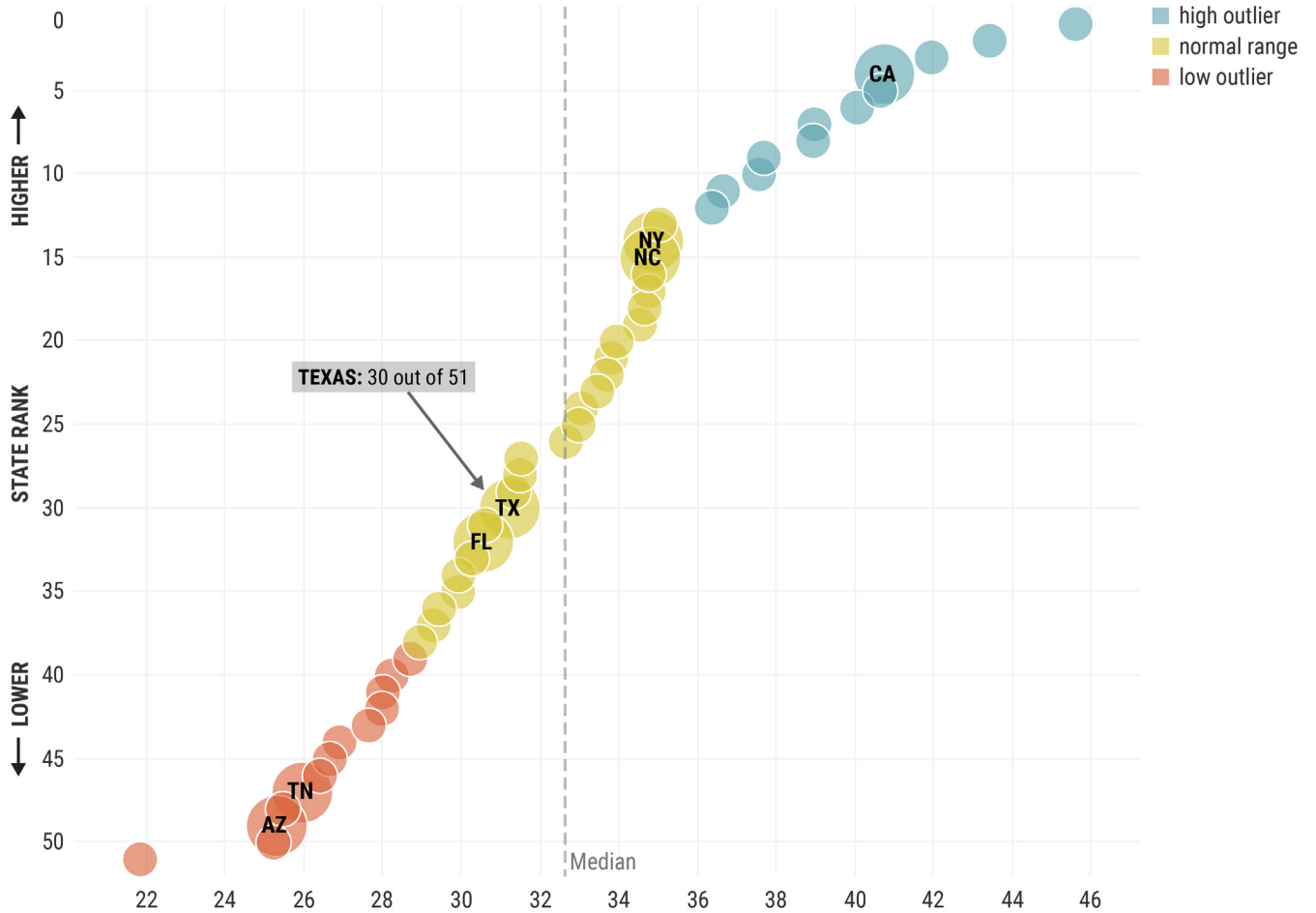
Indicator	Texas	Median for All States	Texas' Rank		
			Low Outlier	Normal Range	High Outlier
Public School Expenditures (% of GDP), 2017 ⁽⁹⁾	3.06%	3.21%		33	
Public School Expenditures (\$ per Student), 2017 ⁽⁹⁾	\$9,520	\$11,538		42	
Eighth Grade Mathematics Proficiency (%), 2019 ⁽¹⁰⁾	30.00%	33.00%		35	
AP Exam Participation (% of Graduating Class), 2014 ⁽¹¹⁾	35.35%	29.58%		13	
Educational Attainment: Bachelor's Degree or Higher (%), 2019 ⁽¹²⁾	30.80%	32.30%		28	
Share of Prime Working Age with a Bachelor's Degree or Higher (%), 2019 ⁽¹³⁾	33.06%	35.99%		34	
Average Annual Undergraduate Costs (\$), 2019 ⁽¹⁴⁾	\$18,779	\$19,869		32	
Associate Degrees in Technology Conferred (per 1,000 18–24 Yr. Olds), 2019 ⁽¹⁵⁾	1.50	1.23		19	
Science and Engineering Degrees (% of Degrees Conferred), 2019 ⁽¹⁶⁾	31.22%	32.64%		30	
SEH Graduate Students (per 1,000 25–34 Year Olds), 2018 ⁽¹⁷⁾	11.64	13.54		32	
State Support for Higher Education per Full-Time Equivalent Student, 2019 ⁽¹⁸⁾	\$5,587	\$6,618		36	

* Indicators are from the Early Education and Higher Education categories within TIP’s State Comparison Tool.

Source(s): National Science Foundation; National Science Board; National Center for Science and Engineering Statistics (NCSES), Science and Engineering Indicators 2020; US Census Bureau, American Community Survey, 2019 1-Year Sample, S1501_C02_015E; National Center for Education Statistics, Integrated Postsecondary Education Data System; TIP Strategies, Inc.

Note(s): (9) Public education spending covers primary and secondary school expenditures but excludes spending on public higher education. (10) Calculations are based on the National Assessment of Educational Progress (NAEP) scores and include public school students, only. (11) Calculations are based on Advanced Placement (AP) data reported by the College Board and only includes public school students. (12) The results shown are drawn from the Census Bureau’s 2019 1-year sample of the American Community Survey and represent the share of the population age 25 or older with a bachelor’s degree or higher. (13) This metric represents a more precise measure of educational attainment among younger workers, ages 25 to 44. (14) Average costs include in-state tuition, fees, room, and board for full-time equivalent undergraduate students at public four-year institutions. Data are not available for the District of Columbia. (15) Calculations of degrees conferred are based on the Integrated Postsecondary Education Data System (IPEDS) as of November 2020. (16) Higher education degrees include bachelor’s, master’s, and doctoral degrees. (17) SEH = science, engineering, and health. (18) State support for higher education excludes special purpose appropriations for research, agricultural extension programs, and medical education. FTE enrollment includes only enrollment at public higher education institutions and equates student credit hours to full-time, academic-year students but excludes medical students.

Figure 6. Science and Engineering Degrees
Percent of Total Degrees Conferred, 2019



Source(s): National Science Foundation; National Science Board; National Center for Science and Engineering Statistics, Science and Engineering Indicators 2020.

Note(s): States in a "normal range" fall one median absolute deviation (MAD) from the median of all states. States outside this range are displayed as "high outlier" and "low outlier."

Indicators: Innovation and Investment

Texas is home to more Carnegie Tier 1 research universities than any state in the US. It produces more new, highly trained advanced degree and university graduates than any state but California. The state is home to major new medical innovation centers in Dallas and Houston. Texas has an R&D sales tax credit to attract leading-edge innovation. The state-endowed Cancer Prevention and Research Institute of Texas (CPRIT) provides nondilutive investment to researchers and potential commercializers in this critical field. Texas hosts innovation centers in Austin, San Antonio, Houston, and Dallas.

However, despite major advances in the 1980s and 1990s with the advent of SEMATECH and the Microelectronics and Computer Technology Corporation (MCC) in Austin, Texas remains a relative newcomer to innovation. The state represents 10 percent of the nation’s angel capital but is a marginal—though growing player—in VC, well behind California, New York, and Massachusetts. Among the various innovation indicators related to R&D and VC and expenditures and investment, Texas generally ranks in the middle of the 50 states and the District of Columbia. The lone indicator that is a high outlier for the state is total federal R&D expenditures.

While Texas ranks in the top 10 among US states in terms of total R&D expenditures, the state falls to 33rd when expenditures are considered on a per capita basis.

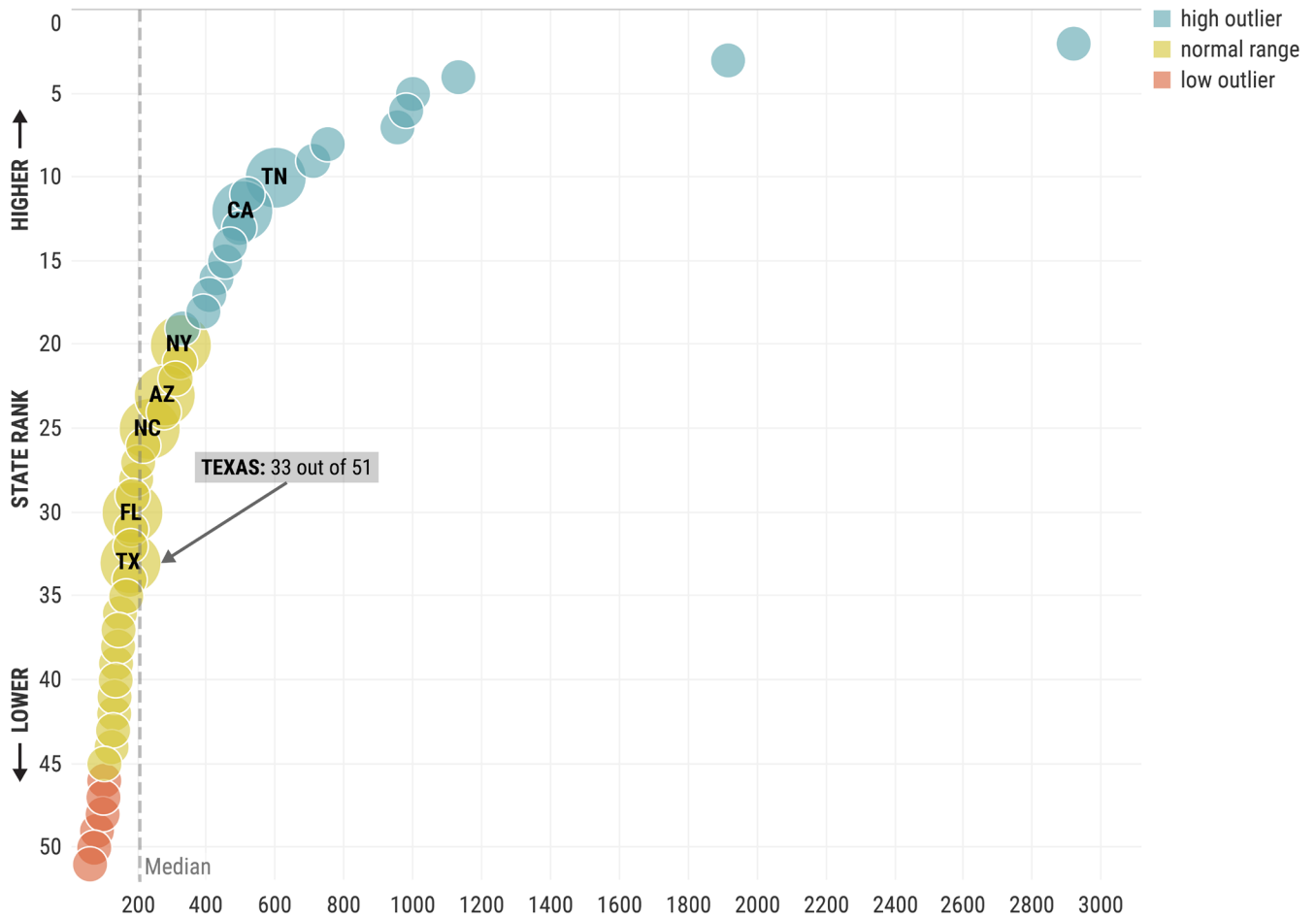
Figure 7. State Comparison Indicators: Innovation and Investment

Indicator	Texas	Median for All States	Texas' Rank		
			Low Outlier	Normal Range	High Outlier
Total R&D (% of GDP), 2017 ⁽¹⁹⁾	1.63%	2.14%		31	
Business-Performed R&D (% of Private-Industry Output), 2018 ⁽²⁰⁾	1.30%	1.32%		27	
State Agency R&D Expenditures (Per \$1 Million of GDP), 2019	\$123	\$87		20	
Total Federal R&D Expenditures (\$ Millions), 2019 ⁽²¹⁾	\$5,132	\$923			10
Total Federal R&D Expenditures Per Capita (\$), 2019 ⁽²¹⁾	\$177	\$214		33	
Average Annual Growth of Federal R&D Expenditures (%), 1999–2019 ^{(21), (22)}	-0.55%	1.85%	43		
SBIR/STTR Awards by NIH (\$ Per Capita), 2020 ⁽²³⁾	\$5.54	\$8.48		30	
SBIR/STTR Funding (Per \$1 Million of State GDP), 2016–2018	\$70	\$93		32	
Venture Capital Disbursed (per \$1 Million of GDP), 2019 ⁽²⁴⁾	\$1,993	\$1,737		24	
Venture Capital Disbursed per Deal (\$ Millions), 2019 ⁽²⁴⁾	\$6.79	\$5.57		23	

Source(s): National Science Foundation; National Science Board; National Center for Science and Engineering Statistics (NCSES), Science and Engineering Indicators 2020 and Survey of Federal Funds for Research and Development; Small Business Administration (SBA); US Census Bureau, 2020 Decennial Census; Pitchbook; TIP Strategies, Inc.

Note(s): (19) R&D includes performance by federal agencies, businesses, universities, other nonprofit organizations, federally funded research and development centers, and state agencies. (20) This metric attempts to measure the extent of business R&D in state economies. (21) R&D shown includes fixed investments for R&D plant. The Survey of Federal Funds for Research and Development is the primary source of information about federal funding for R&D in the United States. (22) Calculations are in constant dollars. (23) Awards for Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) may be awarded by any government agency. Per capita award rates shown in this figure specifically reflect grants awarded in 2020. The data were sourced through the SBA. (24) Calculations are based on PitchBook's venture capital and private equity database as of February 2021.

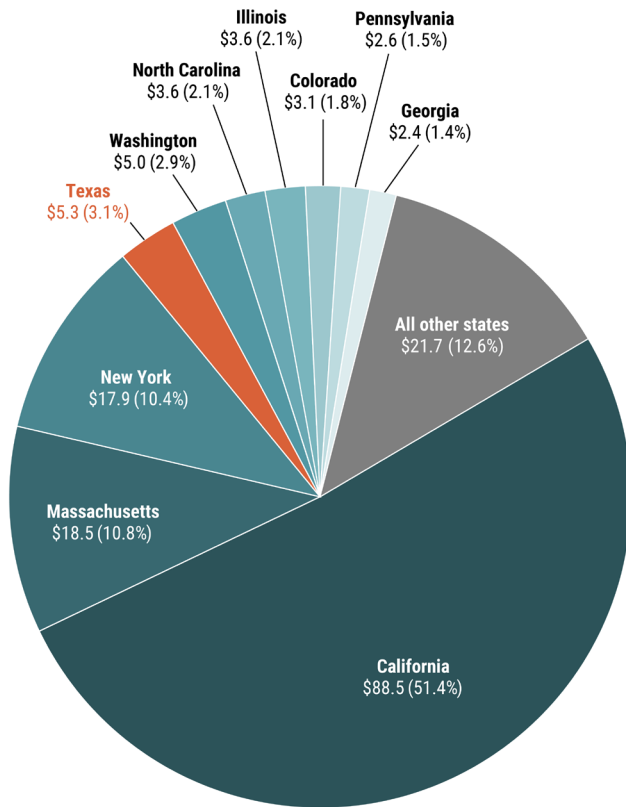
Figure 8. Total Federal R&D Expenditures Per Capita (\$), 2019



Source(s): National Science Foundation; National Science Board; National Center for Science and Engineering Statistics, Survey of Federal Funds for Research and Development; TIP Strategies, Inc.
 Note(s): States in a "normal range" fall one median absolute deviation (MAD) from the median of all states. States outside this range are displayed as "high outlier" and "low outlier." The District of Columbia is an extreme high outlier and has been omitted to improve the readability of this chart.

VC funding is a critical component of an innovation ecosystem. For most sectors, the majority of VC investment comes from within the US and is mostly split between investors from the Northeast, the West Coast, and Texas (Figure 9, page 18). The energy sector is an exception to this trend. Texas investors account for almost one-third of VC investment in the sector; international investors account for nearly one-half of VC awarded to Texas firms. When looking across all sectors, VC investments in Texas have gone almost exclusively to the major metro areas in the past five years. Most new firms locate in or near population centers to take advantage of resource proximity to knowledge centers and agglomeration economy benefits.

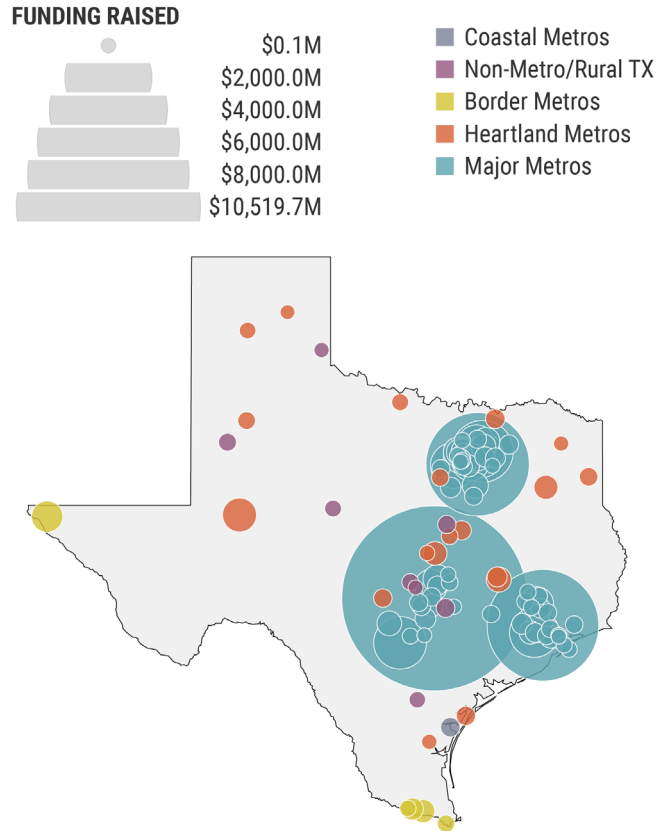
Figure 9. Venture Capital Disbursed by State in 2020
(in \$ Billions)



Source(s): National Science Board. "Millions of Venture Capital Dollars Disbursed" Science and Engineering Indicators: State Indicators. Alexandria, Virginia: National Science Foundation. <https://nces.nsf.gov/indicators/states/indicators>. Accessed on October 27, 2022.

Note(s): Data were originally reported by the National Science Board in millions of US dollars. For this chart, the numbers have been adjusted to billions of US dollars.

Figure 10. Texas Venture Capital Destinations
Venture Funding by Location, 2015–2021



Source(s): Crunchbase; TIP Strategies, Inc.

Note(s): Circle sizes represent amount of funding announced in the selected interval. Circle color represents the regional group where the recipient company is headquartered. Only active funded companies as of September 2021 are included. Crunchbase is a crowdsourced dataset. All analysis should be interpreted with these limitations in mind.

Reshoring Assets

Texas has benefited from recent global trends, including supply chain disruption, trade policy, and rising labor costs in offshore locations, that have pushed firms to consider bringing jobs and production back to the US (reshoring) or to neighboring trading partners, like Mexico or Canada (nearshoring). According to the Reshoring Initiative, Texas gained just over 15,000 jobs in 2021 due to the reshoring of 78 companies. Texas’ performance in 2021 was second only to Michigan, which added 17,300 jobs.² The reshoring trend is expected to continue with the Reshoring Initiative predicting as many as 350,000 jobs returning to the US through 2022. Positioning the state to maximize this opportunity should be an essential part of a competitiveness strategy.

Reshoring decisions involve a variety of factors, many of which are not in a region’s control, such as location of natural resources, shipping costs, and global political and economic climates. As a result, this analysis examines reshoring through a competitiveness lens, with the goal of answering the questions: Which factors make Texas competitive now? What does the state need to compete in the future? This section begins with a brief discussion of supply chain disruptions followed by an analysis of relevant factors, organized into four main categories: geography, infrastructure, energy, and workforce.

ONSHORING AND NEARSHORING IS RAPIDLY ACCELERATING

Economic future of US depends on making engineering cool

Purdue University races to expand semiconductor education to fill yawning workforce gap that threatens reshoring effort.

By Jeanne Whalen
October 23, 2022

The Washington Post

US Manufacturers “Pumped Up” About Supply-Chain Reshoring Trend

- US companies will reshore 25% more jobs than in 2021: Deloitte.
- Pursuit of supply-chain resiliency to increase production cost.

By Bryce Baschuk
November 1, 2022

Bloomberg

US Companies on Pace to Bring Home Record Number of Overseas Jobs

After COVID-19 pandemic upended supply chains, American companies are shifting jobs and processes to the US.

By Jeanne Whalen
October 23, 2022

THE WALL STREET JOURNAL

US Factory Boom Heats Up as CEOs Yank Production Out of China

- The pandemic forced companies to rethink their supply chains.
- “This is just economics,” says one executive who made the move.

By Ryan Beene
July 5, 2022

Bloomberg

Reshoring Is Soaring in 2022—350,000 New Jobs Predicted

More than two years of constant global catastrophes is driving a huge increase in the number of companies bringing work back to the US.

By Michael Ouellette
Aug 28, 2022

engineering.com

Weary of Snarls, Small Businesses Build Their Own Supply Chains

They’re shifting to domestic sourcing and production, like some big manufacturers, but with at least one advantage the giants don’t have.

By Amy Haimerl
October 19, 2022

The New York Times

² Reshoring Initiative® 2021 Data Report: [Essential Product Industries Drive Job Announcements to Record High](#), Exhibit 8a. Jobs by State, Top 10, 2021 Only.

TEXAS' ADVANTAGES ARE RESULTING IN BIG WINS

Samsung Floats Nearly \$200 Billion Spend on New Texas Chip Plants in Next Decades

The South Korean tech company divulged proposed spending in filings, but isn't obliged to commit to the investments.

By Jiyoung Sohn
July 21, 2022

THE WALL STREET JOURNAL

Texas Instruments breaks ground on new \$30 billion manufacturing plant

The landmark investment could reach \$30 billion and create as many as 3,000 jobs over time.

By Texas Instruments
May 18, 2022

TEXAS INSTRUMENTS

Steel Dynamics Opens \$1.9 Billion Next Generation Mill in Texas

The mill located in Sinton, Texas will use the next generation of EAF steelmaking to produce high-quality, lower-carbon, sustainable steel.

By Steel Framing Industry Association
2022

BuildSteel™

Governor Abbott Announces New \$1.7 Billion USA BioEnergy Advanced Biorefinery In Bon Wier

By Office of the Texas Governor
February 15, 2022



Producer Owned Beef announces \$670 million facility in Amarillo during event Wednesday

By Michael CuvIELLO
August 10, 2022

AMARILLO GLOBE NEWS

Occidental plans up to \$1 bln for facility to capture carbon from air

By Sabrina Valle
March 23, 2022

REUTERS

Supply Chain Disruption

As part of the strategic planning process, TIP conducted an online survey of business decision-makers familiar with the Texas business environment. The TABCCF Resilience Survey was open for a 16-week period between November 5, 2021, and February 28, 2022, and drew 90 respondents. The survey instrument opened with nine basic questions about respondent demographics, location, and professional responsibilities. The remainder of the survey included eight questions directed at supply chain resilience. All responses were confidential. Question-by-question survey results are provided in this interactive data visualization using Tableau Reader. The key findings of this survey were used to guide the direction of the strategic plan.

Nearly all respondents (83 percent) self-identified as having decision-making responsibility. Roughly two-thirds of respondents (57 of 87 answering this question) were based in major Texas metropolitan areas, while less than one-tenth of respondents (7 of 87 answering this question) were based outside of Texas. Roughly three-quarters of respondents (65 of 86 answering this question) work for companies with fewer than 50 employees. The survey was not designed to be a scientific sample, nor was the pool of respondents large enough to provide standalone strategic feedback. Nevertheless, the survey did yield valuable corroborating input from a small, carefully targeted group of professionals doing business in Texas.

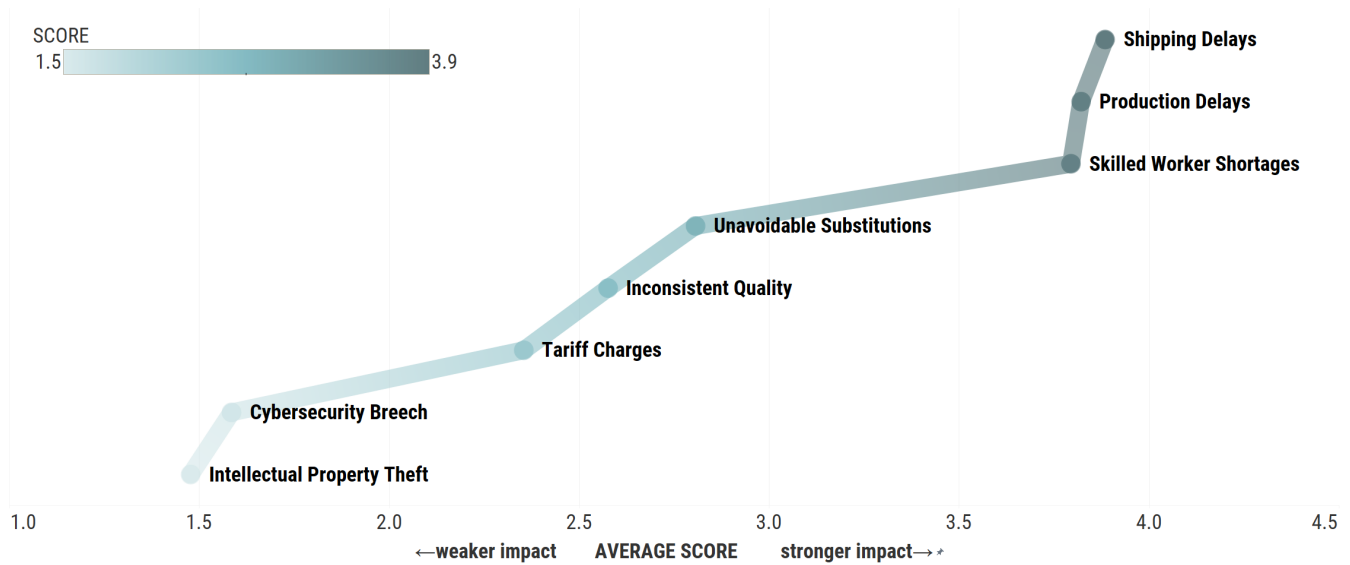
The following findings emerged from the survey.

- **Skilled worker shortages are top of mind.** Supply chain disruptions were seen as being broader than just shipping and production delays alone. Survey respondents identified skilled worker shortages as one of their top supply chain disruptions of the past three years (with an average score of 3.8 out of 5.0). Exposure to skilled worker shortages was viewed as even more disruptive to international supply chains than to domestic channels during the same three-year window. Respondents expressed pessimism that the pipeline of skilled workers was likely to improve. They chose skilled worker shortages as the disruptive factor most likely to persist over the next three to five years as well as the disruptive factor with the most potential impact.

- **Transportation and logistics continue to be bottlenecks.** Along with shortages of skilled labor, respondents rated shipping and production delays as major disruptive forces of the past three years, with average scores of 3.9 and 3.8, respectively (see Figure 11). Consistent with this theme, respondents indicated transportation and logistics cost and reliability as leading disruptors to both domestic and international supply chains.
- **Localizing or nearshoring of production and suppliers is viewed favorably.** A large share of respondents were receptive to the idea of localizing or nearshoring suppliers or production as a plausible course of action for mitigating risks. And in a separate question, more than one-half of respondents (62.6 percent), indicated risk mitigation as the most compelling reason to localize or nearshore suppliers or production.

Figure 11. Supply Chain Disruptions

On a scale of 1 to 5 where 5 is the most severe, how has your workplace been impacted by the following supply chain disruptions in the past three years?



Source(s): Survey results compiled by TIP Strategies, Inc.

Note(s): The scale indicates the average score, with 5 being the highest possible and 1 being the lowest possible. Of the 90 total respondents, 69 answered this question.

Geographic Location

Texas has several geographic advantages: it is centrally located between the east and west coasts, shares a 1,254-mile border with Mexico, and has direct access to the Gulf of Mexico. These intrinsic advantages are significant to the state’s competitiveness as they offer businesses access to a variety of raw materials, suppliers, and markets.

Texas’ expansive shared border with Mexico has resulted in extensive cross-border trade. There are currently 29 ports of entry, which include land and seaports, intermodal ports, and airports. These connections have enabled a strong trading relationship with Mexico, strengthened by the North American Free Trade Agreement (NAFTA) and now the United States-Mexico-Canada Agreement (USMCA). Trade between the countries has grown significantly. In 2021, Texas exported \$122.7 billion in goods and imported \$108.4 billion. Top traded goods included oil and gas, chemicals, plastics, electric machinery, and vehicles and parts. These exports and imports include final goods, as well as inputs, many of which cross the border several times during the production process.

Mexico’s well-developed maquiladora industry along the border has played a substantial role in cross-border supply chains and the Texas economy. As China’s wages have surpassed Mexico’s in recent years, Mexico has become increasingly attractive to manufacturers looking to relocate. This change, in conjunction with the political and economic uncertainty, has meant some businesses are adopting a China-plus strategy—one that does not involve a full departure from China, but rather, a diversification to other countries.

Texas’ shared border with Mexico means the state can benefit from nearshoring as well as reshoring. Companies that choose to locate along Mexico’s border may engage in cross-border trade, benefiting suppliers located in the US as well as the transportation, trade, and warehousing industries. Mexico’s role in Texas’ economy will only continue to grow.

Infrastructure

Texas’ geographic advantage is significant, but to realize its full potential, efficient and resilient infrastructure is essential. Texas’ ports and the transportation systems that connect them—including highways, railways, shipping channels—are vital to its manufacturing and production businesses. These vital assets require consistent investment for maintenance and modernization.

However, there is evidence that Texas is struggling to maintain some of its assets. According to the American Society of Civil Engineers, Texas’ overall infrastructure score was a C in 2021. The state received a B- in both aviation and bridges, and a D+ and a D in dams and levees, respectively. Notably, the state received a C- in flood risk mitigation, and a D+ in highways and roads.

Figure 12. 2021 Texas Infrastructure Report Card
Grade and Estimated Funding Needs for Selected Infrastructure Categories

B-	<p>AVIATION</p> <ul style="list-style-type: none"> • Growing needs will require an estimated \$11.2 billion over the next five years.
B-	<p>BRIDGES</p> <ul style="list-style-type: none"> • \$3.6 billion needed annually over the next 10 years. • \$18 billion over same period to erase backlog of deficient bridges.
C-	<p>FLOOD RISK MITIGATION</p> <ul style="list-style-type: none"> • Needs exceeding \$31.5 billion over the next decade.
D+	<p>DAMS</p> <ul style="list-style-type: none"> • \$5 billion to rehabilitate all non-federal dams.
D+	<p>HIGHWAYS AND ROADS</p> <ul style="list-style-type: none"> • \$15 billion annually through 2040. • Texas gas tax has remained fixed since 1991.
D	<p>LEVEES</p> <ul style="list-style-type: none"> • More than 1 million Texans and \$127 billion worth of property are protected by levees. • Not possible to estimate needed funding without a clearer picture of the state’s levee infrastructure.

Source(s): Texas Section of the American Society of Civil Engineers.

Delays at land ports of entry have also been a concern. According to the *Texas-Mexico Border Transportation Master Plan*, in 2019 these delays resulted in \$2.3 billion in reduced GDP in both the US and Mexico. Using projections for population, employment, and income growth, the report estimates these delays will result in \$116 billion in reduced GDP by 2050. The plan estimates that to address these delays, 661 projects are needed in both the US and Mexico, at a cost of \$37.4 billion.

5G Investments

Texas' future competitiveness will not only rely on its transportation, flood mitigation, and wastewater infrastructure, but also on its technology infrastructure, specifically 5th-generation mobile network (5G) infrastructure and beyond. 5G promises higher speeds, low latency, and greater bandwidth, all of which will enable a host of new technologies and services.

Most relevant to this work, 5G will be the key to unlocking Industry 4.0, which encompasses the digitalization of the manufacturing process through the application of technologies, such as the Industrial Internet of Things, big data, artificial intelligence (AI), remote sensing, digital design, and advanced automation. Industry 4.0 can lower costs of production for manufacturers in Texas by reducing waste, preventing major equipment failure, and filling employment gaps.

While 5G can operate on low, mid, and high bands, high-band 5G—which is not yet widely available—will enable the most notable advances. Enabling high-band 5G will require two significant investments: spectrum and small cell infrastructure. The Federal Communications Commission (FCC) has started auctioning spectrum, which telecommunications companies can then use to transmit 5G connectivity. The high stakes of owning the adequate spectrum band have made these auctions increasingly expensive. The latest auction in January 2021 grossed more than \$80.9 billion.

Small cells enable the transmission of 5G through walls and other physical obstacles. Unlike previous mobile network generations that could be communicated via large but sparse towers, 5G requires smaller, more closely situated “cells.” As of 2020, Texas cities have approved 10,720 sites for small cells. Just over one-half of these are in Houston.

A coordinated effort between public and private entities will be necessary to ensure Texas' competitiveness in this space. An existing example of this kind of cooperation can be found in the Texas Department of Transportation (TxDOT) small cell leasing program. Both Texas House and Senate budget proposals in 2023 propose substantial increases in state funding for broadband deployment.

Infrastructure Funding

As of 2018, Texas' capital spending represented 13.3 percent of total state spending, a 0.38 percent decrease from 2002–2016. Per capita expenditure was estimated to be between \$500 and \$750 in 2018, which is on par with the national average. However, Texas' outsized role in the US economy and its position as the gateway to one of the nation's top trading partners reasonably requires above-average infrastructure needs and investment. Further, population growth and increased road usage has meant that the state's gas tax and current funding levels cannot keep up with growth.

Texas' ability to keep up is also reflective of national budgeting. The US spends less on infrastructure than other developed nations—just 2.5 percent of GDP, while China spends 8 percent of GDP, and the European average is 5 percent of GDP. Only 25 percent of funding for state infrastructure projects comes from the federal government, placing the burden on states to fund improvements.

However, the federal Infrastructure Investment and Jobs Act passed in 2021 will allocate approximately \$35.44 billion in funding to Texas. Most of these funds are allocated to state highway programs, but other eligible

projects include bridge replacement and repairs, protection against wildfires and cyberattacks, the expansion of the electric vehicle (EV) charging network, and broadband access.

Energy

A discussion of infrastructure must include a discussion of energy infrastructure. Texas has an ample supply of natural gas, which helps keep energy prices comparatively low in the state. This energy supply is a clear advantage for the state but aging thermal utility infrastructure is a cause for concern. Winter storm Uri in 2021 exposed vulnerabilities in the Texas system that need to be addressed. Senate Bill 3, passed in 2021, requires weatherization but exempts natural gas companies if they voluntarily do not declare themselves to be critical infrastructure.

As the state continues to grow and attract business, especially in energy-intensive industries, such as petrochemical plants and data centers, energy demand will increase as well. Being able to supply this demand without interruption will be a challenge unless energy grid capacity is increased and systems are made more reliable and resilient.

While oil and gas will remain a large component of the Texas economy, renewable energy production is expanding in the state. Consumption of renewables amounted to one-quarter of total energy consumption in 2020 (up from 8 percent in 2010). Utility-scale solar capacity in Texas is also growing rapidly. Last year, roughly 40 percent of clean energy deals (5,500 megawatts out of 13,600 megawatts), most of which were in solar, were in Texas. Investments in energy infrastructure and diversified energy sourcing can make Texas more resilient to shocks and better able to serve Texas business.

Workforce

The COVID-19 pandemic accelerated existing workforce trends that resulted in the current tight labor market. Earlier-than-anticipated retirements, lack of affordable childcare options, and low wage growth all contributed to lower labor force participation rates and exacerbated labor shortages across a variety of industries. While this challenge is hardly unique to Texas, it will be up to each state to address the shortages.

Nearly one-third of adults in Texas (30 percent) hold a bachelor's degree, a number that is on par with the national average. Meanwhile, advanced industry employment in Texas—which includes manufacturing jobs—outpaces many states. Texas' large number of institutions of higher education, which support educational opportunities, research, and employment, are also an asset.

But low high school graduation rates, decreasing labor force participation, and low wage growth pose additional obstacles to alleviating labor shortages. Texas' high school graduation rate ranks near the bottom nationally, at 84 percent. Labor force participation rates in the state have hovered around 63 percent for much of the past decade, a figure just slightly above the national average. Further, wage growth has been below national averages, making a less compelling case for workers to choose employment in the state.

In manufacturing specifically, a lack of work-life balance and low wages are often cited as reasons for leaving jobs. With thousands of jobs in manufacturing projected to come to Texas in the next decade based on agreements signed in 2022, it is essential that the state attract and develop the workforce to fill them, taking into consideration current skill needs as well as future skill needs. Providing targeted educational opportunities could strengthen the talent pipeline and address some of these concerns.

Immigration policy reform is also worth consideration. Reskilling workers takes time. Offering opportunities to skilled workers abroad could help alleviate shortages in the short term. Further, decreasing birthrates will pose a challenge in the coming decades; enabling population growth through immigration could help avert a crisis in the future.



SECTION

4

Competing on Texas' Strengths

Texas is home to one of the most dynamic and resilient economies in the world. The state is a premier destination for jobs, investment, talent, and innovative technologies. However, maintaining Texas' competitive edge requires new initiatives and investments that address barriers to higher levels of growth. Many of these issues were highlighted by stakeholders around the state who contributed to this planning process. They identified challenges related to the state's talent pipeline, infrastructure, regulatory environment and incentives toolbox, and local supply chains. The recommendations in this section are designed to strengthen the underlying foundations of the Texas economy, which in turn will make the state more competitive for reshoring opportunities.

Goal 1. Talent

Strengthen the talent pipeline for Texas employers.

For decades, Texas has served as a beacon for dreamers and doers seeking opportunity. Since oil was discovered in the ground more than 120 years ago, Texas has built its economic strength on attracting people willing to relocate in hopes of a better life for themselves and their families. Looking ahead, for Texas to assume its rightful place at the nexus of technological, financial, and economic sovereignty, communities and regions across the state must grow more of their own skilled workforce to fully partake in the opportunities Texans are creating and ease barriers to attracting the finest the world has to offer. The 88th Legislature made a substantial investment in Texas higher education by creating the \$3 billion Texas University Fund and realigning community college funding around outcomes and workforce alignment.

Throughout the planning process, stakeholders in Texas indicated their greatest challenge is finding and retaining talent. Certainly, this was a major issue for employers prior to the pandemic. However, workforce availability is now the paramount concern for Texas businesses of all sizes and across industries. As Texas continues to be the leading destination for new investment and employment opportunities, deepening and expanding the pipeline of skilled workers through talent development programs is crucial to meeting existing and future demand. It will require new initiatives and additional resources that are coordinated and implemented at the state and local levels.

Strategies and Actions

- 1.1. Study state and regional workforce plan alignment with Texas competitiveness priorities.
- 1.2. Ensure Texas is producing a world-class talent pipeline for current and future employers by continuing to improve educational outcomes for K–12 students.
 - 1.2.1. Maintain the statewide A-F Accountability System for rating K–12 academic performance.
 - 1.2.2. Expand bilingual proficiency among students.
 - 1.2.3. Promote entrepreneurship education, to include personal finance, within each endorsement in the state's foundation graduation plan.
 - 1.2.4. Expand dual credit and career and technical education programs provided by public junior colleges, state colleges, and technical colleges in partnership with school districts.

- 1.3. Adopt and enact the Texas Commission on Community College Finance recommendations for creating a new funding model that is tied to student outcomes. This issue was addressed the 88th Legislature with the passage of House Bill 8, which established a new funding model for community colleges in Texas that prioritizes an outcomes-based approach and rewards colleges for awarding degrees, certificates, and other credentials of value. Preliminary estimates show that, if adopted, the commission’s recommendations would require the Texas Legislature to appropriate somewhere between \$600 million and \$650 million in additional state funding toward community colleges for the next biennium.
 - 1.3.1. Community college enrollment rates have largely been flat despite aggressive Texas population growth. Texas should focus on strategies to understand and enroll increasingly larger numbers of adults into upskilling programs aligned with growth industries. Enrollment processes should be simplified and interoperability of credit should be improved.
- 1.4. Support the Texas Higher Education Coordinating Board’s strategic plan to simplify pathways, expand access, boost education attainment, align, and accelerate research.³
- 1.5. Expand the Toward EXcellence, Access, and Success Grant Program (TEXAS Grant) and the Tuition Equalization Grant to Texans studying in key fields aligned with the state’s critical technologies. The Texas Legislature should explore how to expand the number of US citizens, and Texans specifically, who can fully attend and complete their STEM studies in a Texas public university.
- 1.6. Support Governor Abbott’s funding request to attract global, high-production research talent through GURI.
- 1.7. Expand slots for US doctoral degree candidates in Texas higher education institutions for mission-critical fields of study.
- 1.8. Support local and regional efforts to educate, inform, and expose Texas high school students about high skill, high-wage career opportunities that do not necessarily require a four-year college degree.
 - 1.8.1. Invest \$20+ million to improve marketing and ease of enrollment into fast-growing, highly skilled trades through the Make It Movement, a 501(c)(3) nonprofit based in Austin that seeks to reach out to youth in the Central Texas region through school counselors, teachers, and parents to raise awareness of career pathways to high-income jobs.
 - 1.8.2. Target career exploration activities around the locally developed Target Occupations lists from the 28 workforce boards across the state.
 - 1.8.3. Expand apprenticeship, internship, and work-based learning opportunities in skilled trades.
- 1.9. Create a tuition-free Texas Digital Service Academy to answer the growing demand for highly skilled computer programmers in the state. The academy could function as a standalone institution or could be embedded in an existing institution. It’s purpose should be to attract world-class, Texas-based, US citizens who agree to serve the Texas state government, after graduation.

CRAFT TRAINING CENTER OF THE COASTAL BEND

The Craft Training Center of the Coastal Bend provides US Department of Labor-approved four-year apprenticeship training programs, allowing students to receive paid, on-the-job training while simultaneously completing their coursework. The program currently offers apprenticeship training programs for electrical and plumbing.

www.ctccb.org/programs/apprenticeship-programs

³ <https://reportcenter.highered.texas.gov/agency-publication/miscellaneous/agency-strategic-plan-fiscal-years-2023-2027/>

1.10. Advocate for the modernization of federal legal immigration system.

1.10.1. Support the federal passage of the American Dream and Promise Act that would incorporate the provisions of the Deferred Action for Childhood Arrivals (DACA) program into federal law. This would result in over four million Dreamers being eligible for conditional permanent residence or temporary protected status.

1.10.2. Advocate at the federal level for passage of the Stopping Trained in America Ph.Ds. From Leaving the Economy Act of 2017 (STAPLE Act), which provides a path to US citizenship for completers of key graduate and doctoral programs.

1.10.3. Support the passage of legislation to create a path to residency or citizenship for DACA Dreamers. The Bipartisan Border Solutions Act of 2021, which establishes regional processing centers for conducting immigration-related activities and addresses other related issues.

1.11. Double the state funding for the Jobs & Education for Texans (JET) grant program. JET provides grants to eligible entities to purchase and install equipment necessary for the development of career and technical education (CTE) courses or programs that lead to a license, certificate, or post-secondary degree in a high-demand occupation. Eligible grantees include public, junior, or technical colleges; Texas independent school districts (ISD); and open-enrollment charter schools.

1.12. Double state funding for the Skills Development Fund (SDF). SDF grants provide site-specific, customized training opportunities for Texas businesses and their employees to increase skill levels and wages of the Texas workforce. Success comes through collaboration among economic development partners, business partners, and eligible grant applicants, which include public community or technical colleges, the Texas A&M Engineering Extension Service (TEEX), community-based organizations in partnership with one of these entities, or a local Workforce Development Board.

1.13. Support the continued work to develop the credential library as a tool to guide career seekers toward training opportunities with effective career outcomes and a tool to guide employers to recruit talent from high-impact education providers.

1.14. Drive improvements and alignment to the state's prekindergarten through PhD + workforce (PK-20W) education, career, and labor market information systems.

1.15. Launch statewide sector partnerships that align with the target industry clusters identified by the Governor's Office.

1.16. Establish a Texas digital modernization sequence multidisciplinary program to train professionals to lead digital modernization (goals, legal, contracts, human capital) within local, state, and Texas-based federal operations.

TEXAS TARGET INDUSTRY CLUSTERS

- Advanced Manufacturing
- Aerospace, Aviation & Defense
- Biotechnology & Life Sciences
- Energy
- Information Technology
- Petroleum Refining & Chemical Products
- Corporate Services
- Creative Industry

gov.texas.gov/business/page/target-industries

Goal 2. Infrastructure

Build a world-class infrastructure for today and future generations.

For Texas to compete globally for jobs and investment, it must have world-class infrastructure. The rapid expansion of the Texas economy and population over the past few decades has put immense pressure on the state's roadways, airports, seaports, railways, water systems, electric grid, and telecommunications infrastructure. Moreover, disruptions to global supply chains and natural disasters in recent years have exposed vulnerabilities and inadequacies in the state's critical infrastructure. Indeed, enhancing and expanding infrastructure in Texas was a chief need cited by stakeholders throughout the state and across industries.

Texas' competitiveness will not only rely on addressing its infrastructure vulnerabilities, but also on preparing to meet the demands of the future economy. The continued expansion of Texas-Mexico trade will put increasing pressure on the state's ports of entry; high energy needs of tech-centric businesses, like data centers, will place additional demand on the electric grid; and broader adoption of Industry 4.0 technologies will require access to full 5G, which demands vast amounts of new infrastructure. This landscape is still evolving, yet Texas can make investments today to meet the needs of the future global economy.

Strategies and Actions

- 2.1. Advocate for increased capacity at Texas border ports of entry. Trade between Texas and Mexico continues to grow and has been further bolstered by new provisions in the USMCA as well as reshoring trends. While border port-of-entry delays have long been an issue, these delays will worsen at a dramatic economic cost to both Texas and Mexico. Increasing capacity at the border through infrastructure, technology and personnel investments, policy changes, and increased collaboration will be essential to meet the needs of this growing demand.
 - 2.1.1. Modernize Texas ports of entry to improve traffic flows by implementing nonintrusive inspection and a "single window" system for electronic document submission.
 - 2.1.2. Recommend transportation infrastructure investments based on the *Texas-Mexico Border Transportation Master Plan 2021* (rail, airports, seaports). 559 Texas (US) projects at a cost of \$32.7 billion; 26 projects are partially funded (\$2.1 billion), and 353 projects are unfunded (\$25.1 billion).
 - 2.1.3. Increase border inspection staff and expand border crossing hours of operation.
 - 2.1.4. Improve collaboration with Mexico by creating a binational stakeholder group, like the existing El Paso/Ciudad Juárez International Bridges Steering Committee. Goals should include streamlining border procedures and data sharing.
 - Explore the feasibility of leveraging the border to pilot innovative technologies. (See the Michigan-Ontario cross-border partnership mobility corridor, for example.)
 - 2.1.5. Advocate for federal policy changes intended to improve flows of rail traffic across the border, including international crews, international Class I mechanical inspections, and unified cargo processing.
- 2.2. Advocate for increased transportation infrastructure funding. As the state's population and trade continues to grow, additional investments will help meet the growing demand for its vast transportation network. The investments should aim to remediate deficiencies identified by the American Society of Civil

Engineers (ASCE) report, increase capacity to meet current and future demand, and invest in modernization to create efficiencies and enhance competitiveness. The 88th Legislature made a major down payment on allocating \$5 billion toward surface transportation infrastructure and \$400 million for Texas ports.

2.2.1. Advocate for use of Texas budget surplus and US Infrastructure Investment and Jobs Act funds. Texas Transportation Plan 2040 estimates total need at \$547 billion.

2.2.2. Promote the *2022-2023 Texas Port Mission Plan*. The Port Authority Advisory Committee is requesting \$460 million in TxDOT’s legislative appropriations request for port capital investment needs. There is a total need of \$3.6 billion in direct port system investments (local, state, and federal) over the next five years.

- Create a mechanism to allocate direct and sustained funding to Texas ports. (See Florida Seaport Transportation and Economic Development program, for example.)

2.2.3. Explore the TxDOT Aviation Capital Improvement Program 2023–2025, which requests \$15 million annually for Texas aviation facilities development. Study over the interim what a longer-term plan should entail to support Texas’ growing prominence in international commerce.

2.2.4. Accelerate Texas rail connectivity in south and east Texas.

2.3. Advocate for policies and investments to enhance Texas’ utility and telecommunications infrastructure. Meeting the energy and connectivity needs of a growing population and increasingly technology-centered economy will require additional capacity across the state as well as future-forward infrastructure investments. The 88th Legislature did allocate major investments in the state’s utility and energy infrastructure, including \$1.5 billion for rural broadband, \$1 billion for a Texas water fund, \$5 billion for surface transportation, and \$5 billion for electric generation funding.

2.3.1. Advocate for investments to improve Texas’ energy resiliency.

- Invest in thermal energy plant maintenance to minimize downtime.
- Incentivize additional reserve power capacity.
- Expand battery storage capacity to improve renewable energy usage.
- Address transmission line congestion.

2.3.2. Create a Texas Water Infrastructure Resilience Fund, as recommended by Texas 2036. This includes seeding the fund with \$5 billion in state funds and establishing a dedicated sales tax revenue stream for the fund.⁴

2.3.3. Adapt regulations and permitting to meet small cell needs for 5G connectivity.

2.3.4. Support the passage of the bipartisan Hydrogen Infrastructure Initiative by the US Congress. The federal initiative is a set of four bills reintroduced by Senators John Cornyn and Chris Coons intended to support the adoption of hydrogen as a fuel source for energy-intensive industries. In recent years, billions of dollars of investment have been made in Texas to develop hydrogen fuel production facilities.

⁴ [“Legislative Blueprint for Addressing Texas’ Water Infrastructure Crisis.”](#) Texas 2036. January 2023.

Goal 3. Regulatory and Incentive Tools

Ensure Texas remains the best location in the world to invest and create jobs.

One of the keys to Texas' economic success has been its pro-growth, business-friendly, regulatory environment. The state of Texas and local communities also offer an array of competitive tax incentives for both new and existing businesses, resulting in billions of dollars of new investment and thousands of high-paying jobs. Maintaining, and in some cases enhancing, the state's competitive advantages related to business climate and incentive tools will be crucial to the state's attractiveness for reshoring opportunities. Indeed, TAB's goal is to help ensure that Texas is the premier place in the world to do business.

Today, Texas has the nation's enviable economic and regulatory climate for existing large private sector enterprises. However, as US capital and industrial supply chains reshore from China, other US states are aggressively competing for both the investment and the jobs. States such as Ohio, Georgia, and North Carolina have recently surpassed Texas in the number of jobs reshored from overseas. In response, Texas should reload its competitive tax structure for large capital investment and small, high-growth companies in target or emerging industries.

Strategies and Actions

- 3.1. Rapidly revamp Texas' large capital investment tax limitation agreement policy. The state of Texas taxes property at a significant rate, making larger capital investment difficult to accomplish without at least temporary tax limitation. Texas had a powerful tool in Chapter 313, which temporarily limited school property tax payments for up to 10 years. This tool expired on December 31, 2022. The 88th Legislature passed a Chapter 313 replacement with a new statewide incentive limiting taxable value of certain property (House Bill 5).
- 3.2. Replenish the Texas Enterprise Fund (TEF) to ensure \$150 million at the beginning of the next Texas fiscal biennium to continue to attract corporate headquarters of strategic value to Texas. Texas' "deal closing" fund is a cash incentive sufficient to finalize an agreement with a company to make a large, transformative jobs creation announcement in Texas. This fund has typically been replenished by the Texas Legislature every few years. It is projected that the TEF will run out of funds by the end of the next biennium and requires approximately \$150 million to meaningfully assist Texas throughout a two-year budget term to secure transformative economic development projects.
- 3.3. Maintain Texas' competitive R&D tax credit to attract disruptive, leading-edge companies.
- 3.4. Maintain Texas' local competitiveness through continuation of Chapters 311 and 312, Chapters 380 and 381 tax limitation agreement capabilities. Local cities and counties have the legal ability to limit tax collection for certain projects, which can help develop and diversify their economy. These are important economic development tools to lure projects, which likely would not invest in a community without them.
- 3.5. Maintain triple freeport exemptions, foreign-trade zones, and free-trade zones to continue to attract and retain manufacturing projects.
- 3.6. Explore how Texas can attract small, high-growth, export-oriented companies in supply chains of target and emerging industries (batteries, semiconductors, aerospace, etc.). The Texas Legislature should consider how to identify and align its economic development attraction incentives to successfully lure more components of more critical supply chains in areas where Texas can demonstrate differentiated value.

- 3.7. Explore how Texas government can revamp outdated acquisition models, especially for dual use and leading technologies. Like many US states, procurement can favor bidders who have the financial and political wherewithal to handle the complex bid development, lengthy timeline, and extensive reporting requirements. Small, high-growth companies—especially those with transformative technologies—can face overwhelming barriers, denying state governments of transformative business practices and technologies. While the Texas Department of Information Resources (DIR) has developed a portal for companies to gain eligibility to bid across all agencies of state government, more focus can be made to accelerate Texas’ ability to incorporate disruptive technologies and procurement.

Goal 4. Local Economic Development Playbook

Support local and regional efforts to make supply chains more resilient.

Supply chain disruptions often involve complex multinational events, such as trade disputes, international conflicts, natural disasters, labor strife, and health crises. The COVID-19 pandemic revealed serious and systematic weaknesses in global supply chains, a realization that has made supply chain resilience a top priority for local economic development organizations (EDO). Focus group discussions with local economic development leaders across Texas revealed that EDOs are challenged with how to prepare their businesses for the next significant disruption.

While EDOs are limited in their ability to mitigate supply chain disruptions for local businesses, there are actions they can take to assist businesses to become more resilient to future shocks. This playbook will highlight the part of the EDO and six strategies to support a more resilient supply chain.

Strategies and Actions

- 4.1.** Understand local businesses and their challenges through business retention and expansion (BRE) efforts. A core element of any economic development program is engaging with existing businesses through a formal BRE program. This includes regular visitations, surveys, and events. Use these interactions with local businesses to capture information on supply chain issues, existing suppliers and vendors, and current and potential customers. EDOs can use this information to identify potential suppliers for targeted attraction and reshoring and also to connect local employers with other suppliers in the community.
- 4.2.** Create a local/regional supply chain ecosystem map. Engage with local manufacturers to ascertain current conditions and gaps within existing supply chains (existing suppliers, supply chain nodes, and product markets). Supply chain mapping allows an EDO to explore the interconnection of goods and services in the local area or for a specific industry. Data and information for the supply chain map can be collected during existing BRE activities (business visitation and surveys). This critical information can direct policymakers on resources and partners needed to fund supply chain initiatives.
 - 4.2.1.** Conduct a gap analysis survey for current recruitment and retention opportunities. Supply Chain maps may include the following.
 - Suppliers, vendors, and customers.
 - Potential sources of supply chain disruptions, contingency plans for disruptions, and infrastructure needs for transporting incoming/outgoing raw materials and products.
 - Economic data: sales, employment, earnings, and purchasing levels.
 - Workforce trends and forecasts, training needs/opportunities, certification opportunities.
 - 4.2.2.** Consider approaches which can maximize utilization of internet platforms, such as Sustainment or Connex, which can provide Texas companies an opportunity to be connected to purchasers of their products, especially as it is organized around critical supply chains.
 - 4.2.3.** Consider how Texas state government can build the value and utility of these electronic exchange platforms/marketplaces to help Texas-based companies more easily connect to potential companies with aligned needs both in Texas and beyond.

- 4.3.** Solidify local supply chains through targeted recruitment and retention. EDOs can engage in targeted business attraction and retention activities to fill supply chain gaps and diversify the base of suppliers and customers for existing employers.
 - 4.3.1.** Pursue the targeted recruitment of domestic and international suppliers of local manufacturers identified through BRE and supply chain mapping activities.
 - 4.3.2.** Seek to retain existing suppliers through BRE efforts, including assistance with regulatory, infrastructure, workforce issues.
- 4.4.** Develop a collaboration framework. Establish and convene a consortium of local supply chain suppliers and manufacturers to explore opportunities and problem solving, potentially in line with industry groups at the state and regional levels.
 - 4.4.1.** The consortium can serve as a resource to provide policymakers and government entities with information to support resiliency and competitiveness. Areas of focus could include supply chain, talent development, innovation, public policy, and marketing.
 - 4.4.2.** Consortium participants include original equipment manufacturers (OEMs), local suppliers, workforce, high education, and small business leaders.
 - 4.4.3.** Engage and support centers of excellence within key industries.
- 4.5.** Support the development, retention, and attraction of talent to support existing and potential employers. Lead an initiative with industry, government, workforce entities, and education to develop strategies to recruit, retain, and develop the state’s workforce.
 - 4.5.1.** Leverage the Tri-Agency Workforce Initiative’s Texas Regional Pathways Network funding for a regional convener in each Workforce Development Area to analyze labor market information, working to support the talent pipeline in filling employment needs for key industry sectors. The Texas Education Agency has \$12 million in funding that it is distributing to a "regional convener" for each of the 28 workforce development areas in Texas.
 - 4.5.2.** Collaborate with workforce boards, educational institutions, chambers of commerce, and industry leaders to develop and implement a talent strategy to address talent and skills gaps with a focus on attraction, retention, and development.
- 4.6.** Foster entrepreneurship and innovation to enhance the local supply chain ecosystem. Actively support the creation/expansion of an entrepreneurial ecosystem to support the growth and sustainability of key industries and supply chains.
 - 4.6.1.** Establish strategic partnerships with universities, community colleges, manufacturers, entrepreneurship organizations, and local suppliers to support supply chain innovation and advances in technology for resilience. Such funding has been contemplated in the Texas House budgets through investments in incubators at Texas universities.
 - 4.6.2.** Develop incubators and accelerators focused on industry and supply chain needs. Approach partnerships between the Texas Higher Education Coordinating Board, economic developer organizations, and universities on global best practices.
 - 4.6.3.** Create a “grow local” promotion to encourage procurement opportunities and business development.



SECTION

5

Investing in Innovative Sectors

The COVID-19 pandemic set off supply chain disruptions that have continued even as the pandemic has waned. These disruptions coupled with a volatile global political climate have created an urgency for developed nations to secure their supply chains and reshore production of critical technologies.

In March 2022, the US Department of Defense named 14 technologies where the US and its allies must retain technological dominance to maintain or enhance national security. Several of these technologies (energy, batteries, FutureG, trusted artificial intelligence, integrated network systems, and microelectronics) play in part to Texas' existing economic strengths, while others represent areas of opportunity.

The recommendations below represent an initial set of actions that Texas state and regional leaders can take—in partnership with the federal government—to ensure that Texas is a leader in next-generation research, development, and technology transfer; prototyping and rapid dissemination; and scaling of industrial capabilities. The first set of recommendations aims to enhance cross-cutting strategies. The second set of recommendations focuses on enhancing sector-specific strategies to maintain and build dominance.

Cross-Cutting Strategies

Florida, Colorado, Alabama, Virginia, and California created programs to compete nationally to foster innovation and support small business and industry growth. Texas can compete nationally by leveraging its relative advantages to accelerate a new industry while strengthening existing, mature sectors throughout the state. These advantages include the following.

- Fastest-growing microprocessor and information technology community in the world.
- Largest number of certified cyber professionals outside of Washington, DC.
- Global leader in defense industry manufacturing.
- Energy capital of the world.
- Largest medical and biotech complex in the world.
- Home to human spaceflight and private launch facilities.

Emerging high-growth industries, like commercial space, biotechnology, and cybersecurity, face significant barriers to developing a minimum viable product and commercializing their technologies to generate annual revenues to enter the market. Most small, high-growth businesses are not likely to succeed because they do not align with the demands seen within existing, mature industries. Government grants are not guaranteed, and contract to acquisition costs do not match industry speed with current and future national security implications and economic demand.

Recently, Texas has been able to attract federal capital, which can help mitigate technological risk in startup companies and deepen the local supply of risk capital. In Austin, Army Futures Command established Trusted Capital and the US Air Force launched the AFWERX Austin Hub. The CIA located In-Q-Tel in San Antonio to invest in relevant small, high-growth companies.

The technologies within these emerging high-growth industries are vibrant and transferable throughout multiple sectors; however, their value proposition, messaging, and infrastructure needs for continued development and testing are absent. Strengthening Texas' innovation ecosystem will require investments in several areas, including

expanding the state's R&D capacity, capturing a greater share of public and private investment funding, and taking steps to build a robust pipeline of skilled talent.

Strategies and Actions

1. **Update and expand the study of Texas' differentiated research capabilities.** The Texas Academy of Medicine, Engineering, Science and Technology (TAMEST), in partnership with the Texas Foundation for Innovative Communities (TFIC), preliminarily released a study in summer 2022 that listed the top 400 Texas R&D projects in four key dual-use research areas based on commercialization potential. This work should be continuously updated and expanded on.
 - a. Ensure endowment funding for both the Permanent University Fund and the newly established \$3 billion Texas University Fund.
 - b. Provide state funding for TAMEST and partners to expand the study to additional industries and to maintain the study's currency.
 - c. Build complementary functions to identify active and passive investors and government customers, reduce barriers to entry, and enhance incentives that enable infrastructure and technology commercialization.
 - d. Convene annual funder conferences around the initial four research areas in line with major global conferences.
2. **Position TAMEST as a strategic leader among research institutions to improve coordination and collaboration in critical technology research.** Created in 2004 by former US Senator Kay Bailey Hutchison and two Texas-based Nobel Prize winners, TAMEST can play a key role in organizing the most esteemed public and private researchers across institutions. Additional university investment would facilitate the creation of a cross-cutting team of university vice presidents of research and private sector leaders. This group would be tasked with designing strategies to create or enhance research consortiums in critical technology fields and, in line with the Texas Higher Education Coordinating Board's (THECB) Building a Talent Strong Texas, design and execute strategies to attract an additional \$1 billion per year in federal research expenditures.
 - a. **Further develop industry clusters.** In partnership with the US Economic Development Administration, Texas should map out Texas-based suppliers, including small and midsize businesses (SMB), within the critical supply chains to SMBs in South, Central, and North America. This has an estimated cost of \$1.5 million per cluster per year for five years.
 - b. **Create a proof-of-concept fund.** Texas public universities are leaders in multiple basic research areas. However, research teams lack a formal structure to turn research into a rapid proof of concept or prototype. THECB or TAMEST should be considered for a \$10 million per year investment, split among university systems, to accelerate the innovation cycle and improve Texas' competitiveness in key technologies and industries.
 - c. **Create an R&D strategic research fund.** Invest \$25 million in annual research matching funds for endowed faculty chairs to enhance alignment with the US Department of Defense's (DoD) 14 critical technology areas. This effort should be partnered with advocacy efforts to establish a federal R&D center in the state.
 - d. **Further develop university commercialization and innovation programs.** Nearly all Texas public university systems have created innovation and technology commercialization centers. Texas state government should convene a global science and research park symposium to create and implement a strategy to create nodes of differentiated university-based parks.

- e. **Establish an in-state innovation public-private investment incentive.** Develop a state strategic plan and provide public equity matching incentive for core research assets or improvements (\$80 million per biennium). Explore mechanisms and a state fund to match federal investment in SBIR and STTR funded companies.
- 3. **Expand future investment in GURI to deepen leading-edge talent in critical fields.** Governor Abbott created the successful GURI program to help attract star, highly productive researchers and their teams to a Texas public university. Using the TAMEST study of Texas’ most differentiated research capabilities, expand GURI to recruit more of the star researchers and scientists in fields where Texas needs to foster R&D projects with commercial potential aligned with the DoD’s 14 critical technology areas for national security. The 88th Legislature maintained GURI funding at \$40 million.
- 4. **Increase future DEAAG funding by \$20 million to \$50 million.** Texas has led an effective effort to BRAC-proof its Texas military installations through a roughly \$30 million state fund managed by the Texas Military Preparedness Commission. Texas has begun to receive larger-scale grant proposals, which can build key research capabilities like the Army Software Factory. An expanded DEAAG can attract more strategic Texas investments in hypersonics, additive manufacturing, and other national security priorities, while creating a nexus of talent that can maintain Texas’ 30:1 return on its cash investment.
- 5. **Create a deal-closing fund for research consortia.** Typically, when Texas competes with other states or nations for cutting-edge research consortia or a national manufacturing innovation institute, an up to 50 percent local or state investment or match is required to win the project. Texas has no Texas-sized matching structure to make those commitments today to secure leading-edge research consortia, relying heavily on political connections or existing flagship university funders to win.
- 6. **Deepen Texas-focused angel and venture capital.** The US invested approximately \$269 billion into venture capital in 2021, according to Crunchbase. Within that number, Silicon Valley companies received 60 percent of all US venture capital compared to 2 percent for Texas companies. Texas, however, has massive liquid assets in its retirement funds, ranging from Employees Retirement System, Permanent University Fund, Teacher Retirement System, and the Permanent School Fund. To diversify its portfolio, between 11 to 17 percent of these hundreds of billions of dollars are already invested in alternative investments. However, Texas doesn’t strategically focus on growing the venture capital available to Texas-based ventures. A new Texas-based approach might invest a small increment, such as 0.0025 percent, of state liquid assets into Texas-based, privately run alternative investment funds. As with other forms of investments, Texas public investment decisions will be made by private investors—not the state government—to maximize returns.
- 7. **Solidify trade offices/marketing initiatives with Mexico, Canada, Israel, East Asia, and the European Union.** As Texas builds its reputation for leading-edge quality in various technologies and deepens its knowledge of Texas-adjacent suppliers, the state should invest more deeply in strategic international relationships. The state should partner with the TABCCF, the Texas Association of Mexican American Chambers of Commerce, the Asian Chamber of Texas, the Texas-Israel Chamber of Commerce, and the Texas-European Chamber of Commerce to explore additional outreach and marketing avenues to improve trade and investment relationships. As a first step, the 88th Legislature appropriated \$880 thousand to establish a new Texas trade office in Taiwan.

Sector-Specific Strategies

Semiconductors/Microelectronics



Semiconductors and microelectronics are at the center of every advanced technology.

According to various estimates, the United States and its allies currently possess a lead in semiconductor design and advanced manufacturing. The US is the global leader in chip design and holds many of the patents that undergird cutting-edge semiconductor manufacturing.

However, according to PwC, US semiconductor manufacturing capacity dropped from nearly 37 percent of global supply in 1990 to 12 percent in 2020.⁵ The massive economic disruption and inflationary effects caused global chip shortages and reinforces the vital need to reshore chip production to the US and Texas. In addition, China has invested \$150 billion on semiconductor research through 2030.

The bipartisan passage of the Creating Helpful Incentives to Produce Semiconductors and Science Act of 2022 (CHIPS Act) demonstrates the importance of the semiconductor industry to Congress and the executive branch. The CHIPS Act directs \$280 billion over the next 10 years to enhance US competitiveness, innovation, and national security by marshaling investments in the domestic semiconductor industry. About 70 percent of the expenditures—\$200 billion—is allocated for scientific R&D and commercialization efforts. Approximately \$53 billion is dedicated for semiconductor manufacturing, R&D, and workforce development, with \$24 billion allocated for tax credits for chip production. The CHIPS Act also provides \$5 billion for the creation of an advanced packaging materials center, \$5 billion for the creation of a national semiconductor technology center, and additional funds for a metrology center.

Before the CHIPS Act passage, major investments in semiconductor fabrication facilities had been announced in Arizona, Ohio, North Carolina, New York, and Texas. Some of these states have established their own initiatives to support semiconductor innovation and industry growth. The enormous federal subsidies and incentives will create an even more competitive environment to attract such facilities. Texas is where initial semiconductors and most advanced designs were invented. Today, the state represents one-third of US semiconductor manufacturing capability and output with concentrations in North and Central Texas. However, to maintain and grow its position as a global leader in the sector, Texas should make a substantial long-term investment in semiconductor R&D, production, and workforce development. To capitalize on this opportunity, the 88th Legislature appropriated \$698 million to fund the Texas Semiconductor Innovation Consortium, which involves several higher-education institutions, and the Texas Semiconductor Innovation Fund to provide grants to companies that invest here.

Strategies and Actions

- Utilize the Texas Semiconductor Innovation Consortium to attract a national semiconductor research consortium to foster the development of additional research, manufacturing, and workforce development assets.
- Update the analysis of Texas' differentiated research excellence on emerging semiconductor design problems. Utilize the Governor's University Research Initiative to build Texas research capabilities, especially in metrology and in core semiconductor design.
- Re-establish state large capital-intensive investment tax limitation in the 88th Legislature to attract new semiconductor and semiconductor tool manufacturing and advanced packaging projects to Texas communities.

⁵ <https://www.pwc.com/us/en/library/forward-now-accounting-business-news/chips-act.html>

- Update the 2022 Texas Comptroller supply chain mapping on a biennial basis, collaborating with the Texas Workforce Commission and the Office of the Texas Governor’s Economic Development and Tourism office to inform company attraction and retention.
- Establish and coordinate a state semiconductor technician workforce training program to power the frontline talent to power the growth of the semiconductor manufacturing and packaging industry, especially in North and Central Texas.
- Expand the number of Texas-based, US citizens with doctoral degrees who can power the next-generation of raw materials, design, manufacturing innovation, and advanced packaging.

Batteries/Energy Storage



Batteries power most of the world’s technology. The global lithium battery market is projected to grow between 500 percent and 1,000 percent by 2031. The United States has the leading edge on advanced battery R&D, but that has not translated into a domestic manufacturing and supply chain base. While the US currently has 12 battery gigafactories, China has 156 and controls 80 percent of global battery production.

However, there have been recent announcements of new electric vehicle (EV) battery manufacturing facilities in multiple US states, including Kentucky, Georgia, and Michigan. Each state anticipates, if currently announced projects as of January 2023 are implemented, 97 to 135 gigawatt hours’ worth of EV batteries per year by 2030.

In Texas, which is the birthplace of the lithium-ion battery, Tesla’s massive Giga Texas facility has brought increased focus on the state as a future center for battery R&D and production. Tesla itself is planning to produce more of its own EV batteries at Giga Texas and is considering Texas for a lithium processing facility. Mexico is also a growing destination for EV battery investment, including a major BMW production facility. Still, Texas is trailing other states in new battery production investments. Making up ground will require new state and local economic development investments, incentives, and initiatives focused on this fast-growing sector.

Energy storage is also becoming a critical area of focus and need in the state. Increased energy storage capacity is especially important for Texas’ substantial renewable energy sector and helping to ensure greater reliability of the state’s energy grid. Indeed, in 2019 the Electric Reliability Council of Texas (ERCOT) established a Battery Energy Storage Task Force to identify key topics and concepts for the integration of energy storage resources in ERCOT. The task force developed a set of policy recommendations for ERCOT’s Technical Advisory Committee. The Texas grid’s battery storage capacity more than doubled in 2022 alone, increasing from about 833 MW at the end of 2021 to almost 1,999 MW as of the end of October 2022.⁶

Strategies and Actions

- Enhance energy innovation hubs for battery research in Texas with state matches. Existing battery research centers are located at the University of Houston, the University of Texas-Austin, Southwest Research Institute, and Texas A&M University. Texas should consider how to invest further in its university capabilities in alternative material battery cell storage and power capabilities.
- Encourage the Texas Legislature to study how to enhance the Governor’s Office economic development funding to map and update critical supply chains and plan to attract, develop, reshore, and nearshore

⁶ <https://www.spglobal.com/commodityinsights/en/market-insights/latest-news/natural-gas/110222-battery-storage-leads-400-mw-addition-to-texas-power-grids-commercially-operating-resources>

components to enhance Texas' standing as a leading destination for battery design, manufacture, storage, assembly, and packaging.

- Explore mechanisms to connect startups to military, federal, and state government market demand signals.
- Move forward with the South Texas battery raw materials refining capabilities.
- Continue development of raw materials mining in Hudspeth County.
- Leverage the Texas A&M University RELLIS Campus and Southwest Research Institute test beds for rapid prototyping, testing of battery, and vehicular innovation.
- Support ERCOT's efforts to expand the state's energy storage capacity and integrate it into the grid.

Energy



Texas is the nation's leading energy producer and a global center for extraction, transportation, processing, science, R&D, professional services, and finance activities connected to energy. Texas refines one-third of US energy and is home to the global petrochemical industry. In many ways, energy laid the foundation of the modern Texas economy and continues to play a crucial role in fueling the state's economic growth.

Beyond oil and gas, Texas is the nation's leader in renewable energy production, primarily in wind and solar. No other state has the climate or capacity to surpass Texas' dominance in renewable energy. However, international competition, primarily from China in the solar sector, is a growing threat. China already has the world's largest fleet of renewables and tripled its investment in solar power projects in 2022.⁷ It also controls key components of the solar power manufacturing supply chain.

To maintain its position as a global energy leader, Texas should invest in the development of next-generation energy technologies in the state, ensure a pro-energy regulatory structure, and provide the financial incentives needed to compete for new energy investment and jobs. Toward this end, the 88th Legislature funded a \$5 billion loan program for generators to build dispatchable power plants in the state.

Strategies and Actions

- Enhance Texas' dominance on next-generation energy research, storage, and dissemination technologies by encouraging and investing in knowledge-generating, R&D-industry-government consortiums and partnerships.
- Map the supply chain for next-generation energy technologies and procedures.
- Maintain Texas' best-in-class energy regulatory infrastructure and environment.
- Recraft large, capital-intensive tax limitation agreements to continue to be the top US market for major energy generation, capture, refinement, and distribution.

⁷ <https://www.bloomberg.com/news/articles/2022-05-23/china-triples-solar-investments-as-clean-energy-push-accelerates?leadSource=uverify%20wall>

Biotechnology



Today, the United States is a global leader in medical research and development, thanks to its renowned research universities and robust biotechnology industry. In Texas, the internationally renowned medical research universities have established the state as the leader in multiple areas of medical service and devices and pharmaceutical basic and applied research, with more than 100,000 jobs in the field.

To strengthen its position as a global leader, Texas must grow its ability to translate research into new, high-growth enterprises. In 2008, Texas established the \$6 billion Cancer Prevention and Research Institute of Texas (CPRIT) by an overwhelmingly bipartisan vote in the legislature voter approval. CPRIT has been an entrepreneurial partner to researchers working to deepen Texas' ability to invent, prototype, rigorously test, and translate into market product to grow Texas' autonomy and economic strength. CPRIT remains the largest state cancer research investment in the US and the second largest cancer research and prevention program in the world.

At the regional level, initial steps have also been taken to strengthen medical research and entrepreneurship capacity. For example, in the DFW Metroplex, University of Texas Southwestern Medical Center has partnered with Lyda Hill Philanthropies to create the Pegasus Park innovation district. MD Anderson and the Texas Medical Center in Houston have partnered to create the TMC Innovation center. The Austin Healthcare Council, the University of Texas at Austin Dell Medical School, Central Health, and the Downtown Austin Alliance have created a medical innovation district in Austin. Beyond R&D and company formation in emerging technology markets, Texas must develop a clear strategy to develop, grow, and attract suppliers and manufacturers to and near the state.

Texas' strength in biotechnology could be crucial to national security. China has been developing critical raw materials, components, manufacturing, assembly, and distribution of pharmaceuticals while attempting to close the gap between it and the United States in key medical and device innovation. Conflict between the US and China could negatively impact US access to pharmaceuticals, medical devices, and other essential components of health services and care.

Strategies and Actions

- Establish a biotechnology cluster initiative in the state, similar to those formed in Boston, San Diego, Suzhou (China), and Oxford (United Kingdom).
- Map the supply chains in the state for pharmaceutical and medical device manufacturing.
- Continue supporting CPRIT's efforts to implement the Texas Cancer Plan through grants to public and private institutions.
- Rapidly recraft large cap investment tax limitation agreements to attract pharmaceutical and medical device manufacturers.

Commercial Space Technologies



According to Morgan Stanley, the global space industry will reach \$1 trillion in revenues by 2050, currently up from \$350 billion. In addition, the Foundation for the Future suggests the industry will employ over 5 million people (420,000 now) with diverse backgrounds and skill sets. In 2021, CNBC reported venture capital space investments totaled \$17.1 billion, with an estimated \$770 million invested in Texas.

Texas is the leading state in the nation for aerospace; 18 of the top 20 aerospace and defense companies have operations in Texas. In its 2022 index report of national and international aerospace and defense markets, PwC ranked Texas as the top state in the nation for aerospace manufacturing attractiveness.⁸ The vibrancy of the state's commercial space sector was a major component of that recognition. Companies such as SpaceX, Blue Origin, Firefly Aerospace, and Axiom Space have located significant R&D, testing, manufacturing, and launch facilities in the state.

However, the global competition for commercial space activity is fierce. Texas must cement its position as the epicenter of space exploration with an aligned narrative that will promote an entrepreneurial spirit within the academic institutions and innovation hubs, developing breakthrough technologies that can increase capital investment in the state and support R&D and workforce development. The state of Texas is globally recognized for its business-friendly environment supporting the existing mature industries that choose to do business here. Texas can tap into its relative advantage by investing in the space industry and rekindling the spirit of "Houston, Tranquility Base here. The Eagle has landed" by establishing a Texas State chartered public-private partnership that unifies the Texas space ecosystem to drive innovation, promote small business growth, and remain a preferred location for corporations to call home.

Strategies and Actions

- Create the Texas Space Commission with substantial net new funding under the Governor's Office Economic Development and Tourism office, with the Texas Higher Education Coordinating Board, and the private sector. Explore appropriate structures to coordinate with academic institutions, local innovation communities, and local and state municipalities and organizations to offer incentives and contacts for coordinating relationships with regional businesses. The 88th Legislature did allocate \$150 million to create the Texas Space Commission.
- Map critical space technologies to Texas research capabilities and develop a strategy for research dominance, with focus on the Rio Grande Valley, West Texas, Waco, and North Texas. Determine approaches to attract critical elements of the Space Force as that command develops.
- Map emerging space industry supply chains and develop a strategy for attracting/developing key suppliers near and onshore.
- Ensure NASA Johnson Space Center receives appropriate state investment to prolong its use for manned space flight and to evolve into an economic partner in the development of the Texas space industry.
- Create incentive mechanism for 1:1 match for multi-launch, multi-use, vertical spaceport in Brownsville.
- Advocate for the first Texas Space National Guard at Ellington Field, considering the Federal Aviation Administration/Environmental Protection Agency (FAA/EPA) impact assessment.
- Explore how to seed equity investments to de-risk technology.
- Establish a Texas State chartered public-private partnership that unifies the Texas space ecosystem to drive innovation, promote small business growth, and remain a preferred location for corporations to call home.
- Drive business to Texas by organizing specialized regional conferences on critical space-related technologies and participating in national conferences.

⁸ <https://www.pwc.com/us/en/industries/industrial-products/library/aerospace-manufacturing-attractiveness-rankings.html>

FutureG



Future-generation wireless technology (FutureG) is a suite of emerging wireless network technologies that builds on the capabilities of fifth-generation (5G) wireless technologies that are being adopted around the world. The US Department of Defense (DoD) has identified FutureG as one of fourteen critical technology areas that are vital to maintaining the US national security. DoD plans to invest in FutureG for leap-ahead technologies that lay the groundwork for continued US leadership in information technology, which is vital for maintaining economic and national security.

Texas has a prominent role to play in the domain of 5G and FutureG wireless technology development and deployment. The state is home to the global headquarters for AT&T. Ericsson USA established its 5G Smart Factory in Lewisville, where it leverages Industry 4.0 technologies for assembling 5G equipment. At the state level, the Texas Broadband Development Office (BDO) was created in 2021 as part of the Texas Comptroller of Public Accounts. The BDO mission is to expand broadband access in underserved areas of the state by awarding grants, low-interest loans, and other financial incentives to internet service providers. The BDO also offers a variety of tools and resources supporting the expansion of broadband access across Texas, including 5G technologies.

Strategies and Actions

- Map the critical supply chain in autonomy applications, 5G/6G, and low orbital connectivity.
- The Texas Broadband Development Office should explore best practice permitting changes for accelerating deployment of 5G, 6G, fixed wireless access, and FutureG small cells.
- TxDOT and local governments should identify and pursue infrastructure acquisition and deployment models that promote the adoption of leading-edge technologies.
- Expand Texas-funded US doctoral degrees in relevant research clusters and create a Texas digital service academy modeled after tech internship program at the Texas Commission on Environmental Quality (TCEQ).

Cybersecurity



In 2021, the Texas comptroller analyzed and reported that the cybersecurity industry employs about 130,000 Texans and contributes at least \$35.5 billion to Texas' gross state product. The average annual salary for an employee in this industry is \$110,000 and one job in cybersecurity generates about \$224,000 in economic output and \$124,000 in Texas wages. In 2018, JobEQ projected that the number of Texans employed in cybersecurity would increase by 40 percent by 2028 to approximately 13,000. With nearly 40 cyber companies headquartered there, San Antonio is the second largest global cyber hub in the United States. Cybersecurity San Antonio is an initiative led by the San Antonio Chamber of Commerce to expand the sector in the city through public, private, and education collaboration.

The state of Texas has taken several actions over the past decade to support cybersecurity initiatives in the state. In 2011, the Cybersecurity, Education and Economic Development Council was formed to study Texas' cybersecurity infrastructure and make recommendations to the Texas Department of Information Resources (DIR). Texas also created the Texas Information Sharing and Analysis Organization, comprised of nearly 2,000 entities. In 2021, the Texas Legislature appropriated more than \$700 million to DIR to implement a rollout of the statewide cybersecurity upgrade.

With the growing incidence of nation-state and organized attacks, and with 3.5 million unfilled jobs in the cybersecurity field, Texas should continue investing in cybersecurity and ensure that it is building the future of the industry.

Strategies and Actions

- Encourage use of the statewide cybersecurity framework, meant to be used as an assessment for public sector agencies at the local, regional, and state levels.
- Ensure the talent pipeline is in place to meet the cybersecurity needs of the state.
- Continue supporting the Texas Cybersecurity, Education and Economic Development Council.