

Developing the Idaho STEM Ecosystem and State STEM Education Strategic Plan

WHO WE ARE

Background

The Idaho STEM Action Center (STEM AC), an agency under the Executive Office of the Governor, was established by legislative mandate in 2015 by leadership of a small group of visionary legislators, education leaders, and industry partners. STEM AC's enacting legislation focuses on five broad areas: a) student learning and achievement (targeting underrepresented populations); b) student access to STEM, including equity issues; c) teacher professional development and opportunities; d) college and career STEM pathways; and e) industry and workforce needs. In subsequent years, STEM AC has been legislated to oversee the Computer Science Initiative and STEM School Designation and has helped pass legislation for computer science course work and STEM diplomas. Another major role for STEM AC is to actively engage Idaho businesses and industries. Decisions related to STEM AC are guided by a nine-member Board appointed by the Governor. The Board is a unique blend of state leaders from the State Board of Education, State Department of Education, Workforce Development Council, Department of Commerce and 5 representatives from the state's leading STEM industries, such as technology, power, healthcare, mining and agriculture. Additionally, the STEM AC Foundation has been created to engage more effectively with a broader network of businesses.

Mission

Engineering innovative opportunities for educators, students, communities, and industry to build a competitive Idaho workforce and economy through STEM and computer science education.

Vision

A diverse, equitable, thriving ecosystem for a prosperous, STEM-literate Idaho.

What We Do

STEM AC has three primary goals to develop a diverse and equitable STEM-literate Idaho. Programs, initiatives, and partnerships are strategically designed and implemented to reach one or more of these goals through measurable objectives and outcomes.

1. Advance equitable **access** to high-quality STEM and CS opportunities for educators, students, and communities. STEM AC supports and offers professional development opportunities and grants for educators, programs and competitions for students, and events for communities.
2. **Align** STEM education and workforce needs throughout Idaho. STEM AC partners with businesses and partners in order to support STEM education that meet industry needs through public-private partnerships, teacher externships, professional development guided by industry input, workforce development programs, and career exploration programs.
3. Increase **awareness** of the importance of STEM throughout Idaho. STEM AC hosts annual events, to help inform students, educators, parents, legislators, and businesses on the importance of STEM education. STEM AC also partners with Idaho's major media outlets to communicate the value of a STEM education.

WHY AN IDAHO STEM ECOSYSTEM?

Idaho citizens are not entering the STEM pipeline at a rate that will meet the current and future workforce needs of Idaho employers to sustain Idaho's economic development and secure future prosperity. Solving this problem is a cross-sector endeavor in which partners must come together to instill systemic change in educational practices and workforce training. A STEM ecosystem is a network of STEM education partners that come together to foster inclusive, productive, and effective learning experiences and pathways both in-and out-of-school. STEM AC has partnered with partners since its inception in 2015; however, a need to formalize these partnerships arose to meet the workforce need challenges and to provide an equitable STEM education to all Idaho students. In the fall of 2019, STEM AC and eleven partners created the Idaho STEM Ecosystem and joined the national [STEM Learning Ecosystem Community of Practice \(SLECoP\)](#). To formalize the Ecosystem and begin to organize and develop it, STEM AC applied for a STEMx grant to host a feedback session to bring together partners. The goals of this feedback session were to introduce the Ecosystem, identify a shared aspiration for STEM education in Idaho, and to set the preliminary stage for developing a STEM education strategic plan with goals, objectives and outcomes to track the collective impact of the Ecosystem.

FEEDBACK SESSION AND FORMATION OF ECOSYSTEM

Preparation

In preparing for the session, STEM AC realized support was needed from an organization that has helped other ecosystems begin to coalesce around large-scale STEM education needs. As a new member of the SLECoP, STEM AC contracted with the [Teaching Institute for Excellence in STEM \(TIES\)](#), the managing body of SLECoP, to help with a preliminary needs assessment and facilitation of the feedback session. Since 2002, TIES has committed to providing all students access to authentic, applied STEM education and the opportunities for a meaningful future that accompany it. They do this through connecting partners - educators, funders, community organizations, businesses, and government agencies - who, through collaborative partnerships, create meaningful STEM learning experiences for all learners, particularly those underrepresented or underserved. TIES uses the Engineering Design Process (EDP) to engage key partners seeking to reimagine STEM learning in their community. The four phases of this process are 1) Listening and Learning, 2) Design, 3) Implementation and Support, and 4) Transition and Sustainability.

Preliminary Needs Assessment - TIES suggested collecting information from key partners prior to the feedback session as part of the Listening and Learning phase. TIES conducted phone interviews with nine partners representing business/industry, K-12, higher education, and out-of-school learning. Transcripts of interviews were provided in a report and takeaways summarized and organized into the following components: economic changes in the state, how to ensure Idaho's future, goals for the STEM ecosystem, special challenges to address, and assets in the Idaho STEM Ecosystem. The Executive Summary of this report is provided as Appendix 1.

Content - Because STEM AC is a primary funder of STEM programming for many of the groups at the feedback session and because it is a state agency, STEM AC hired TIES to host the feedback session and guide the direction and content of the session. This structure was chosen to help maximize partner input, collaboration, and participation at the feedback session. In

addition, TIES has extensive experience using EDP to bring together partners in a positive, collaborative format that produces outcomes.

Invitation - Idaho has a large STEM education partner group. Deciding who to include in the feedback session proved difficult as STEM AC tried to balance inclusiveness but also tried to be aware that the larger the group, the more difficult it may be to make decisions and move forward. The initial goal was to invite 30 partners, however, in the end, due to TIES expertise in managing large groups through EDP, STEM AC felt comfortable inviting as many participants as could be financially supported through STEMx grant funds. 80 individuals were invited and 65 attended. There was representation from higher education institutions, K-12 (educators and administrators), out-of-school programs, business and industry supporters, librarians, museum educators, tribal organizations, community health organizations, educational nonprofits, legislators, the Governor's Office and state agencies that support education (State Board of Education, State Department of Education, Career Technical Education, Commission for the Libraries, Commission on the Arts, Public Television), diversity (Commission on Hispanic Affairs), and economic development and workforce (Department of Commerce, Workforce Development Council). Business supporters represented all major industries in Idaho such as aerospace, technology, mining, and agriculture.

Travel - Idaho is a large state with geographic barriers to inclusion. In order to minimize this barrier, travel reimbursement was offered for at least one participant from each of the invited organizations. Most participants were from the Boise area, where the feedback session was held, or represented funders who paid their way. About half of the participants travelling from out of town, not from a business, requested travel funding. STEMx grant funds were used to cover the cost of these 11 participants that requested reimbursement. These individuals traveled to Boise from all over the state and represented a diverse group of partners that may not have been able to attend if travel was not provided.

Timing - The feedback session was strategically planned to be the day after the annual STEM Matters Day at the Capitol since many partners were going to be in town for this event. STEM Matters Day is an awareness event at the Idaho Capitol in which STEM organizations and programs are showcased to show the value of STEM education to the public and to legislators. State leaders get the opportunity to learn about STEM education from across the state and local students enjoy STEM activities. Pairing the feedback session with this event also brought awareness to the ecosystem initiative.

Outcomes

The feedback session was held on January 16, 2020 at Boise State University and ran as an in-person design studio (see Agenda, Appendix 2), facilitated by TIES. The TIES team set the stage for why the group would want to create an ecosystem and provided background on how the ecosystem can function and what it can accomplish. The 65 participants were grouped by table into regions of the state to foster local connections and collaboration throughout the day. STEM AC staff mingled with participants but avoided imposing on conversations. It was agreed by the group that STEM AC should serve as the 'backbone' organization of the Ecosystem and provide the logistical support for the network, however, STEM AC did not want to be the sole decision maker, emphasizing the need for this effort to be collaborative and inclusive.

Participants were asked to review, add, and edit Ecosystem aspirations that were identified by those that participated in the pre-meeting interviews. Each table group also developed an aspiration and the TIES and STEM AC teams synthesized the aspirations into one main draft aspiration for the Ecosystem:

The Idaho STEM Ecosystem will foster the integration of STEM in the educational experiences of all Idahoans, leading to the creation of problem-solvers and critical thinkers who will sustain and lead the Idaho economy of the future.

Participants determined that the aspirational statement will only be realized with certain circumstances such as systemic change, informed collaboration with appropriate resources and authentic alignment, and intentional inclusiveness and commitment to addressing opportunity gaps for under-represented populations in STEM. Participants also spent time identifying orthodoxies and constraints that will be a challenge to achieving the aspiration. These challenges can be grouped into the following categories: resources and awareness; equity, equality, and diversity; relationships, attitudes, and beliefs; funding; professional development and teacher shortage; student preparedness; infrastructure; and institutional constraints. Being aware of these challenges will help identify potential roadblocks as we move forward and will also help steer the direction of action items.

The next step was to identify priorities for achieving this aspiration. This work was done in table groups and then shared with the larger group. Priorities were categorized by the TIES and STEM AC teams into 5 major groups and these became five working groups:

Communications & Public Awareness - This group serves to provide guidance on Ecosystem communications including the bi-monthly newsletter, the website, press releases, and other pertinent outreach efforts. In addition, this group is prepared to support other working groups when in need of communication and/or public awareness guidance. This group will also serve as the lead for the development of the Ecosystem communication plan which will include internal communication between existing Ecosystem members and external communications to potential members, as well as to the broader education and workforce communities.

Career Pathways & Exposure - The overarching goal for this group is to further develop clear STEM career pathways for Idaho's youth and provide opportunities to those pathways. Two priorities for this group are to: 1) identify existing, career-oriented programs, both inside and outside of Idaho, that have high impact and can be effectively scaled throughout the state; and 2) collect/develop visual representations of STEM career pathways so that they are more accessible to students and parents.

Resource Identification & Asset Mapping – This group aims to give the Ecosystem a 'lay of the land' – a better picture of partners' biggest needs related to STEM education, as well as regional assets that may address those needs. The group is identifying and exploring resource portals to build a user-friendly and inclusive data tool for the Ecosystem. They are also supporting the needs assessment work that will help define goals for the Ecosystem.

Opportunities & Access – The goal of this group is to break down barriers and provide equitable access to opportunities. Identified barriers include: preparation, transportation, finances, logistics, culture, technology, rurality, navigation of educational systems, and practices and systems that contribute to sustaining barriers and biases for underserved and disenfranchised populations. The groups aims to identify practices and systems that have greatest impact (+ and -) on equity of access contributing to these barriers or contributing to access.

Educator Preparation, Training & Support - The work of this group centers on support for pre-service and in-service educators. Primary priorities of this group are 1) to identify all available professional development opportunities for Idaho educators and determine where there are gaps in order make informed decisions on how to improve educator training; 2) help establish

the 'STEM Philosophy' into all educational practices; and 3) revisit teacher preparation standards and make plans to change as needed.

Each working group met for approximately one hour to discuss the focus and potential goals of their group. Since the feedback session, each working group has met regularly (usually monthly) to check in on goals, action items, and direction. Each working group has one STEM AC representative to facilitate communication between the backbone organization and the working groups. Meeting notes and synopsis of work is reported to STEM AC and working group progress is reported to the Ecosystem group through the bi-monthly Ecosystem Newsletter.



Stakeholder's enlightened self-interest helps ensure their sustained engagement in the Ecosystem to help achieve the goals set forth. In addition, understanding what each organization and/or individual can bring to the table and contribute to the ecosystem is important for efficient and successful achievement of goals. During the feedback session, partners were encouraged to think through what they need to get from the Ecosystem to invest in it and what they can provide to the Ecosystem. Individual and organizational needs and contributions were recorded and captured in final report documentation.

Preliminary discussions on the structure of the Ecosystem were had. These discussions included both internal and external Ecosystem structure. For internal structure (e.g. leadership structure, communication pathways), TIES presented various models that have been successful for other networks. The primary piece of advice was to match the structure with the culture of the community to get the work done. Regarding external structure, the concept of regional STEM hubs was introduced to the group and there was a healthy discussion on the strengths and challenges associated with them. The partner group decided that now was not the time to decide on both internal and external structures and these topics will be revisited at the next session. The STEM AC team plans to provide a presentation on the success and challenges of other state network structures (see STATE STEM ECOSYSTEMS & EDUCATION PLANS

section and Appendix 3) at the next session. In addition, Idaho has other regional education networks (Idaho Education Network, Math Coaching Network) on which the Idaho STEM Ecosystem can learn from and build upon. STEM AC will research these more and present findings to the larger group at the next session.

Preliminary discussions were also had on a state STEM education strategic plan. While the amount of time during the feedback session was not enough to develop goals, objectives, and outcomes for a strategic plan (see Reflection & Highlights section), steps toward a cohesive aspiration were made. The larger group, again, decided it was too soon to settle on goals, objectives, and outcomes and that these should be discussed more at future meetings.

Reflection & Highlights

There was **high interest** from partners to participate in this process and to form an ecosystem. Almost everyone who was invited to participate, attended the feedback session. And there was an understanding that working together will be a more efficient and productive course of action than working individually.

There was a strong commitment to addressing **opportunity gaps and equity issues**. Providing awareness and opportunity for all Idaho children was woven into most discussions and working group themes centered around the need to increase both aspects.

As STEM AC prepared and held the feedback session, it was clear that a one-day workshop was not enough time to bring partners together for the first time, develop goals, objectives and outcomes, and develop a structure for the ecosystem (the original goals of the feedback session). This process requires more **time and intentional work**. The feedback session proved to be a solid starting point and since then, STEM AC has worked to secure funding for additional feedback sessions in order to further develop the Ecosystem structure, leadership, and communication, as well as to set goals, objectives and outcomes of a STEM education plan. The next session will be in September 2020, followed by a third session in spring 2021. STEM AC has dedicated a staff team to work with partners and working groups in between these sessions to move action items forward. This year-long pace of developing the Ecosystem and setting goals for a STEM education plan will allow for more intentional work.

Challenges & Lessons Learned –

A primary lesson learned was recognizing who was **missing** at the feedback session. There were few PreK-12 educators in attendance because the feedback session was held during a school day. Participation from organizations in northern Idaho and rural communities was low and feedback from these organizations in attendance was that they often feel isolated from other efforts throughout the state. To combat this, the next session will be held in north-central Idaho with the intention of making it easier for organizations from northern communities to attend. Likewise, the spring 2021 session will be held in south-east Idaho to hopefully increase participation from that area of the state.

While partner **engagement** and interest was high during the feedback session, it decreased afterwards, as typically happens when individuals return to their busy schedules. Working group participation has varied over the months since the feedback session. Clear action items and early 'wins' have helped sustain engagement in robust working groups.

Communication is important and especially so with a large network. Understanding what organizations throughout the state are doing to work towards the Ecosystem aspiration is a challenge. To combat this, the Ecosystem has taken two steps. One is the formation of the

working groups that meet regularly and report progress to the backbone organization. The second step is the development of a bi-monthly newsletter to Ecosystem partners that includes the working group reports, news about partner organizations and their work, and news about the Ecosystem.

Navigating the formation of an ecosystem to develop a state STEM education plan is more of a challenge than originally anticipated. As shown through our research of other state networks and education plans (see STATE STEM ECOSYSTEMS & EDUCATION PLANS section and Appendix 3), there are a variety of ways to develop them, and there are successes and challenges with each of the strategies. Our goal is to undertake this process with intention from the beginning, learning from others, using available resources, listening to partners, and adjusting the process along the way.

Being a part of **national groups**, such as STEMx and SLECoP, is incredibly helpful. These groups offer resources, guidance, and connections. The guidance from TIES made the feedback session more efficient and informative. As the Ecosystem develops, it is important to work with the greater ecosystems at the national level to learn from and share our knowledge.



Future work

Idaho is a large and diverse state (economically, socially, geographically, racially) and even though there was representation from many partner groups from across the state at the feedback session, one takeaway was the necessity for a **comprehensive needs assessment** at the local and regional levels. The preliminary needs assessment conducted by TIES was informative but limited. To better understand the communities we want to serve, a more in-depth survey and data collection process is needed. STEM AC has secured funding for this effort and will work with TIES over the summer to conduct the needs assessments.

The STEM AC ecosystem team is working to develop internal ecosystem components such as a leadership structure and communication plan, that will be presented and revised by Ecosystem

partners during future sessions. In addition, STEM AC will present options for an external structure, such as regional hubs, based on what has been learned from other state networks and feedback given by Ecosystem partners. During the fall session, break out groups will work to identify common goals, objectives, and outcomes, including success metrics, for the Ecosystem and the strategic plan. A metrics group will be formed to work on defining outcomes data, data collection, and analytics. This work will continue through the winter until the spring session when it will be presented and discussed. In addition, during this spring session, external communication and advocacy plans will be generated. Based on feedback, a final strategic plan will be drafted that includes goals, objectives, and metrics that can then be utilized to track the successes and adjustments that are needed as the Ecosystem continues to develop and expand.

STATE STEM ECOSYSTEM & EDUCATION PLANS

Several other states have formed STEM ecosystems or networks with varying structures, missions, and successes. Before embarking on the formation of the Idaho STEM Ecosystem, the STEM AC team reached out to four states who, like Idaho, adopted the statewide ecosystem model. Questions focused on the genesis of both their ecosystems and strategic plans, as well as challenges they have faced along the way.

Of the four states interviewed, three of them are in the western United States and one is in the upper Midwest. Despite the small sample size, there was tremendous variation in the early development of all four ecosystems which echoes what STEM AC team members have discovered in conversations at SLECoP convenings. It is this lack of a clear roadmap to ecosystem formation that this paper, in part, hopes to address. Table 1 summarizes the four ecosystems as case studies that are elaborated on in more detail in Appendix 3.

Three primary threads emerged from the comparison of the four ecosystems. Firstly, intentional development and structure of the ecosystem and strategic plan from the beginning leads to more successful and efficient ecosystems. Combining this information with feedback from the first convening, STEM AC is taking a more purposeful route towards defining the Idaho STEM Ecosystem that will need more time and thoughtful considerations than originally estimated. Secondly, a clear understanding of who within the ecosystem is responsible for implementing components of the strategic plan is necessary to efficiently succeed at meeting the goals and objectives. Effective models have a backbone organization that is responsible to keeping the ecosystem on task, and clearly defined roles and responsibilities of ecosystem members. Lastly, all four ecosystems have regional hubs or are moving towards having regional hubs to meet local needs and leverage local resources. There are challenges in keeping the hubs cohesive and planning should include clearly defining infrastructure components such as funding sources, strategic planning expectations, and similar data reporting methods.

Table 1.

Ecosystem	Formed By/Through	Strategic Plan	Structure	Funding	Challenges
Case Study 1	Legislation, STEM Council.	State STEM strategic plan and regional hub strategic plans.	Autonomous regional hubs with state leadership from the Department of Education and STEM Council.	State funding distributed to regional hubs.	Stronger statewide leadership needed for hubs; competition for resources between hubs.
Case Study 2	STEM Coalition and then STEM Council of partners.	State STEM strategic plan led by STEM Council.	No backbone organization, funding through the Department of Education and After School Network; STEM Council is advisor; large network of >100 orgs.	State funding distributed to school districts; grant/private funding.	More clear leadership; lack of funds to establish regional hubs as outlined in strategic plan; consistency from partners.
Case Study 3	STEM nonprofit	In development by lead nonprofit.	Nonprofit serves as the backbone organization, large network of >800 orgs.	Grants, donations, registration fees for events.	Lack of sustained funding; consistency from partners.
Case Study 4	Industry representatives and philanthropic organizations created a nonprofit that serves as the backbone org.	Regional hubs have their own strategic plans.	Nonprofit backbone organization with board and CEO; autonomous regional hubs.	Large donations.	Hierarchical structure is difficult to manage and keep a statewide focus; providing for all students has made it difficult to serve certain populations.

Appendix 1 – Executive Summary, TIES Report

Appendix 2 – Feedback Session Agenda

Appendix 3 – Detailed State STEM Ecosystem & Education Plans

Idaho STEM Ecosystem Partner Report



THOUGHTS ABOUT IDAHO, THE ECONOMY, AND THE FUTURE OF THE IDAHO STEM ECOSYSTEM

December 2019

Background and Introduction

With direction from Idaho STEM Ecosystem leadership, TIES developed a series of starting questions for key ecosystem partners to acquire a deeper understanding of some of the unique opportunities, as well as challenges, facing Idaho. This information will be used to inform the direction of the planned design work scheduled for January 16, 2020, in Boise, Idaho.

Between December 16 and December 17, 2019, TIES interviewed a total 9 partners, with several offering additional resources and information via follow-up communications.

The summaries of those interviews are included and linked below.

SUMMARY

ECONOMIC CHANGES

Partners said Idaho has endured significant economic shifts in the last ten years, due in large measure, to the following:

- The automation of staple industries historically central to Idaho's economy;
- The increase in the cost of living, especially housing costs, and stagnant minimum wages;
- A large increase in the growth of the tech sector in Idaho, specifically the Boise area;
- The state's emphasis on workforce development efforts;
- A move away from the support for inclusive access to education and other training opportunities; and
- A growing population, with the region attracting new people to work and live in Idaho.

HOW TO ENSURE IDAHO'S FUTURE

Partners said they believe that Idaho's economic future will be enhanced by:

- Creating stronger career pathways and training opportunities, especially in technology and adding STEM skills in seemingly unrelated fields (e.g. adding data science to psychology fields);
- Deepening connections between education and industry to reinforce skills necessary to succeed in a 22nd century economy, including stronger college and career advising;
- Investing in early childhood education, as well as teacher preparation and professional development that support problem-based learning;
- Collaboration among all partners in the state to ensure the network of all education and career pathways are well maintained and that families know how to access them; and
- Ensuring access to education and training opportunities are available for all Idaho residents, especially those in rural and remote areas of the state.

GOALS FOR IDAHO STEM ECOSYSTEM

Partners said they have hope that the Idaho STEM Ecosystem will:

- Leverage existing resources and networks to foster greater collaboration among diverse organizations and populations;
- Start early and enable the provision of strong early childhood education for Idaho's youngest residents;
- Reimagine teacher preparation and professional development programs;
- Highlight existing bright spots and replicate promising practices;
- Work with state government to strengthen career pathways; and
- Support strategies that will increase access to STEM opportunities for all populations in Idaho.

SPECIAL CHALLENGES TO ADDRESS

Partners said special challenges that can and should be addressed are:

- Remote regions in the state with no access to broadband and limited access to education and training opportunities;
- Stronger pathways to careers that pay livable wages;
- Shifts in state political climate and policy;
- Racial and ethnicity-related achievement gaps due to limited access to STEM opportunities.

ASSETS IN THE IDAHO STEM ECOSYSTEM

The following assets were mentioned by partners in the development of Idaho's STEM Ecosystem:

- The Idaho STEM Action Center is the right partner to lead the ecosystem work;
- The state's three public state universities collaborate well together and are able to lend a lens of research and equity to the work; and
- Strong collaborative cross-sectors networks established that can be leveraged to scale positive impact.

Idaho STEM Ecosystem Design Studio

January 16, 2020 | Boise State University

Intended Outcomes

- Develop a shared understanding of the importance of ecosystem approach to goals
- Craft shared goals, aspirations, indicators of success for Idaho STEM Ecosystem
- Identification of constraints that stand in the way of success for Idaho
- Development of outline of action plan for Idaho, including identification of priorities, work groups, general governance structure and timeline

8:00am	Informal Networking and Breakfast
8:30am	Welcome and Introductions
8:45am	History of Local Initiative and Connection to Global Organization Overview of Idaho STEM Ecosystem Overview of STEM Learning Ecosystems Community of Practice Review of Summary Report for Idaho STEM Ecosystem
9:20am	Aspirations, Ideas and Crafting the Vision for Idaho
10:15am	Constraints and Orthodoxies <i>What stands in the way of your aspirations?</i>
10:35am	Break
10:45am	Discussion: Ecosystems in Action <i>How are other ecosystems working?</i> <i>What are other ecosystems achieving?</i>
11:00am.	Idaho STEM Ecosystem Priorities <i>What do we intend to accomplish in 1 year? 5 years?</i> <i>Identify goals, implementation ideas and indicators</i>
12:30pm	LUNCH and TABLE DISCUSSION About Proposed Priorities
1:30pm	Mapping Proposed Priorities with Working Strategies <i>How will we accomplish our priorities?</i> <i>Will we form working groups? (Or some other strategy?)</i> <i>Specifically, how will we accomplish what we hope to do and by when will we accomplish it?</i> Examples from other ecosystems
3:00pm	Next Steps Securing commitments from attendees for what they want to do, how they can help further the mission. Recap of final plan.
4:30pm	End of Day
4:30-6:30pm	Reception with Appetizers No host bar will follow immediately in Hatch Ballroom CD (Cash only bar)



STATE STEM ECOSYSTEM & EDUCATION PLANS

Case Study (CS) Number One

In 2012, a statewide network of regional STEM hubs was approved by the legislature to devise local solutions to local needs regarding STEM education and the STEM career pipeline. The overall goal was to leverage multi-sector relationships to transform teaching and learning in regards to STEM. Then in 2013, a STEM council was established by legislative mandate to improve student achievement in math and science and increase college enrollment in STEM fields. Together, these initiatives formed the basis for the development of CS1's STEM ecosystem.

The next significant step forward was the formation of the statewide STEM education plan. Started in 2015 under the leadership of the STEM council, this eighteen month process brought together K-12 education, academia, industry, community-based organizations and other partners to provide clear goals for moving STEM education forward in the state. The final version of the plan was released in December of 2016 and underwent review in 2018 to reassess outcomes, initiatives and metrics, and to determine to what extent progress had been made towards the plan's original goals. Recommended changes to the plan were then sent to the state board of education for consideration.

Funds legislated for STEM education are administered by the department of education. With an average yearly appropriation of approximately two million dollars, funds are distributed to the hubs in the form of ongoing funding and grants.

The department of education serves in an oversight capacity for the ecosystem. The STEM council, on the other hand, functions more as a strategic leader, but has no legislated authority other than to advise the state board of education. In 2012, the ecosystem started with six hubs and that number has now expanded to 13, largely due to expansion into unserved areas. They range in size from one county to as many as seven, in more rural parts of the state. Each receives funding for 1.1 full time equivalent (FTE) to administer hub operations and must have their budget approved by the department of education. It is also the responsibility of individual hubs to develop their own strategic plans in conjunction with local partners. STEM hubs are given considerable autonomy when it comes to focus, operation, programming, fundraising and how they report data to the ecosystem. This level of independence has allowed some hubs to flourish, while others struggle to maintain significant progress.

CS1 has no single backbone organization to coordinate overall ecosystem operations. Instead, some of these responsibilities are shared between the department of education and the STEM council. This arrangement leaves a void in terms of statewide strategic leadership, and while regional STEM hubs appreciate a certain level of local control, the consensus among them is that more statewide leadership is needed. Another struggle that has limited growth of the ecosystem is that the original grant funding available to the STEM hubs for special projects was competitive. This process was counterproductive in regards to fostering a collaborative statewide network, and while subsequent restructuring during later rounds of funding has addressed this issue and reduced feelings of competition, it is still felt by many of the STEM hubs.

Case Study Number Two

In 2006, a partnership developed between a large multinational corporation, a prestigious research university, and the state department of education to address K-8 math, and later, science education. Then in 2012, a statewide STEM coalition made up of the original group plus several other key STEM partners was formed with the purpose of expanding the focus on STEM statewide. The group also began working on the development of the state's first STEM education plan.

In 2016, the coalition, in conjunction with an afterschool network, formed the statewide STEM council that included state agencies, postsecondary institutions, businesses, and philanthropists. This group soon coalesced into the statewide STEM ecosystem and started lobbying the legislature for funding in support of STEM initiatives. That effort bore fruit in 2019 in the form of two million dollars of one time funding. However, instead of the funds being allocated to the ecosystem, they were directed to the state's department of education, who in turn made them available to school districts in the form of competitive grants to identify/implement research-based curricula in STEM. In addition to the funds earmarked for STEM, there was an additional appropriation made specifically for computer science. Both line items were renewed in 2020. The ecosystem has also been able to attract private funding through grants for specific, STEM-related projects. This revenue is routed through the aforementioned afterschool network who acts as the fiscal agent for the ecosystem.

Also in 2016, as an outgrowth of the ecosystem, a statewide STEM council was created, although its membership is made up primarily of partners from the state's largest city and the surrounding area. The council serves in a quasi-advisory capacity to the ecosystem, but has no governing authority. Originally, one of the council's primary responsibilities was to develop a statewide, STEM strategic plan that included goals, objectives and common language for the budding ecosystem. After a nearly year-long process, the six-year plan was finally published in November of 2018.

Over the years, the ecosystem, in its various incarnations, has been able to attract the participation of over 400 different organizations from K-12, post-secondary education, afterschool programs, industry, state agencies, and philanthropic organizations. It hosts two statewide convenings per year to help build momentum in STEM throughout the state, but a vast majority of the participants come from the state's main population center and there are fewer than 100 organizations that remain actively engaged. Consequently, there is renewed emphasis on making convenings more effective at building cross-sector partnerships that are mutually beneficial and can be sustained over time.

There has been significant discussion about the formation of regional networks as described in the strategic plan, but as of yet, no progress in that regard. This is primarily due to a lack of funding to create the necessary infrastructure to develop, staff and maintain ongoing network operations. Instead, the decision has been made to keep costs as low as possible and focus limited funds on providing resources statewide in the hope that it will foster more regional collaboration.

Currently, there is no single backbone organization moving STEM forward in the CS2 ecosystem; funding is administered between two organizations (the department of education and the afterschool network), the council developed the strategic plan, but only plays an advisory role, and the ecosystem receives no direct funding from the state to fund operations. Consequently, there is the perception among many partners that no one is driving

implementation of the strategic plan which has resulted in a number of business partners reducing their level of support. However, recent legislation hopes to address this problem. Historically, the superintendent of public instruction has been an elected position, but that was changed this year making it a position appointed by the governor. As the governor is a strong STEM advocate (and is expected to be reelected this fall), it is believed that there will be a more unified and sustained effort to elevate STEM, implement the strategic plan and support the growth of the ecosystem statewide.

Case Study Number Three

A nonprofit that holds a statewide technology fair, among many other programs that it offers, provided the impetus back in 2012 for the development of the CS3 STEM ecosystem. Located in the state's largest metropolitan area, it has served as the backbone organization from the beginning and continues in that role today, despite the fact that the time the staff devotes to ecosystem activities is largely volunteer. In addition to the statewide fair, it also supports smaller, regional fairs throughout the state. Collectively, these fairs offer over 4,500 expos, workshops, conversations, exhibitions and tours held in diverse neighborhoods throughout the state. It is largely through the association with these fairs that the ecosystem has been able to attract over 800 participating organizations from industry, academia, arts, municipalities, communities and K-12. A recently held statewide digital convening was attended by over 100 participants.

To date, there have been no funds from the state dedicated to supporting the ecosystem. This lack of funding has severely limited the ecosystem's ability to provide programming or support to move STEM education forward in a comprehensive, sustainable fashion. Consequently, grants, donations and fees collected at fairs are the only relatively regular sources of revenue for the ecosystem. While these funds fluctuate significantly, the amount generated that is dedicated to STEM ecosystem activities is typically between one hundred and two hundred thousand dollars per year.

The backbone organization, along with key partners throughout the state, would like to see the development of regional hubs similar to other western states. Doing so would allow for stronger regional partnerships that can help fund STEM programs that address the desires of the communities they serve. In addition to providing more autonomy, they would also be more responsive to the specific needs of the diverse cultures in the state that are largely located in distinct geographical regions. Fortunately, the backbone organization has recently received a federal grant that is designed to aid the ecosystem in developing hubs in rural areas of the state.

There is, as of yet, no statewide strategic plan to guide the direction of the ecosystem. Staff from the backbone organization, working in conjunction with other STEM partner groups, have been working to develop such a plan and hope to have it completed sometime this year. They are hopeful that, once completed, the plan will not only establish the mission and vision of the STEM ecosystem, but also help to elevate their stature in the eyes of the legislature resulting in secure, ongoing funding.

The lack of consistent levels of sustained funding has been a significant impediment to the growth and vitality of the CS3 ecosystem. It has slowed the development of a strategic plan, made it difficult to establish a framework for the creation and ongoing support for regional hubs, and made statewide convenings, which are very expensive to host, all but impossible. Additionally, it has been difficult for the backbone organization to keep participating

organizations engaged beyond the limited scope of the regional fairs. As with the other challenges the ecosystem faces, this too is impacted by a lack of funding.

Case Study Number Four

Industry representatives and philanthropic organizations were the primary drivers for the formation of the CS4 ecosystem. A private, non-profit was formed that ultimately became the governing board of the backbone organization and also supervises the ecosystem's CEO. The goal was to bring together business, K-12, post-secondary education, and community based organizations to elevate STEM education in support of the region's thriving high tech industry. Significant investment from a number of large donors allowed for a deliberate process during the early stages of development and it has continued to foster the ongoing strategic growth of the ecosystem. The backbone organization currently has a budget of approximately six million dollars and a staff of 20. This amount does not include funds generated by the regional networks. This consistent and relatively high level of funding has made possible a methodical, vision-driven process that is uncommon when compared to the other ecosystems interviewed for this paper.

With the backbone organization located in the largest metropolitan area in the state, it was planned from the beginning to allow for the formation of regional networks based on geographic/economic boundaries as opposed to political ones. This has allowed the networks to remain somewhat apolitical, while still being able to effectively operate in that arena, when necessary. Also, having such a focus has allowed each network to build strong, collaborative relationships rooted in regional interests that finance much of their work. This has afforded each of the networks a considerable amount of power and autonomy.

Three networks were formed in the early stages of the ecosystem with additional ones being added incrementally over the intervening years to the point where there are currently a total of ten, serving 57% of the state's K-12 students. Each has its own director and is administered by one of a variety of regional organizations ranging from educational service districts to community colleges to the local chamber of commerce. The backbone organization provides some funding to the networks, but focuses primarily on training, tools and data. It also hosts five convenings of network representatives each year and one annual summit of a much larger group including educational partners, industry, community-based programs and nonprofit organizations.

From the start, developing a strategic plan was a high priority that included a broad range partners with a vested interest in STEM education, as well as legal counsel and insurance representatives. The backbone organization also works with the regional networks to write their own strategic plans and ensure that they mesh with the statewide plan. Both the statewide strategic plan and the agreements between the backbone organization and the regional networks are reviewed every two years. As it is a living document open to revision, the process is seen as being expensive, inefficient, and time consuming, but necessary to maintain cohesion between the disparate entities.

Despite its relatively orderly rollout and development, CS4 is not without its challenges. Primary among these is the hierarchical structure of the organization from the board to the CEO down to the network directors. The board is not simply advisory, it also has the authority to hire and fire the CEO. At the same time, directors at the regional network level have considerable autonomy and their own strategic vision. It has proven to be challenging for the CEO to satisfy the needs of both entities while maintaining effective communication and transparent operations. In

response, the CEO is meeting more frequently with individual network directors to build stronger working relationships and address their concerns.

A related problem is that while regional autonomy is seen as a real strength in terms of being able to leverage local resources and respond to specific needs, it makes statewide coordination/collaboration difficult. The more independent they become, particularly from a financial standpoint, the more difficult they are to control for the statewide organization. It may be that in the future, some networks choose to sever ties with the backbone organization and go it alone similar to some of the ecosystems in the eastern half of the United States.

Finally, from the beginning, the ecosystem has lacked a strong focus on addressing the needs of specific student populations. The attempt to be “everything to everyone” hasn’t been successful for a significant number of students throughout the state. Consequently, the ecosystem is aggressively analyzing data to identify underserved populations and implement researched-based programs to close existing gaps in achievement in STEM.