Texoma Semiconductor Innovation Consortium (TSIC)

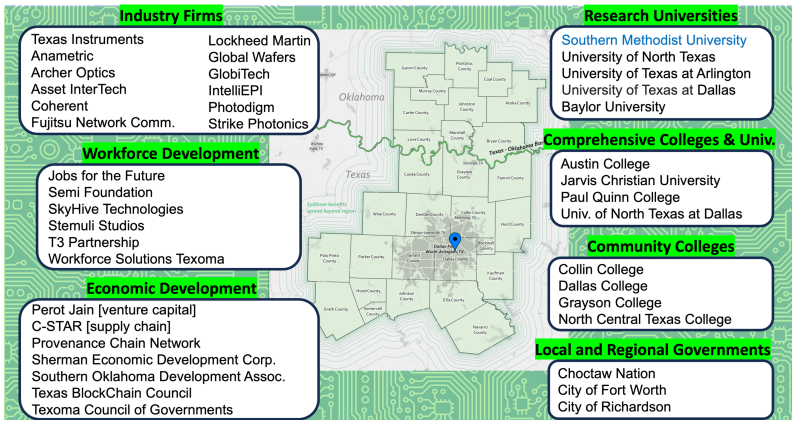

Figure 1: TSIC Membership

TSIC offers a new model of ecosystem development that elevates the Texoma region within the next ten years into a global leader in **KTFA #2 Semiconductors**. The region extending from North Central Texas into Southern Oklahoma is exceptional in that infrastructure currently exists or is planned for the entire semiconductor supply chain, including: 1) the manufacture of bare semiconductor wafers, 2) the use of wafers to create electronic and opto-electronic devices, 3) the placement of devices in electronic packaging for computer chips and sensors, and 4) the use of those chips in industries critical to economic productivity and national security, especially within the defense industry. For Texoma to achieve its full economic potential and ensure the benefits of growth are equitably-distributed, resources are needed to promote enhanced collaboration, expand the technical workforce, and catalyze the commercialization of technological advances. TSIC proposes the following innovations to encourage semiconductor ecosystem advancement, meet market demand, and uplift underserved communities:

- **"Fablets"**—sophisticated, targeted, and accessible labs containing equipment for electronic design, semiconductor manufacturing, packaging, and/or testing—will be distributed throughout the region and used by the consortium's members and regional innovators to advance both education and commercialization activities. Some fablets will focus on traditional silicon-based technologies. Others will focus on the III-V materials that are critical for new applications such as electric vehicles. Additionally, mobile fablets/demonstration labs will introduce people across the region to the semiconductor industry, enhance equity, and increase access to high tech jobs.
- **Commercialization Councils** will link innovators, venture capitalists, and industry representatives throughout the supply chain to ensure that new ideas and products get proper exposure and the needs of end applications are targeted and met.
- **Workforce Development Councils** will collaboratively fulfill industry workforce requirements. They will promote the provision of "on and off ramps" at multiple skill levels for students and adult learners to enter the workforce, acquire new knowledge and capabilities, and obtain advanced degrees and certifications while minimizing the amount of coursework and time required at each level. These councils will engage in public outreach to ensure that the entire community from middle school students to older adults, especially people from underserved areas, are aware of the opportunities in the semiconductor industry and learn how working in the industry provides a good income, enhances our nation's quality of life, and ensures its economic stability and security.

The large number of diverse verticals in the region (e.g. application-based markets such as defense, automotive, biotech, and telecommunications) also gives the region a prime opportunity for systems that can only be realized through close collaboration among the stakeholders.

The TSIC Region: Southern Methodist University (SMU) in Dallas, TX leads the effort. The Tech Hub encompasses 29 counties covered by the North Central Texas and the Texoma Councils of Governments, and by the Southern Oklahoma Development Association. The consortium will significantly **benefit small and rural communities**. Of these, Atoka, Coal, and Johnston Counties have been identified as **persistent**

poverty counties. Oklahoma is an **EPSCoR state**, and the **Choctaw Nation** is a consortium member. TSIC includes **HBCUs** (Historically Black Colleges and Universities) and **HSIs** (Hispanic Serving Institutions).

TSIC is central to the U.S. with outstanding transportation connections to other regions. The entire manufacturing process can occur *within the TSIC region* from bare wafers to the use of chips in final products, **reducing transportation and energy needs.** The Texas power grid has a strong **climate-friendly wind power** component, and new rules for electric utilities ensure reliable power even during extreme temperatures in summer and winter. Existing and new fabrication facilities are also **designed to survive extreme storms and weather events.** Refer to the Appendix for a TSIC region map.

1. **Technology-based potential of the region for global competitiveness:** The North Texas Region is the birthplace of the integrated circuit and counts among its strengths a decades-long foundation of innovation and commercialization in semiconductor manufacturing and chip-enabled products. TSIC has identified innovation potential within the regional semiconductor ecosystem in the areas of 1) heterogeneous integration of components, 2) use of both silicon and advanced materials beyond silicon, and 3) responsiveness to demands for new computing capabilities from emerging technology markets.

The region's central location and robust transportation network provide resiliency against supply chain disruptions, and its semiconductor base has attracted some of the biggest names in telecommunications (Fujitsu), aerospace and defense (Lockheed), and transportation (Toyota). A 10th place ranking on StartupBlink's index of U.S. startup ecosystems[i] indicates a very strong innovation capability, and with one of the highest index ratings among U.S. metros (.8)[ii], the region's industrial diversity represents a key aspect of resiliency against economic shocks to any single sector. This strength has produced or attracted 49 Fortune 1000 companies that have committed to investing in the region. GlobalWafers has selected Sherman, TX for its new $5 billion 300 mm silicon wafer manufacturing facility, the first of its kind in the United States in over 20 years. When complete, it will be among the largest in the world with more land available for the future[iii]. Most wafers are currently manufactured in Asia, increasing the importance of this facility to fill a critical gap in the U.S. supply chain as identified in the US DOC 100 Day Review of the U.S. semiconductor industry[iv]. Texas Instruments (TI) chose Sherman, TX for expanding its manufacturing footprint. The potential $30 billion investment includes plans for four (4) fabs to meet demand over time, supporting up to 3,000 direct jobs. The first production is expected to commence in 2025. Another new TI fab in Richardson, TX began initial production in September of 2022, and at full production, it and the other TI Richardson fabs will manufacture more than 100 million analog chips every day. State and federal investments will complement and amplify TSIC efforts with respect to geography, technology, and industry. These include: an NSF TIP Engine Development award for technology-driven transformations in Texoma's logistics industry; an EDA Good Jobs Challenge award to upskill the biotech workforce; U.S. DoEd and Texas Workforce Commission (TWC) funding to expand the semiconductor industry workforce pipeline; and the $1.4 billion Texas CHIPS Act that establishes an innovation fund to encourage chip design and manufacturing in Texas.

The Semiconductor Industry Association estimates global sales will reach $602 billion in 2024[v] with the U.S. capturing nearly half of the global market. Lightcast estimates that more than 7% of U.S. semiconductor sales originate in Texoma[vi], which supports the industry's status as the third largest export sector for the region. Accelerating commercialization potential in the TSIC region indicates that every 1% increase in regional sales creates more than 500 new jobs[vii]. Semiconductor industry jobs in the region are high paying with an average weekly wage of $2,451 (more than 40% above the average wage for all industries), greatly enhancing the earning potential of the region's workforce[viii]. Further, a 10% increase in sales captures an additional .3% share of the global market[ix]. This provides a strong foundation for Tech Hub Designation.

2. **Role of the Private Sector:** The consortium includes corporate members from startups to globally known firms. Expertise within the semiconductor supply chain includes the manufacturing of bare silicon wafers, semiconductor chip manufacturing, verification / test, and use in end systems **(**such as defense and quantum

networking). Other members specialize in critical electronic technologies that are based on materials extending beyond silicon, such as III-V materials. Still others specialize in opto-electronics and photonics. Supply chain tracking will be enhanced through the work of the **Texas Blockchain Council** and the **Provenance Chain Network**. Each corporate member has made commitments to the consortium described in the attached letters. A list of members is included in Figure 1.

Private capital will also play a central role in TSIC's success. For example, venture capital firm **Perot Jain** will contribute to the consortium by providing access to a network of technology investors, influence in promoting the semiconductor industry as an investment priority, and expertise on the viability of startups to join the Semiconductor Living Lab concept discussed under Section 6.

3. **Regional Coordination & Partnerships:** Many TSIC consortium members have a **long history of collaborating** with each other on regional initiatives, projects, and programs. For example, the lead institution, SMU, has previous and current educational and research partnerships with Photodigm, TI, ASSET InterTech, Lockheed Martin, Intelligent Epitaxy Technology (IntelliEPI), and STRIKE Photonics. The University of Texas at Dallas (UTD) and the University of Texas at Arlington (UTA) also partner with SMU, TI, Lockheed Martin, and STRIKE Photonics. SMU and Austin College have existing relationships with Coherent. STRIKE Photonics works closely with TI, Lockheed Martin, Coherent, and IntelliEPI. The Provenance Chain Network, C-Star, and the Texas Blockchain Council are working to enhance the resiliency and trust in the semiconductor supply chain.

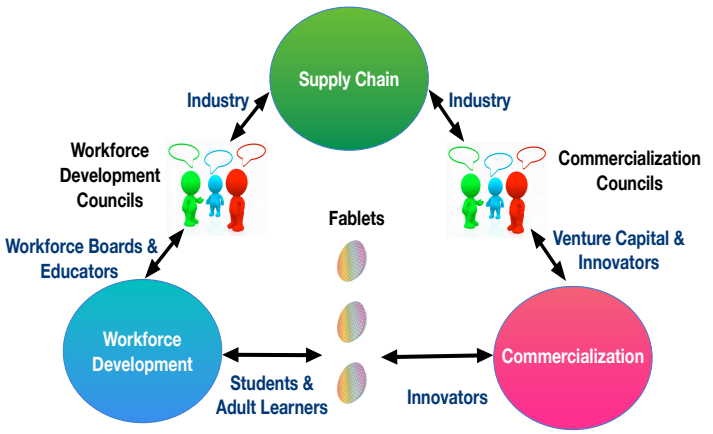

Figure 2: TSIC Collaborative Interaction Model

TSIC will strengthen existing relationships and initiate new ones to develop the workforce and enable commercialization of technological advances. Figure 2 shows how the fablets will facilitate workforce development and commercialization by serving as centers for learning and prototyping. Regular workshops organized by the Workforce Development Councils will ensure curriculum and learning pathways meet industry and community needs. Regular meetings of the Commercialization Councils will be used to reduce friction, ensure that the needs of the semiconductor industry stakeholders are met, and that innovators gain visibility for venture capital. A Regional Innovation Officer (RIO) selected for strategy development, stakeholder engagement, ecosystem development, innovation, commercialization, entrepreneurial support, and partnership management will lead the consortium. An Executive Committee staffed by TSIC members will aid the RIO and provide representation for decision-making processes.

4. **Equity and Diversity:** The majority of the TSIC region's counties are non-metropolitan, with a significant rural component. Much growth in the semiconductor industry is near the Oklahoma border, providing opportunities for residents of these non-metropolitan and rural counties to obtain semiconductor jobs and semiconductor-supporting jobs (e.g. HVAC technicians). The TSIC region is diverse with respect to race and ethnicity. It is 16.4% Black, 7.6% Asian, and 1.3% Indigenous and Native American. Approximately 28.8% of the population identify as Hispanic. Other communities for TSIC inclusion include people with disabilities, veterans, dislocated workers, foster youth, and low-income individuals. Importantly, the **Choctaw Nation** is a consortium member and has been actively engaged in planning.

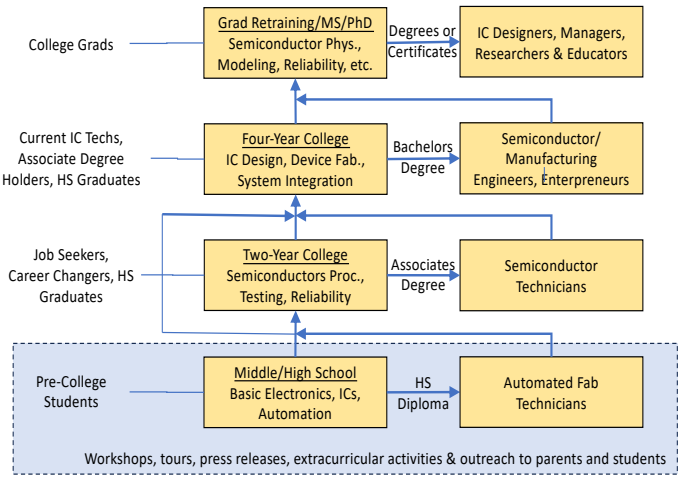

Figure 3: TSIC Career Ladder to Success

To lift up underserved communities, education and outreach are essential. To remove barriers that may prevent residents from accessing the resources and education needed to obtain good jobs, **TSIC will make use of the varied assistance programs offered by Workforce Solutions Texoma, Workforce Solutions North Central Texas, Workforce Solutions for Tarrant County, and Workforce Solutions Greater Dallas to provide wrap-around services, including tuition assistance, supplies, books, uniforms, travel assistance, and childcare**. TSIC will provide outreach and career advice to rural communities in the region, with focus on counties suffering from persistent poverty. TSIC will also provide outreach to urban counties with significant underserved populations. The outreach will start at middle school and extend to the entire community. Some "fablets" or "demonstration labs" will be mobile—containing equipment and materials that move from site to site throughout the region. They will serve as a resource for students in area schools and will introduce adults to job opportunities in the industry. Other activities will include industry visits to classrooms, company tours, teacher externships/shadowing of industry employees, and dissemination of career information at public venues, job fairs, and libraries. **Commercialization Councils will host workshops where minority-owned businesses and startups are actively encouraged to interact with industry partners.**

TSIC also comprises many institutions of higher education throughout the region from community colleges to PhD granting universities who will meet advanced educational needs and perform critical outreach. Among these, Jarvis Christian University and Paul Quinn College are **HBCUs,** and Dallas College, UT Arlington, and the University of North Texas are **HSIs**. Of note, Paul Quinn College was recognized as the **HBCU of the year and the first Urban Work College** as well as the only minority-serving, federally-recognized work college in America. Its Urban Work College model **provides every student an internship—reducing student loan debt by $30,000 and increasing graduation rates by 25%.**

5. **Composition and Capacity of the Regional Workforce:** With a total population exceeding 8.5 million[x], the TSIC's regional workforce totals more than 4.7 million[xi] with nearly 300,000 employed in high-tech fields[xii]. Combined with 55,000 annual completions from regional institutions of higher education[xiii] (including three R1 research universities[xiv]), the 2022 DFW population gain of 170,000 – exceeding all other metros[xv] – ensures a consistent talent supply. TSIC member companies have stated that there is a significant unfulfilled semiconductor workforce need for technicians at the associate degree level. However, only 7.4% of the working age population has an associate degree, while 43.2% have only a high school degree. Many jobs that support the semiconductor industry, such as HVAC technicians, require vocational or associate degree training. There is a significant gap between the workforce needs of the industry and the supply from current training and education that TSIC will fill.

TSIC's interconnected institutional programs will create a "ladder to success" for the **STEM semiconductor workforce,** as shown in Figure 3. A key feature of this ladder is the collaboration among educational institutions that enables people at different career stages and educational backgrounds to obtain the education and credentials needed in a streamlined fashion by taking previous experience and coursework into account. TSIC Workforce Development Councils created by the Tech Hub will ensure that these programs will be tightly coupled to industry partners' needs in terms of classroom curriculum and on-site

interactions while focusing on the need for equity for underserved populations. Companies will help support this ladder through custom training and internships. **TSIC member Stemuli Studios will establish the nation's first digital P-TECH and Beyond model, which will provide learners with 24/7 access to personalized learning journeys for entry-level through expert-level semiconductor jobs.** The P-TECH model is a proven public-private partnership that bridges the gap between education and workforce with 73% of students graduating high school with an associate degree compared to only 16% of high school seniors earning any post-secondary credential within 6 years of graduation.

6. **Innovative "lab to market" approaches:** TSIC will establish the **Semiconductor Living Lab (SCLL)** to address the primary barriers to commercialization, including access to customers, partners, facilities, workforce, and funding. SCLL **Commercialization Councils** will focus on the requirements, technology, and/or processes associated with a particular application space. For example, the region is home to a thriving defense industry; thus, a ***Defense Commercialization Council*** will be formed with Department of Defense (DoD) contractors, start-ups, venture capital, investors, and IP generators. Other Commercialization Councils will be formed for other application spaces, such as **automotive, telecommunications and health care**.

The Commercialization Councils will facilitate the flow of IP from regional start-ups and universities to each application space. Councils will use modern Open Innovation Concepts (OIC) to disclose the needs, data, and operations essential to their success. The fablets will be an integral resource for streamlining solutions in application spaces. The SCLL will be similar to an integration of the DoD's successful Manufacturing Innovation Institutes[xvi] and the NSF's Industry-University Cooperative Research Centers[xvii].

The Commercialization Councils will provide visibility and outreach to the broader community. They will partner with local entities, such as UNT's DOE-funded SEEP-IT consortium, to promote semiconductor industry collaboration and ensure that resources and knowledge are shared. The region's venture capital partners will be included in each council to allow them to fund and socialize new technology advances through their national networks—providing the broadest possible access to funds and enhancing the region's global competitiveness. Sustaining funds will be pursued through corporate sources, state / federal government agencies, and private foundations. Regional resources, including fablets and incubators, will be included in workplans that start in the Customer Councils and will be part of the ongoing council-supported, braided funding plan for facility upgrades and workforce training. TSIC will also pursue expansion of innovative models for Intellectual Property (IP) protection, e.g., UTD's Intellectual Property Assignment sponsored research agreement (IPA-SRA), which provides investors and other research sponsors a path for full ownership of IP developed with a focused commercialization goal.

7. **Impact on economic and national security of the entire United States**: The TSIC Tech Hub is the core of a semiconductor ecosystem that impacts technology deployment throughout the U.S., including the defense, automotive, and telecommunications industries, among others shown in Figure A2 in the Appendix. Everything from the Internet to refrigerators to pacemakers to water treatment depend on semiconductors. A reliable and trusted supply chain of semiconductors is critical for economic and national security.

TSIC is poised to not only be a global leader in semiconductor technologies, but one that is resilient against supply chain disruptions. This is particularly important as multiple countries try to take the lead in advanced technologies and as global politics threaten the security of supply chains. In addition, TSIC has a strong base of expertise in *advanced semiconductor materials*, including III-V materials, that are needed for electric vehicles and other applications. The region is also a hub for national defense contractors **(65% of DoD funding in Texas comes to North Texas**[xviii]**).** Training and education of the local workforce enabled by TSIC will enhance the security of the defense industry by providing workers that can operate in sensitive facilities. The DoD has grave concerns about the security and supply chain risk of semiconductors manufactured overseas. The Provenance Chain Network, a member of the consortium, will provide innovative supply chain tracking for use within TSIC and that can be applied across other Tech Hubs.