Evaluation of Utah Science Technology and Research Initiative's Strategic Value and Operational Effectiveness:

Response to Utah Code 63M-2-802(6)(b)

August 1, 2018

TEConomy Partners, LLC is a global leader in research, analysis, and strategy for innovation-based economic development. We help nations, states, universities, and industries blueprint their future and translate knowledge into prosperity.

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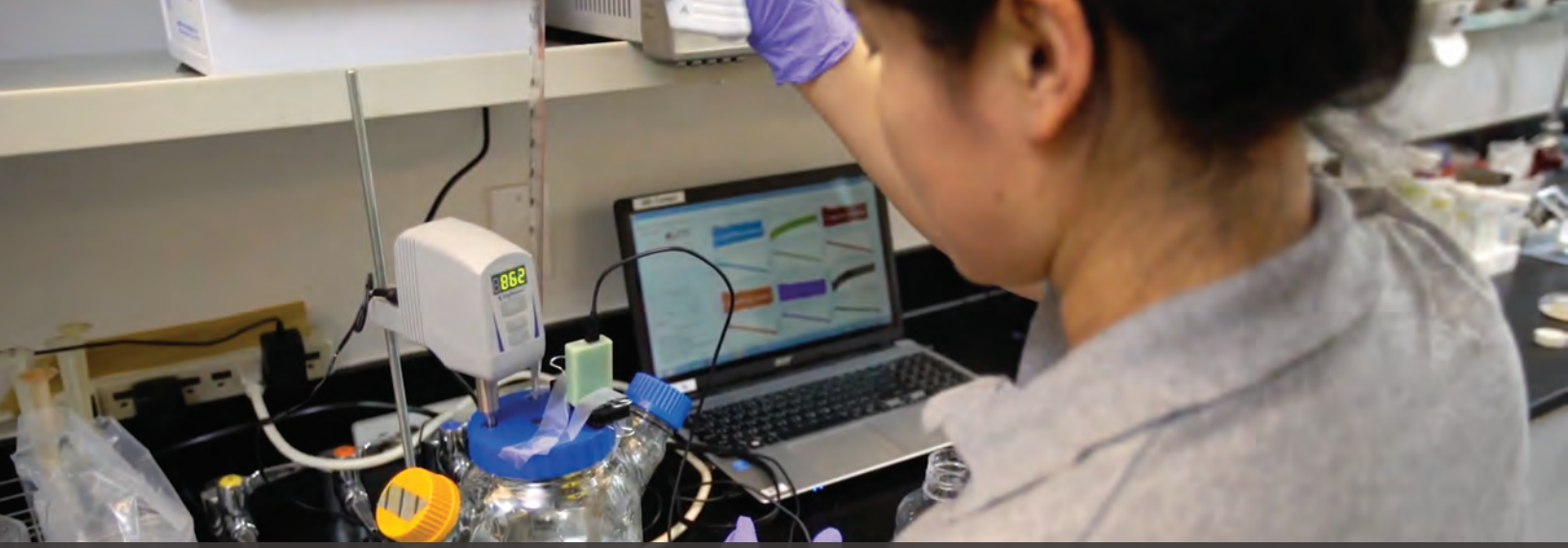


Executive Summary

The Utah Science Technology and Research Initiative, or USTAR, is Utah's set of technology-based economic development programs and the agency charged with implementing them. USTAR aims to support the State's long-term growth and diversification through the provision of competitive grants and entrepreneur support services to "deep technology" startups. Without this funding, many of these companies will not advance greatly limiting the type of startup activity that Utah's economy can support.

The data and analysis presented in this evaluation find that USTAR's current portfolio of programs are strategic, aligned to the state's technology-based economic development goals, and focused on an important market gap that is constraining deep technology startup growth and economic diversification. Since the 2016 legislative reseat, USTAR program data indicate strong demand for USTAR grant programs and good investment and sales growth performance by USTAR companies.

The study further finds that USTAR is a lean, effective, and outcomes-driven organization. When USTAR is benchmarked against peer organizations in other states, USTAR ranks 7th (out of 10) for total staff size and 10th for average compensation per employee. On a salary by position basis, USTAR salaries for 11 positions are the same or lower than nearly all the same positions at the Governor's Office of Management and Budget, the Governor's Office of Economic Development, and the Governor's Office of Energy Development. Nevertheless, USTAR has been able to attract top talent to accomplish much in the two years since the 2016 legislative reset.

USTAR's effectiveness is due to both the caliber of its staff, as well as the deep level of engagement by its Governing Authority members—many of whom bring private sector, deep technology, and startup experience. These members take their role in providing strategic direction and oversight of USTAR seriously and are focused on making USTAR additive to the ecosystem as a whole.

Objective

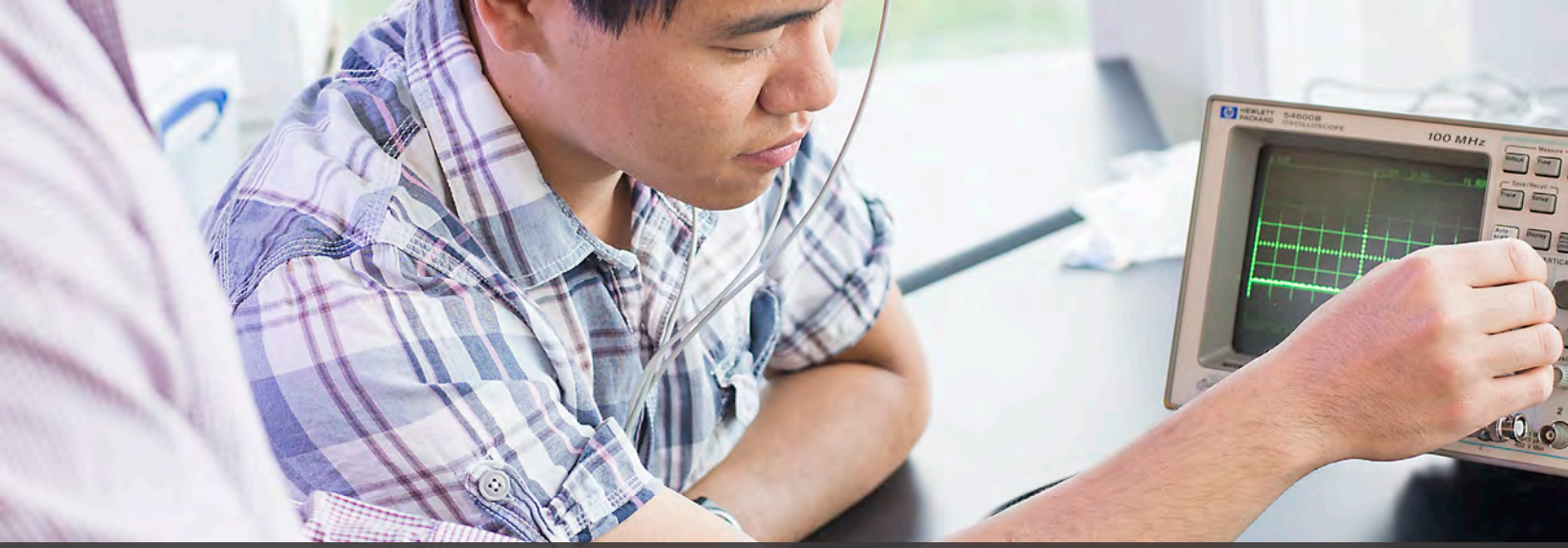
The State of Utah is committed to long-term economic growth, diversification, and the creation of high-wage jobs. To this end, each year the State spends $71 million on economic development programs and another $524 million on economic development tax incentives to retain and recruit companies (e.g., tax credits, tax exemptions, tax rebates, etc.).[1]

The vast majority of these incentives target larger, more established companies.[2] By comparison, Utah will spend $14 million in FY19 to support the growth of new, home-grown, "deep technology" startup companies in sectors characterized by large and growing global markets and identified as important to the state's economy. These target sectors include life sciences, aerospace and advanced materials, energy and cleantech, robotics and automation, and big data and cyber systems.

This study evaluates a set of strategic and operational questions posed by the Utah legislature about the $14 million appropriation for technology-based economic development executed by the Utah Science Technology and Research (USTAR) Initiative.

1 For breakdown by program or incentive, see appendix. Data comes from the Governor's Office of Economic Development (2018). *2017 Annual Report,* p.49, and the Utah State Tax Commission (2018). *Annual Report FY2016-2017,* pp.63-64.

2 For example, the Economic Development Tax Increment Finance (EDTIF) program is a corporate incentive program that provides tax credits for companies that are stable, profitable, and will commit to creating at least 50 new jobs. In 2013, the Office of the State Auditor stated that EDTIF had outstanding long-term commitments of $94.749 million in cash rebates and $560.739 million in tax credits. See Office of the State Auditor (2014), *A Performance Audit of GOED's Corporate Incentives Program*, p.61. In 2016, the Governor's Office of Economic Development stated EDTIF outstanding tax commitments had risen to $857.453 million. See the Governor's Office of Economic Development (2017). *2016 Annual Report*, p.56.

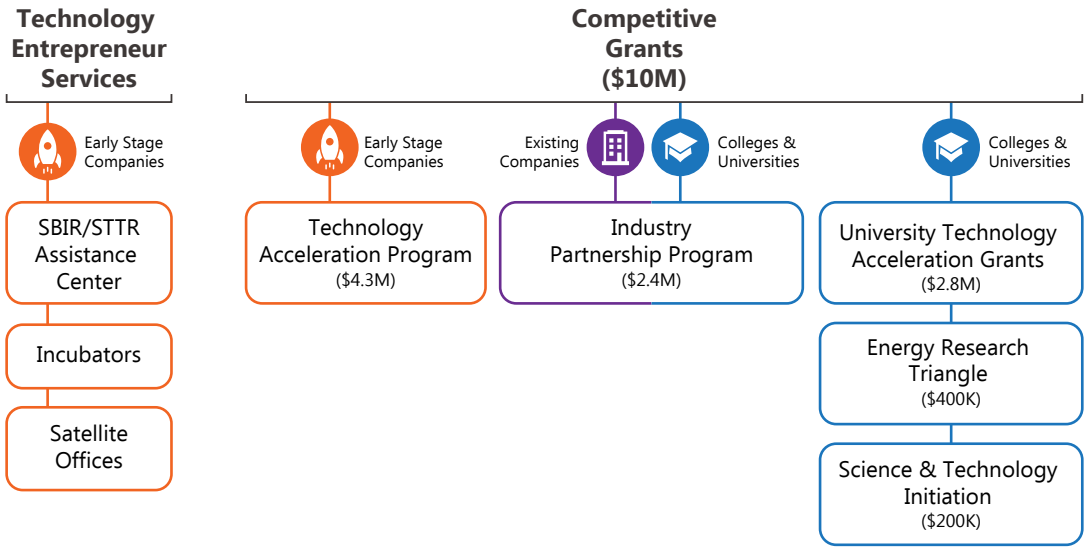


About USTAR

The Utah Science Technology and Research Initiative, or USTAR, is Utah's set of technology-based economic development programs and the agency charged with implementing them. USTAR aims to support the diversification of the state's economy, attract private investment from outside the state, and support early-stage Utah companies in achieving the milestones needed to attract private investors and initial customers.

USTAR does this by providing competitive grants and entrepreneur support services (e.g., incubators, regional offices, and SBIR proposal assistance) to Utah's "deep technology" startups, which are more research and development (R&D)- and capital-intensive than other technology startups. Without this funding, many of these companies will not advance. This greatly limits the type of startup activity that Utah's economy can support and forces deep technology companies to move outside the state to succeed, reducing the diversity of tech-based activity in Utah.

FIGURE 1. USTAR Programs and Type of Innovation Actors Supported

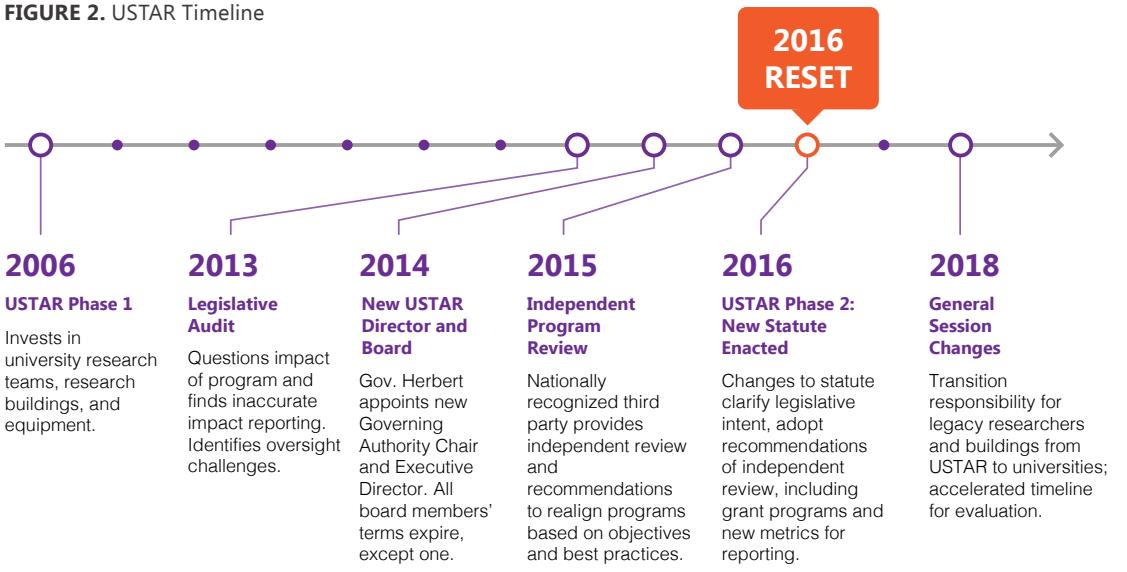


Successful innovation ecosystems hinge on the strengths and interaction of many different actors. As innovation ecosystems evolve over time, different gaps emerge, and policymakers may ask their technology-based economic development agencies to realign their programs with new priorities and challenges. In the first phase of the USTAR initiative (2006-2016), USTAR invested heavily in building university research capacity by recruiting top research talent and investing in core research facilities. World-class research universities are an important upstream driver of technology-based economic development, since they produce and attract talent and ideas to a region. In this first phase, USTAR recruited 40 faculty to the University of Utah and Utah State University and invested in research buildings and labs. USTAR also invested in economic development activity through regional offices within regional universities, although this support was more diffuse and unstructured.

Since the legislative reset of USTAR in 2016, USTAR has shifted its focus to downstream gaps closer to the market. USTAR eliminated programs, such as the faculty recruitment program. It launched new competitive grant programs and continued and strengthened its technology entrepreneur services program, which includes incubators, regional offices, and the SBIR/STTR Assistance Center. All of USTAR's programmatic changes align to the statutory changes of 2016, were approved by the USTAR Governing Authority, and are defined in both administrative rules and policy. In 2018, the legislature removed the legacy university research capacity portion of USTAR from its statute.

The USTAR Governing Authority is the board that provides operational oversight and accountability for USTAR. The Governing Authority is comprised of eight leaders from business, higher education, and government appointed by the Governor, the Speaker of the House, the Senate President, and the Commissioner of Higher Education for four-year terms. Two additional members, the State Treasurer and the Executive Director of the Governor's Office of Economic Development, are statutorily required. In addition to the oversight provided

FIGURE 2. USTAR Timeline



by the Governing Authority, USTAR is required to report annually to the legislature and the Governor on a set of economic impact metrics, which are outlined in statute and follow best practices from other state innovation programs.

This evaluation focuses on assessing USTAR's strategic importance and operational effectiveness since the 2016 legislative reset. The 2018 General Session transitioned responsibility for the legacy researchers and the university campus research buildings from USTAR to the universities. The General Session also accelerated the timeline of the statutorily mandated quadrennial review, which this report fulfills.

FIGURE 3. Governing Authority

Susan D. Opp
Chair
Senior Vice President Strategy, L3 Technologies

Val Hale
Vice Chair
Executive Director, Governor's Office of Economic Development

David Damschen
Utah State Treasurer

Theresa A. Foxley
President & CEO, EDCUtah

Jennifer Hwu, Ph.D
President, CEO & Co-Founder, Innosys

Richard Kendell
Co-Chair of Education First, Education Policy Advisor to Prosperity 2020

Rich Lunsford
Corporate Vice President, Cardiac Surgery Systems, Edwards Lifesciences

Derek Miller
President & CEO, Salt Lake Chamber

Brigham Tomco
Chairman & CEO, Zylun Global

Approach

This accelerated quadrennial review examines the impact of USTAR since the 2016 statute changes went into effect in May 2016. USTAR requested TEConomy Partners, a leader in research, analysis, and strategy for innovation-based economic development, to conduct the analysis and provide a report to a Blue-Ribbon Panel for their review and comment. The statutory request asks for an evaluation of USTAR's strategic importance and operational effectiveness since 2016, and guidance on whether USTAR should continue its current Phase 2 strategic direction or whether any changes should be made. The strategic and operational assessment questions posed by the legislature are presented in the figure below.

FIGURE 4. Strategic and Operational Questions Posed by the Statutory Review

Strategic	Operational
1 Is USTAR beneficial to the state and should it continue?	4 Are USTAR's programs being run effectively and efficiently?
2 What has been USTAR's performance since the 2016 reset?	5 Are there similar programs that could provide similar benefits at lower cost?
3 Are there changes that should be made to USTAR's current structure of programs?	6 Are the reporting requirements effective at measuring USTAR's performance?

To evaluate these questions, TEConomy Partners collected and analyzed a variety of data, including economic and venture capital (VC) data, program administrative records, program impact data, financial data, and benchmark data. The data used to evaluate each question are provided in the figure below.

FIGURE 5. Data Used to Evaluate Each Question

Strategic Questions		Data Sources
1	Is USTAR beneficial to the state and should it continue?	• Program data • Angel and seed VC data
2	What has been USTAR's performance since the 2016 reset?	• Program data • Impact data
3	Are there changes that should be made to USTAR's current structure of programs?	• Alignment with objectives • Benchmarking
Operational Questions		**Data Sources**
4	Are USTAR's programs being run effectively and efficiently?	• Program data • Award criteria and accountability • Financial data (salaries, space, operations)
5	Are there similar programs that could provide similar benefits at lower cost?	• Within Utah • Models outside of Utah
6	Are the reporting requirements effective at measuring USTAR's performance?	• Industry standard for similar programs • Impact data

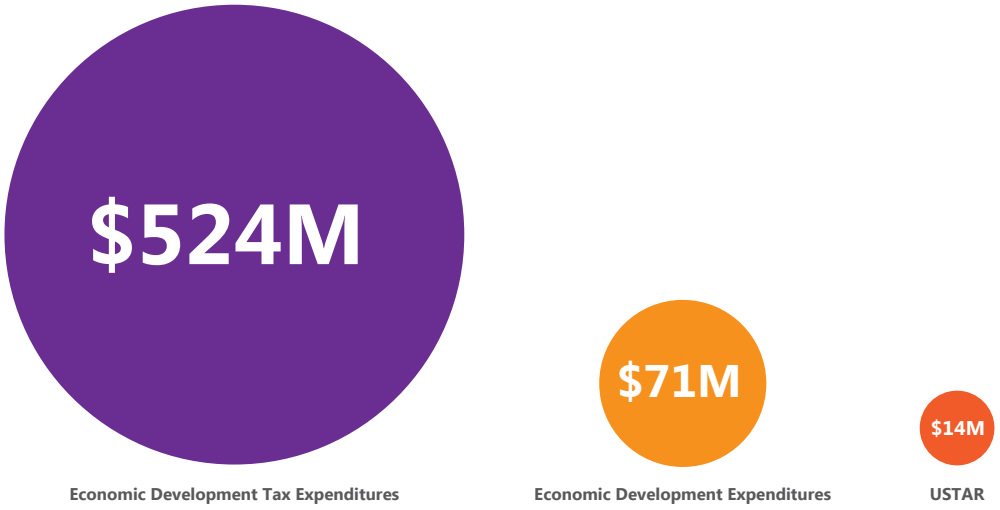
The remainder of the report is organized by each of the three strategic and operational questions posed by the legislature about USTAR. The available data are used to analyze and answer these evaluation questions.

Strategic Questions

1 Is USTAR beneficial to the state and should it continue?

The State of Utah has stated it is committed to the long-term economic growth, industrial diversification, and creation of high-wage jobs in the state. To this end, each year the State of Utah spends $71 million on economic development programs and $524 million on economic development tax incentives.[3] By comparison, $14 million goes to USTAR to support its technology-based economic development programs with another $1.25 million[4] going to GOED's Technology Commercialization and Innovation Program, which focuses on technology commercialization by slightly later-stage companies than USTAR. Nationally, 45 other states have technology-based economic development programs that provide a range of funding and programs to support technology commercialization and startup activity.[5]

FIGURE 6. Scale of Utah's Traditional Economic Development Expenditures vs Technology-Based Economic Development Expenditures



Source: Adapted from the Center for Regional Economic Competitiveness and The Council for Community and Economic Research (2015). Business Incentives and Economic Development Expenditures: An Overview of Utah's Program Investments and Outcomes, and updated with 2017 data from the Utah State Tax Commission, Annual Report FY2016-2017; the Governor's Office of Economic Development, 2017 Annual Report, and USTAR FY2019 budget.

The key differences between technology-based economic development (TBED) programs and traditional economic development programs is that **TBED programs focus on helping small, locally-grown companies bring new technologies to market, whereas traditional economic development programs focus on retaining and recruiting larger, more established companies.**

3 Governor's Office of Economic Development (2017). *2016 Annual Report*; Utah State Tax Commission (2018). *Annual Report FY2016-2017*, pp.63-64; and Center for Regional Economic Competitiveness and the Council for Community and Economic Research (2015). *Business Incentives and Economic Development Expenditures: An Overview of Utah's Program Investments and Outcomes.*
4 Office of the Legislative Fiscal Analyst (2017). *Budget of the State of Utah and Related Appropriations 2017-2018*, p.78.
5 For map of states with technology-based economic development programs, see the "Technology-Based Economic Development Programs" section in the Appendix.

Economies need a mix of both types of industries—mature industries that employ a large number of people today and emerging, high-growth industries that will employ the workforce of tomorrow. If a state does not have a medical device industry today, it may be able to recruit a few companies. However, developing the critical mass of companies needed to support the emergence of a new industry cluster also requires the growth of locally grown companies. Some of these new companies will fail, but a few will scale to become players in their own right. Others will grow and be acquired, like the acquisitions of the home-grown Utah companies that brought Thermo Fisher Scientific and GE Healthcare to the state. This is another effective way to attracting major player and private investment.

USTAR aims to catalyze the growth of new technology-based industry sectors by supporting the successful scale up of home-grown deep technology companies. How can the legislature evaluate if USTAR's programs are helping the state make progress toward this objective and if USTAR should continue?

There are three key criteria for evaluating the "benefit" of a government program:

1. Does the program address a true gap or market failure?
2. Does the program have clear objectives, and is the program design aligned with these objectives?
3. Does the "public good" impact of the program outweigh the program cost?

USTAR is focused on a clear objective and private sector gap: access to early-stage capital for Utah's "deep technology" companies.

USTAR provides competitive grants to companies to develop prototypes and hit milestones leading to follow-on private sector investment and customers. Without this funding, many of Utah's deep tech companies will not advance or will leave the state trying to do so. This greatly limits the type of technology-based industries that Utah's economy can support.

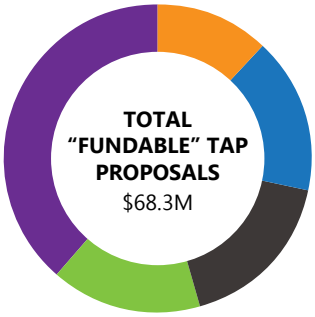
What is "Deep Technology," and what does USTAR Fund in "Big Data and Cyber Systems"?

Deep technologies are characterized by being more R&D-intensive, involving more complex scientific and engineering concepts, requiring larger amounts of capital investment to prototype and validate, and having a longer time horizon before generating sales.

USTAR currently targets the life sciences, aerospace and advanced materials, energy and cleantech, robotics and automation, and big data and cyber systems, because these technology sectors are aligned to priority industry sector development in the state.

USTAR does fund Big Data and Cyber Systems, which can include IT hardware, networks, or big data algorithms that enable or have applications in other deep technology sectors. USTAR does not fund IT projects that are only software development and have a low barrier to entry.

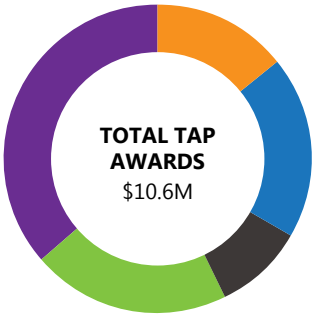
FIGURE 7. "Fundable" TAP Proposals by Technology Sector, 2016-2017



- **Life Sciences** | 38.5% | $26.3M
- **Energy & Clean Tech** | 15.7% | $10.7M
- **Big Data & Cyber Systems** | 17.5% | $11.9M
- **Automation & Robotics** | 16.2% | $11.1M
- **Aerospace & Advanced Materials** | 12.2% | $8.3M

Note: Data includes TAP Pilot through Cohort 3 proposals.
Source: USTAR

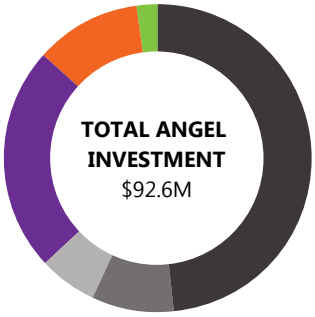
FIGURE 8. USTAR TAP Awards by Technology Sector, 2016-2017



- **Life Sciences** | 36.3% | $3.8M
- **Energy & Clean Tech** | 21.3% | $2.2M
- **Big Data & Cyber Systems** | 9.4% | $1.0M
- **Automation & Robotics** | 18.8% | $2.0M
- **Aerospace & Advanced Materials** | 14.2% | $1.5M

Note: Data includes TAP Pilot through Cohort 3 proposals.
Source: USTAR

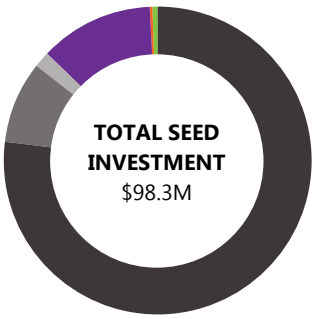
FIGURE 9. Utah Angel VC Investment by Technology Sector, 2016-2017



- **IT** | 48.5% | $44.9M
- **B2B** | 8.7% | $8.0M
- **B2C** | 6.1% | $5.6M
- **Healthcare** | 23.4% | $21.7M
- **Financial Services** | 11.1% | $10.3M
- **Energy** | 2.2% | $2.0M

Source: PitchBook

FIGURE 10. Utah Seed VC Investment by Technology Sector, 2016-2017



- **IT** | 77.2% | $75.9M
- **B2B** | 8.6% | $8.5M
- **B2C** | 1.6% | $1.6M
- **Healthcare** | 11.9% | $11.7M
- **Financial Services** | 0.3% | $0.3M
- **Energy** | 0.4% | $0.4M

Source: PitchBook

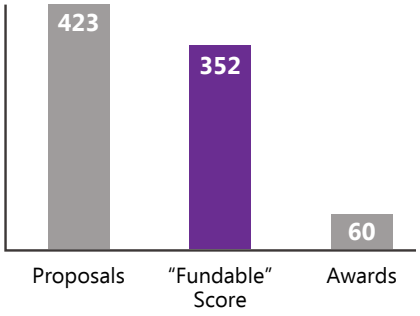
The data for assessing if a significant private sector funding gap exists is the demand for capital by companies in deep technology sectors versus the technology sectors which receive early-stage risk capital investment.

The evidence is clear that there is a significant gap in the availability of capital for deep technology companies. Figures 7 through 10 illustrate how USTAR focuses on deep technology sectors that are overlooked by the venture capital markets in angel and seed stage investments.

USTAR program data demonstrate high demand for early-stage capital from deep technology companies, as shown in Figure 11.

From 2016 to 2017, Utah deep tech startups submitted 423 proposals for TAP grants that totaled $90.1 million in funding. Of these, 352 proposals received a "fundable" score of 3 out of 5 or higher by a peer review panel comprised of three individuals with business and technical expertise. These fundable proposals totaled $67.9 million. Of these 352 fundable proposals, USTAR awarded 60 TAP grants totaling $10.6 million.

FIGURE 11. Demand for TAP Grants, 2016-2017



Source: USTAR and PitchBook

TABLE 1. "Fundable" TAP Proposals, 2016-2017

Total Proposal Value	Total Proposals	Mean Proposal Size
$67.9M	352	$193K

Source: USTAR and PitchBook

The table below demonstrates the total amount, average amount, and concentration of capital going to particular technology sectors. The first row shows USTAR's $10.6 million in funding for 60 TAP projects and the high concentration of TAP awards outside of IT, Business to Business (B2B), and Business to Customer (B2C) software and services. This was the maximum that USTAR could fund over this two-year period based on its budget.[6] The third and fourth rows show the total value and number of Utah angel and seed VC deals from 2016-2017, as well as the low percentage of deals outside of IT, B2B, and B2C software and services.

6 The TAP program is budgeted at $4.5 million a year, and USTAR has flexibility to shift funding across fiscal years and between programs based on varying demand from year to year, which it did in this case.

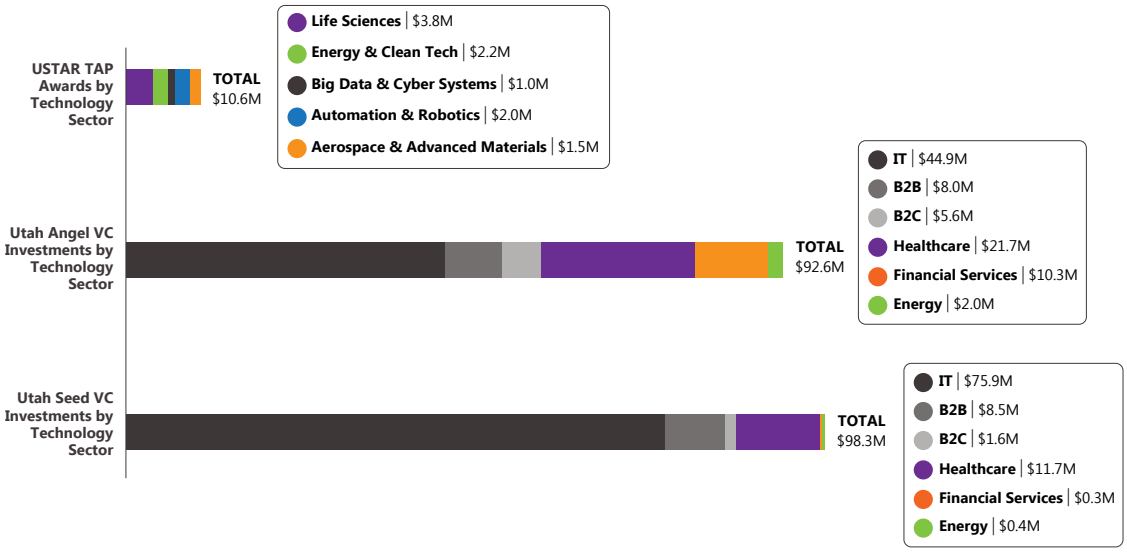
TABLE 2. Deep Tech Company Demand for Capital versus Limited Supply: USTAR Program Data and Utah Angel and Seed Stage VC Data, 2016 and 2017

	Total Value	Total # of Deals	Avg Deal Size	Share of Deal Value Outside of IT/B2B/B2C	Share of Deals IT/ B2B/B2C
USTAR TAP awards	$10.6M	60	$176K	90.6%	91.7%
Angel	$92.6M	71	$1.2M	22.5%	36.8%
Seed	$98.3M	44	$2.2M	12.6%	18.2%

Note: USTAR provides funding at the pre-seed stage.
Source: USTAR and PitchBook

USTAR TAP awards represented only a ninth (11.4%) of total angel investment from 2016-2017. However, 90.6% of USTAR funding went to deep tech companies, while only 22.5% of angel investment and 12.6% of seed investment went to companies in deep tech sectors (i.e., those outside of IT, B2B, and B2C software and services). (See what USTAR funds in Big Data and Cyber Systems in box on p.11.)

FIGURE 12. Comparison of Scale of Capital Provided by USTAR TAP Grants versus Utah Angel and Seed VC Investment, 2016-2017



It is a significant barrier to entry for Utah deep tech startups if they cannot access the capital needed to develop a prototype and to conduct initial validation work with pilot customers. Ultimately, these companies cannot advance, and Utah misses an opportunity to leverage its startups to diversify its economy.

> "You can't compare the business activity of a life sciences company trying to get to market with a software company. There needs be some type of commercialization validation to build trust among private investors before they will invest, and the capital to undertake this validation has to come from somewhere."
>
> –Dan Wee, T3S, a pharmaceutical manufacturing company

The argument is often made that good deals get funded. However, it is also the case that private sector investors increasingly want to see a minimal viable product/prototype and a demonstration of the technology's efficacy with pilot customers before they invest. Increasing access to capital for deep tech companies is important to catalyzing growth in new high-wage technology sectors in the state.

> "I'm an inventor, an entrepreneur, and a taxpayer. I typically look at things and say private markets and entrepreneurs will do it better than government. But, in some areas of technology development, especially deep tech—e.g., aerospace, clean tech, biotech—the private markets aren't participating early on. If a state wants to attract that private investment, they are going to have to invest early on."
>
> –Brigham Tomco, Chairman and CEO, Zylun Global and USTAR Governing Authority member

FIGURE 13. How USTAR Works

On the university side, the first phase (2006-2016) of USTAR focused on recruiting research faculty talent and investing in research capacity building. In its second phase (2016-present), USTAR's much smaller university-focused grant program focuses on maximizing the productivity of its legacy investments—incentivizing research faculty at all universities to work on applied problems that lead to commercialization outcomes.

> "The reality is that the amount of research funding coming from the federal government still dwarfs the funding that comes to universities from industry. This makes it a challenge to change the culture of a university and to focus people's attention on applied research and commercialization."
>
> –Terri Fiez, Ph.D., Vice Chancellor for Research & Innovation, the University of Colorado, Boulder, Role of Government in Innovation Panel, 4th Utah Technology Innovation Summit

Like TAP, USTAR's University Technology Acceleration Grants (UTAG) support commercially-oriented researchers in advancing early-stage technologies, but in the university context. The program seeks the best ideas from across Utah's higher education institutions and takes a milestone-driven approach to supporting Utah researchers in developing and licensing novel technologies. UTAG proposals must be aligned to the same target technology sectors in the state—the life sciences, aerospace, energy and cleantech, automation and robotics, and big data and cyber systems.

The 2016-2018 demand for the USTAR University Technology Acceleration Grant program has been strong.

There have been three rounds of awards to date. University researchers submitted 179 technology proposals totaling $38.2 million. Of these, 158 proposals totaling $34.5 million received a minimum "fundable" score of three out of five. USTAR made 35 awards totaling $8.75 million. The life sciences comprised 60% of awards, followed by automation and robotics with 15.9% of awards, and energy and clean tech with 13%.

FIGURE 14. Demand for USTAR University Technology Acceleration Grants, 2016-2018

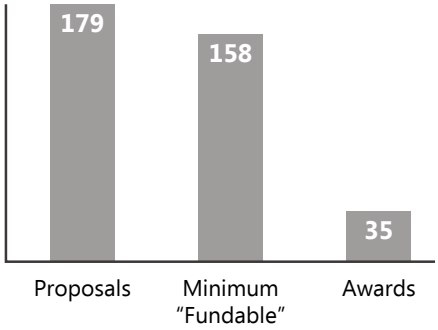
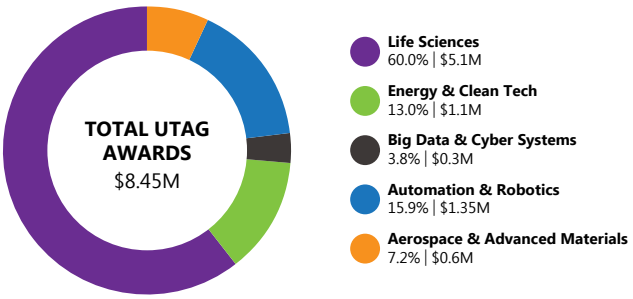


FIGURE 15. UTAG Awards by Technology Sector, 2016-2018



1 Is USTAR beneficial to the State of Utah and should it continue?

Answer:

Based on the data and analysis presented in this section, the answer is "yes." USTAR is focused on a gap that is impeding deep tech startup activity and, in doing so, USTAR is advancing economic diversification in Utah.

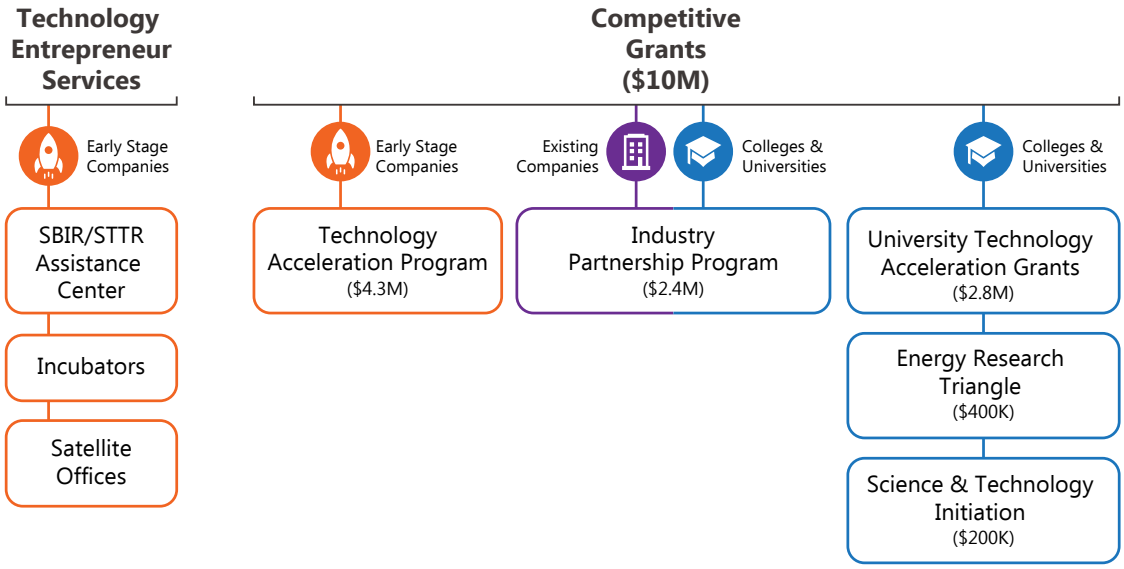
USTAR program data indicates strong demand. From 2016-2017, USTAR received 352 proposals that achieved a minimum "fundable" score of 3 out of 5 via a peer review process. USTAR was only able to fund one of every six commercialization projects, and the $10.6 million in total TAP awards over this period represent only a ninth of total angel investment. However, 90.6% of USTAR funding went to deep tech companies, while only 22.5% of angel investment and 12.6% of seed investment went to companies in sectors outside of IT, B2B, and B2C software and services.

The demand for early-stage risk capital by Utah deep tech startups should be monitored over time to see if the current levels of TAP funding are sufficient. Is demand for TAP grants increasing or decreasing over time? What is the mix of companies applying? Are the same companies applying or is USTAR also seeing a good mix of first-time applicants?

2 What is USTAR's performance since the 2016 reset?

USTAR's performance objectives for both funded companies and funded university researchers is to raise follow-on investment, bring new technologies to market, and generate sales. This section analyzes the available impact data for companies and researchers who have received USTAR funding since 2016 to answer the question of USTAR's impact. The breakdown of USTAR's competitive grant programs are shown in the figure below. This section focuses on the two largest grant programs: the Technology Acceleration Program and the University Technology Acceleration Grants program.

FIGURE 16. USTAR Programs and Type of Innovation Actors Supported



Bringing deep technologies to market and increasing their market reach beyond an initial set of pilot customers takes time. USTAR seeks to be early in the lifecycle of deep technology companies, since this is where the market gap is. Accordingly, the true impact of USTAR's grant programs should be measured over 5-10 years, rather than in the two years since the new programs were launched.

On the other hand, two years is enough time to assess whether a program's objectives, design, amount of funding, oversight and accountability, and demand are optimal to achieve success. The operational effectiveness aspects of USTAR's programs are addressed in the second half of this report. The rest of this section analyzes USTAR program performance using the available impact data to date.

"The rigor of USTAR today did not exist prior to 2014. USTAR today interfaces more with the principal investigators, is milestone-driven, and uses standards and practices used in the private sector when reviewing the progress toward commercialization milestones."

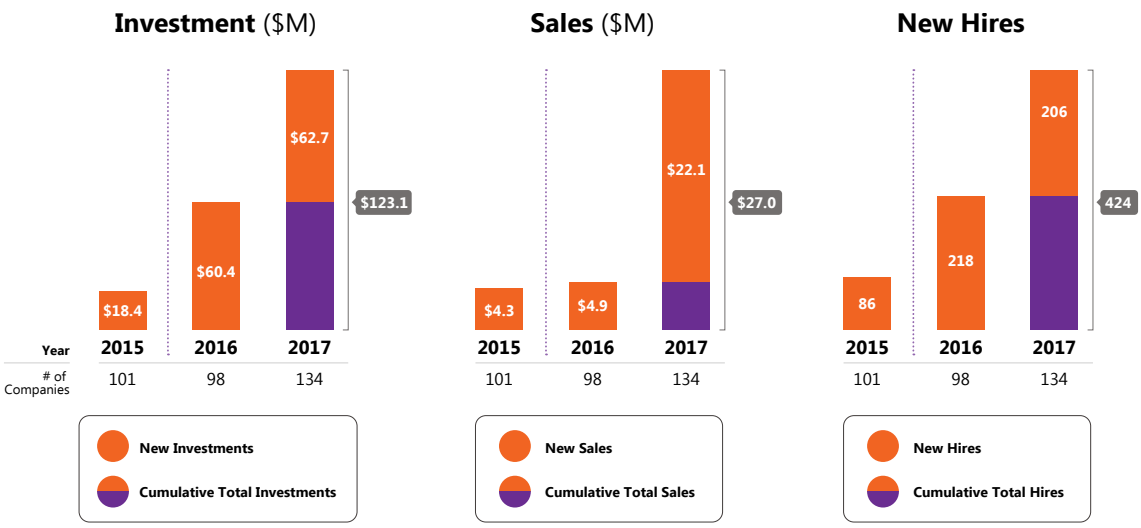
–Rich Lunsford, Vice President of Healthcare Solutions, Edwards Lifesciences, and USTAR Governing Authority member

USTAR collects program data and manages the annual collection of impact data, per the reporting requirement in the 2016 USTAR statute.

The private sector impact data shows that since the 2016 reset, USTAR client companies have raised $123.1 million in follow-on investment, generated $27.0 million in sales of commercialized products, and hired 424 full-time and part-time employees in CY16-CY17.

The figure below illustrates the total follow-on investment, sales, and new hires reported by USTAR client companies in 2015 (prior to the legislative reset) and compares this to 2016 and 2017. These impacts include not only companies that received competitive grants, but also those that received assistance from USTAR's Technology Entrepreneur Services programs (e.g., incubators, SBIR/STTR Assistance Center, and satellite offices) and those companies that licensed technologies from USTAR-supported faculty.

FIGURE 17. Reported Impacts of USTAR Client Companies Before and After 2016 Reset



Source: TEConomy Partners, LLC

Drilling down into the data, the TAP data are a good data set to analyze, because the grants are large enough to be consequential to a company and the response rate for TAP companies to the past two years' impact surveys was 100%. The surveys were administered in 2017 and 2018 to collect economic and financial data for 2016 and 2017.

One challenge with aggregate impact data is that the numbers naturally tend to rise as the number of client companies rises. USTAR has taken a novel and transparent approach to measuring impact by implementing cohort tracking with its new grant programs. A cohort is a group of companies that share common attributes (e.g., similar Technology Readiness Level or similar technology sector, etc.) and that received a first significant round of USTAR funding at the same time. Since 2016, there is one cohort (out of four total TAP cohorts from 2016-2018) with two years of impact data: the TAP Pilot Cohort from 2016.

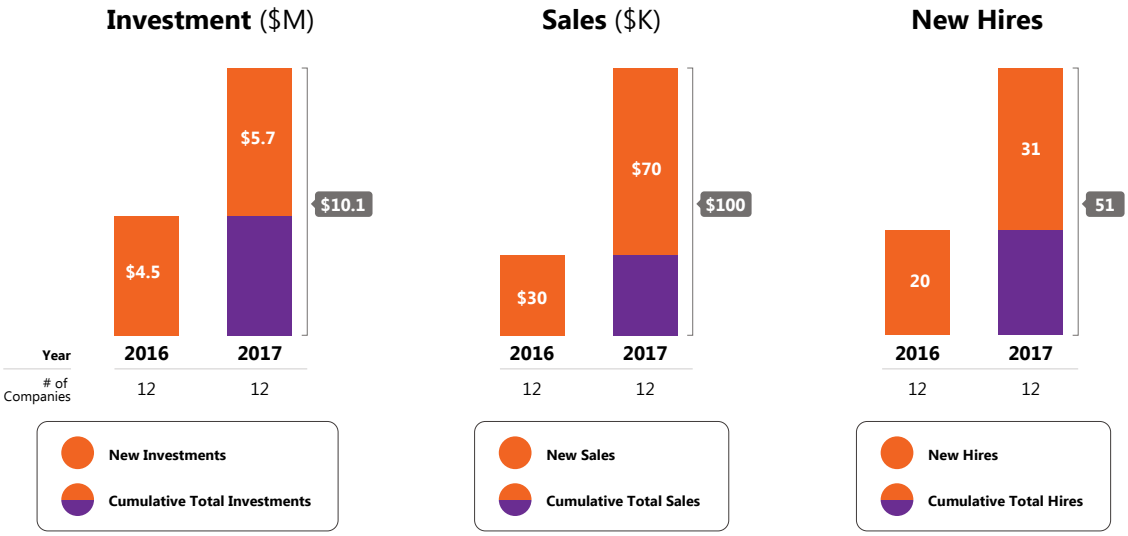
The table below illustrates that USTAR awarded 12 companies with a total $639,404 in 2016. These 12 TAP companies were later asked to report on follow-on investment raised, sales generated, and new hires via their responses to 2017 and 2018 surveys. The surveys asked financial and economic questions about the previous calendar year.

TABLE 3. USTAR Program Data for TAP Pilot Cohort

	Number	Total	Min	Max	Mean	Median
Pilot	12	$639,404	$24,185	$150,000	$53,284	$44,294

The 2016 TAP Pilot Cohort reported gains on all metrics from 2016-2017, except for part-time new hires. For the two-year period, the TAP Pilot Cohort generated $10.1 million in follow-on investment, $100,000 in sales, and 51 new hires

FIGURE 18. Reported Impacts of TAP Pilot Cohort Companies, 2016 and 2017



In USTAR's support for commercially-oriented researchers through the University Technology Acceleration Grants (UTAG), USTAR has similar performance expectations to TAP, but over a longer time horizon recognizing that university technologies are at a slightly lower Technology Readiness Level of 3-4. UTAG impact metrics include leveraged funding, invention disclosures, patents granted, and licenses executed. Once a university technology is

licensed to a company, the same private sector metrics as the TAP program apply (follow-on investment, sales, employment).

It should be noted that there can be lumpiness in the year-to-year impact data. First, the award of large grants may result in a big spike in funding one year, and then much smaller grants in the two to three years after the award. Second, federal grants have specific application periods, and the length of time between the next grant application deadline, the notice of award, and actual disbursement of funds can be an entire year. Third, the execution of projects by universities moves more slowly than execution of projects by companies. However, a benefit of applied research products in the university setting is the number of students trained who become part of the near-term workforce.

The table shows that USTAR made 20 UTAG awards in FY2017 totaling $4.99 million, which represents UTAG Cohort 1. These faculty researchers reported leveraging total federal, industry, philanthropic, and state (non-USTAR) funding of $15.96 million from 2017-2018. This leveraged funding was used along with UTAG funding to advance technology development. Cohort 1 researchers have been awarded 10 patents and executed 7 licenses to date.

TABLE 4. UTAG Cohort 1 Impact Metrics, 2017-2018 (Partial Year Reporting)

Cohort Size	Total UTAG Award	Leveraged Funding	Students Trained	Patents	Licenses
20	$4,992,021	$15,955,409	244	10	7

One example of how USTAR plays a catalytic role both within universities and as technologies spin out from universities is its support for the development of a scrap metal recycling technology. Dr. Raj Rajamani, at the University of Utah, invented an electrodynamic sorting technology that brings greater efficiency and cost effectiveness to sorting non-iron metals. The technology was advanced through grants Dr. Rajamani received from UTAG and the Advanced Research Project Agency at the Department of Energy (ARPA-E). Because of current trade war tensions and rising prices for steel and aluminum, there is high demand for recycled aluminum from scrap metal. The University of Utah technology developed by Dr. Rajamani was licensed to EDX Magnetics, and EDX Magnetics is developing a testing and prototype sorter with a TAP grant from USTAR.

2 What is USTAR's performance since the 2016 reset?

Answer:

It takes 5-10 years to be able to see momentum in the sales growth and trajectory of deep technology companies following a pivotal grant and series of investments early in a company's history. The jobs impact takes longer (10-15 years), since it is a lag indicator driven by rapid and sustained sales growth. With this caveat in mind, the performance of USTAR-funded companies and researchers, based on the two years of available data, has been positive, solid, and in line with expectations based on similar programs in other states. Across all USTAR grant and entrepreneur services programs there is a noticeable increase in follow-on investment, sales, and new hires. USTAR has also set up its performance tracking for new grant programs in a way that enables tracking by cohort. This is a best practice nationally for organizing data in a way that enables USTAR to analyze impact while controlling for factors, such as time period, technology sector, and stage of company.

3 Are there changes that should be made to USTAR's current structure or programs?

From questions 1 and 2, the study has found that USTAR is strategic for the State of Utah and aligned to the legislature's technology-based economic development goals and intent, which were clarified in the 2016 USTAR statute. USTAR's current programs have clear objectives that are focused on an identified private market gap. The structural changes the legislature enacted in 2018 to give the financial responsibility and oversight for the legacy researchers and USTAR campus buildings to the University of Utah and Utah State University enables USTAR to focus on its attention on its competitive grant programs and technology entrepreneur services. These programs have demonstrated a substantial and positive impact and strong demand based on the program and outcomes data for the past three years.

A further question that has arisen is whether grants or another type of financing is the most appropriate financing mechanism to support Utah's early-stage deep technology companies.

The type of financing that is most appropriate depends on what a company is trying to do. If a company does not know whether a technology will work for a particular application or not, then this is applied research and grant funding is most appropriate. If a company needs to generate data to demonstrate efficacy with an initial customer, this is also applied research and the most appropriate financing is a grant. By contrast, if a company has a prototype and a few pilot customers, but needs to recruit a member of the corporate management team to take the company to the next level in terms of sales, then an equity investment might be more appropriate.

FIGURE 19. Type of Funding Appropriate to Company Objective

Looking across the country at other state programs that provide financing for early-stage deep technology companies, one finds a mix of grants, nonrecourse loans, and equity financing in use by innovation funding agencies similar to USTAR.

Despite being high risk, grants can yield very tangible outcomes. The milestones that companies or researchers achieve with a grant have more to do with:

- The criteria used to select the best ideas and teams,
- The caliber of the reviewers,
- The type of accountability and program management employed, and
- The experience level and caliber of the team that receives the grant.

At the federal level, agencies like the Defense Advanced Research Projects Agency (DARPA) use milestone-driven grants and hands-on program managers to fund applied research and technology development by university, nonprofit research institute, and company teams. Early DARPA grants have played a catalytic role in the development of technologies that include the global positioning system (GPS); unmanned aerial vehicles (UAV); the semiconductor material, gallium arsenide; and the Siri voice-recognition system on the iPhone.[7]

Federal SBIR awards and other Federal agency grants are often found in the funding history of deep technology companies in the life sciences, energy, advanced materials, and electronics and IT hardware. For example, Qualcomm was a small company that received $1.5 million in SBIR and other Department of Defense grants in the 1980s that enabled it to explore an unconventional type of wireless communication technology with global commercial applications.[8] Today it is a $22 billion company. In Utah, life sciences companies that are built upon technology licensed from a university and then further advanced by SBIR awards include BioFire Diagnostics, Myriad Genetics, and Recursion Pharmaceuticals.

The average size of USTAR TAP awards from 2016-2018 (approximately $200,000) are similar to the size of SBIR Phase I grants ($150,000). From the founders' and investors' perspective, a big advantage of both USTAR and SBIR grants is that they do not dilute the equity ownership of companies. They work in concert with other types of financing provided by early private investors.

When one examines the continuum of funding mechanisms used by other states, one finds states that invest via equity, as well as providing applied research/proof-of-concept grants for companies to develop prototypes and do some validation work. The table below provides examples from a cross-section of innovation programs in Georgia, Virginia, Oklahoma, and Ohio.

In the Mountain West region, in 2017, Wyoming announced a 20-year Economically Needed Diversity Options for Wyoming (ENDOW) initiative that is likely to have funding or financing components for startups, but its strategy is still being developed.

7 Graham-Rowe, Duncan (2008). "Fifty Years of DARPA: Hits, Misses and Ones to Watch," The New Scientist, 15 May 2008.
8 Hudson, Marianne (2015). "How Angels Can Leverage Returns with Government-Funded Startups," Forbes. 27 March 2015.

TABLE 5. Examples of Mix of Grants and Financing Programs to Support Startups in Other States

	Georgia **GRA Ventures and GRA Venture Fund**	Virginia **CRCF Commercialization Fund and CIT GAP Fund**	Oklahoma **OCAST and i2E Oklahoma Seed Capital Fund**	Ohio **OTF Technology Validation Fund and Regional Funds** (Rev1 Columbus)
Applied Research/ Proof-of-Concept Grants for companies	$100K (1:1 match)	$50K (1:1 match)	$45K-$300K (1:1 match)	$100,000 (no match)
Loans	$250K	No program	$20K-$50K	No program
Equity	• Fund 1 (2009): $11.8M ($7.M from state) • Fund 2 (2015): $25M (all private)	• $3M/year appropriation • Invests up to $125K initially in $500K round • Invests up to $500K in any one company	• $3M/year appropriation • Invests $100K to $1M with co-investors	• Rev1 Fund 1 (2017): $23M ($9M from state) • Invests $250K-$1M in $500K to $10M rounds
Investment Details	• Restricted to investing in university-based startups • 12 portfolio companies to date	• Invests $3M/ year in 15-17 companies	• Invests $5M-$6M/ year, but running out of funds	• Manages multiple funds with different objectives and limited partners

While equity investing is arguably something that USTAR and the USTAR Governing Authority should explore, enough time should be taken to study the issue and develop a comprehensive organizational structure and approach. In many ways, seed stage equity investments would be a natural progression and follow-on investment for TAP companies that hit their milestones. However, equity investments are complex and affect many different aspects of an early-stage company, including their management team and board. If not done well, equity positions taken by a state-supported fund can impede follow-on investment by private investors. Therefore, USTAR and the legislature should conduct the same type of

due diligence and best practices review that was undertaken in 2015. This external review informed the major programmatic and structural changes made to USTAR through the passage of the new USTAR statute in 2016.

The wrong reason for government to invest in seed funds

The wrong reason to invest in a state-supported seed fund is the expectation of high returns and eventual sustainability. The reason that government assistance is needed in the first place is the fact that the private sector does not expect a high rate of return from investing in this stage for deep technology companies. A more compelling policy reason to invest in a state-supported seed fund is if there is a funding gap at the next critical stage in these companies' development. State-supported seed funds and the 501c3 organizations that manage can help to attract co-investors in early-stage "deep technology" deals as they develop a good track record and become a trusted, lead investor.

There are no examples of seed funds that are currently self-sufficient that started as state-supported funds. This is due to several reasons. One is that the funds are not capitalized with enough money to invest in later-stage, follow-on rounds. Therefore, as a company secures larger and larger rounds of financing, the state-supported funds equity share gets diluted. The second is that the higher risk associated with early-stage deep technology startups means a lower rate of return which is the fundamental reason for the gap in private sector investment. **The requirement of sustainability forces state-supported funds to pivot and invest a greater share of their portfolio in IT/software companies just like a private sector investor would do.** In this way, the original strategic objective and rationale for a state-supported seed fund is subsumed by the change in focus to sustainability.

Therefore, it is very important to be clear from a policy perspective what major gaps and impediments to growth the State is trying to address, what the program objectives are, and whether the program design is appropriate and aligned with these goals. It takes time to build good technology-based economic development programs and to conduct outreach to companies and universities to make them aware of these opportunities. While good governance encourages the revisiting and reevaluation of strategic priorities, program objectives, and program design every five to ten years, it is disruptive to stop and start programs without a plan for what replaces it.

3 Are there changes that should be made to USTAR's current structure of programs?

Answer:

USTAR is two years into the implementation of its new programs since the 2016 legislative reset. The evidence based on the performance of USTAR's programs, to date, and best practices from other states do not call for an immediate change to USTAR's current structure of programs. However, it would be a natural progression to begin to study and discuss how other types of financing mechanisms might be a follow-on step. This really depends on where TAP companies find themselves following the completion of their grants. If TAP companies are able to find sufficient private sector investment or customers to continue to scale upon hitting their TAP grant milestones, then the market gap may not exist at these slightly later stages.

Operational Questions

4 Are USTAR's programs being run effectively and efficiently?

Good government programs are relevant to their target audience, fulfill their objectives, are effective and efficient, and generate impact. The data and analysis provided, thus far, support the relevance of USTAR to both the deep technology companies it supports, as well as the State of Utah's technology-based economic development objectives. This section analyzes why and how USTAR has been effective in its program execution.

Competitive Grant Programs

USTAR's grant programs aim to advance the development of the best commercial technologies. This requires an effective peer review process. USTAR and the members that comprise the Governing Authority board have leveraged their professional networks, spanning industry, government, and academia, to develop a robust cadre of reviewers. USTAR reviewers include:

- Over 200 reviewers from 32 states and 11 countries,
- Two Ph.D.-level technical experts and one industry/ business expert on each review panel, and
- More than 85% of reviewers from out-of-state to increase the objectivity and diversity of perspectives and to reduce conflicts of interest.[9]

The review of strategic questions in the previous section points to the investment and sales impact of USTAR's grant programs on funded companies and projects. These impact data suggest that USTAR's proposal selection process is identifying strong candidates, despite the early stage and high technical and market risk of these technologies.

The criteria used by USTAR to evaluate company and researcher proposals are clear and incorporate the success factors for objectively identifying the best ideas, as shown by the type of criteria that merit a five out of five score on a TAP proposal:

- Provides milestones driving toward commercialization that are specific, measurable, and actionable.
- Provides detailed technology description and suggests alternative strategies to navigate unexpected outcomes.
- Has strategy for leveraging other sources of funding (e.g., Federal grants, strategic partners, risk capital investment) and adding full-time staff.
- Management team has experience scaling and marketing technologies in this sector.
- Technical team has experience maneuvering toward a commercial product.

9 All reviewers undergo a conflict of interest review to ensure no financial or personal interest or involvement in the proposals being reviewed.

The universal challenge for competitive grant programs is to avoid the herd mentality and to tap reviewers who are objective, who bring the requisite business and technical subject matter expertise, and who do not have inherent biases or conflicts of interest.

If a review panel has these biases or lacks sufficient expertise to properly evaluate a technology, then the type of projects that are funded will tend to favor researchers at universities with the best reputations, companies that are already known to reviewers, and researchers who are also more established and known. Sometimes the companies and researchers with the most visibility will have the best ideas, but this is not always the case.

There are famous examples of reviewers and decision makers making biased investment decisions that turned out to be very wrong. One of the best is Sony's decision to shelve its MP3 player (which it could have launched a decade before Apple launched its iPod) in favor of its MiniDisc player.

Poor review process, poor investment decision: the decline of Sony

Sony's decision, in 1992, to invest its brand, distribution network, and existing global market share in its MiniDisc player rather than its MP3 player turned out to be a catastrophically bad one. When Apple launched its iPod in 2001, MiniDisc and cassette sales dropped by 70%. Sony shipped its last MiniDisc Walkman in 2011 and has never recovered in the consumer electronics and mobile phone space since Apple's iPod introduction.[10]

In addition to USTAR's strong peer review process, the other factor that has contributed to the effectiveness of its grant programs is the caliber of its staff and its approach to program management. Often, success in bringing new technologies to market is determined by the willingness and proactiveness of the founding team to pivot in response to new data and customer feedback about where the demand and market is today. On the program management side, this means that program managers must also be flexible and proactive in their management of projects that need to go in a different direction in response to an unexpected outcome or finding.

Interviews with USTAR grant awardees, staff, and Governing Authority members highlight the technical backgrounds of USTAR staff and their proactive program management as key strengths. USTAR demonstrates flexibility and willingness to work with grantees to make adjustments as projects drive toward commercialization goals provided there is a sound rationale for doing so. In addition, the USTAR Governing Authority's Commercialization Subcommittee, which is comprised of three to four members from industry, reviews the progress of companies and projects and can recommend that the full board discontinue funding for projects in instances where researchers are not progressing or speed up milestone payments where they see momentum and acceleration toward commercialization goals.

TAP client company interviews and responses to open-ended survey questions about USTAR's impact and value point to the following strengths listed in the table below.

10 Walters, Ray (2011). "The Rise and Fall of the Sony Empire," ExtremeTech, 31 December 2011, and Faulkner, Joey (2012). "MiniDisc, the Forgotten Format," The Guardian, 24 September 2012.

TABLE 6. USTAR Grant Programs: Reasons for Effectiveness from a TAP Company's Perspective

Application Process	Quick turnaround time—only 3 months compared to up to a year for federal grants
Program Management	"USTAR is the only state program that appoints someone to follow you and look at you from the inside out. This person monitors, reviews, and approves unexpected deviations from plan."
Project Outcomes	"You feel positive pressure to hit milestones and do what you said you were going to do."
Impact	"In the end, it helped. My company received a VC round from a healthcare VC fund in California."

Technology Entrepreneur Services

USTAR's Technology Entrepreneur Services encompass its incubators (the USTAR Innovation Center and the BioInnovations Gateway), SBIR/STTR Assistance Center, and Satellite Offices in Utah County and Southern Utah. The Satellite Office staff mentor companies in USTAR's target technology areas in locations outside the Wasatch Front.

Incubators

USTAR's incubators offer co-working space and specialized lab equipment access at decreased costs to Utah startups with the goal of accelerating their technology development cycles by decreasing prototyping costs. The USTAR Innovation Center in Clearfield is geared toward the technology development needs of aerospace/defense, advanced materials, composites, and outdoor products companies. The BioInnovations Gateway in Salt Lake City supports life sciences companies.

It is challenging to tease out and assess the impact and effectiveness of incubators independent of the impact of USTAR grants, SBIR/STTR assistance, and other assistance that an incubator's client companies receive. However, it is widely recognized that access to specialized equipment and labs can be prohibitively expensive and a barrier to entry for startup companies in advanced manufacturing and life sciences sectors. It is also recognized that there are positive indirect impacts created by shared physical space.

The USTAR Innovation Center is open to startups, mature companies, Federal partners, and academic institutions. Drawing these different innovation actors together in the same prototyping space can create the serendipitous collisions and connections that seed new R&D collaboration and customer-supplier relationships. Similarly, the BioInnovations Gateway's partnership with Granite School District is a novel way of providing high school students with opportunities to develop critical thinking and applied biotechnology skills through formal and informal interactions with life sciences startups. This is in addition to BiG's role incubating and accelerating the development of these companies.

A major accomplishment that demonstrates the effectiveness of USTAR's approach to

collaboration and partnerships is the announcement of the U.S. Air Force's decision to invest in the USTAR Innovation Center. In 2018, USTAR and the U.S. Air Force (USAF) announced a major investment by USAF to make the USTAR Innovation Center the USAF Center of Excellence in Composites. This agreement, once signed, will dramatically drive down USTAR's operational costs for the Innovation Center.

The creation of the USTAR-USAF collaboration stems from the caliber of USTAR's staff and highlights the importance of having individuals with technical backgrounds who resonate with technical people in other organizations to build upon common areas of opportunity. The USAF does not view the partnership as investing in a building. Rather, the USAF is investing in a collaboration with USTAR to support the innovation ecosystem around Hill Air Force Base, because USAF views USTAR's objectives and target technology sectors as aligning with its own strategic objectives.

FIGURE 20. Projected USTAR Innovation Center Budget with USAF Lease

	FY19	FY20
IC Lease	$488,670	$1,802,973
IC Fee Collections (80% Occupancy – AF & Client Co's)	$265,680	$265,680
USAF 3D Metal Printer Space	$154,233	$157,745
USAF Lease Payment		$1,559,523
Net USTAR cost	**$68,757**	**-$179,975**

SBIR/STTR Assistance Center

The SBIR/STTR Assistance Center provides proposal assistance to companies applying for federal SBIR, STTR, and other technology commercialization programs. This includes encouraging client companies to directly contact SBIR program directors (each federal agency operates its own SBIR grant program), editing draft proposals, helping to develop or provide feedback on proposal budgets, and answering questions throughout the proposal development process.

The center's key impact metric is its success rate. The win rate for companies that receive USTAR SBIR/STTR Assistance is 25% compared to the 15% success rate nationally for NSF SBIR Phase I grants and the 15.6% success rate for NIH SBIR Phase I grants.[11]

11 See NSF (2016), "Frequently Asked Questions for SBIR and STTR Programs," https://www.nsf.gov/pubs/2018/nsf18016/nsf18016.pdf and NIH (2018), NIH SBIR/STTR Award Data, https://sbir.nih.gov/statistics/award-data.

4 Are USTAR's programs being run effectively and efficiently?

Answer:

USTAR's competitive grant programs and technology entrepreneur support services are well run and effective as evidenced by the performance of companies that receive assistance and other accomplishments, such as the U.S. Air Force's collaboration with USTAR. Notable among USTAR's achievements is the implementation of its new grant programs since 2016, which are characterized by industry best practices in performing peer review for the selection of grant recipients and private sector rigor in monitoring and reviewing grant recipient progress toward commercialization outcomes. USTAR staff and the USTAR Governing Authority members who comprise the Commercialization Subcommittee work well together in executing these programs and making recommendations for action to the full board.

5 Are there programs that could provide similar benefits more effectively at lower cost?

The previous sections presented evidence and analysis explaining why USTAR's programs are effective from its target customers' perspective. This section analyzes USTAR's cost effectiveness and benchmarks USTAR's major personnel and operational expenses against other Utah government agencies and peer venture development organizations in other states.

Talent drives good organizations, and one of the reasons that USTAR has been effective is that it has been able to attract talented staff who bring a mix of scientific and technical domain expertise, strong program management and community outreach skills, and prior academic, government lab, and industry work experience. These diverse backgrounds and skill sets align to the position requirements needed to run USTAR's competitive grant programs and technology entrepreneur service programs effectively.

As mentioned, Utah is not alone in providing funding to technology-based startups. Many states provide early-stage risk capital to startups through their innovation programs and venture development organizations. The table below benchmarks USTAR's staff size, total

FIGURE 21. USTAR Leadership and Key Staff

Ivy Estabrooke, Ph.D.
Executive Director
State Science Advisor

Brian Somers
Managing Director

Barbara Araneo, Ph.D.
Emerging Technology
Development Lead

Andrew Sweeney, Ph.D.
Emerging Technology
Development Lead

Lincoln Clark
Finance Director

Mary Cardon
Director,
USTAR SBIR Center

Wayne Bradshaw
Director, USTAR
Incubation Enterprise

Jared Goodspeed
Corporate &
Community
Outreach Manager

compensation expenditures, total operational expenditures, and total investment in companies and researachers against peer organizations in other states.[12]

The benchmark data indicate that USTAR ranks last among the 10 venture development organizations for average compensation (salaries and benefits) per employee.

USTAR ranked 7th for total employees, 8th for total compensation expenditures, and last for average compensation per employee. Among all benchmark organizations, the total number of employees ranged from 13 to 50, and total compensation ranged from $2 million to $8.5 million. In 2018, USTAR had a staff budget (salaries and benefits) of $2.49 million for 22 FTE.[13] This represents average compensation (salaries and benefits) of $113,400 per employee.

12 Due to the short timeline for this review, TEConomy drew on the 2016 total compensation data it had from a compensation benchmarking study for Connecticut Innovations, a quasi-state agency that manages grants, loans, and equity investment in startup companies. While salary information for state employees is public information, it is difficult to access quickly for state agencies without an existing relationship or a Freedom of Information Act (FOIA) request. Because 501c3 nonprofit organization tax filings are public, they are a good source information used for the Connecticut benchmarking study.
13 Actual expenditures were slightly lower to staff turnover in a couple of senior manager positions.

TABLE 7. Comparison of USTAR Staffing and Total Employee Compensation Compared to Similar Programs in Other States, 2016

State	Venture Development Organization	Type of Corporation	Total Employees	Avg Compensation/ Employee	Total Compensation (Salaries, Benefits) ($M)	Avg Amount Invested[2] ($M)	Total Operating Expenditures ($M)
VA	Center for Innovative Technology (Herndon)	501c3	31	$241,571	$7.489	$3.0	$14.776
CI	Connecticut Innovations (Rockford Hill – Hartford)	Quasi-state agency	44[1]	$193,795	$8.527	$20.0	$46.587
PA	Innovation Works/BFTP (Pittsburgh)	501c3	25	$177,503	$4.438	$5.5	$10.759
IN	Elevate Ventures (Indianapolis)	501c3	13	$168,558	$2.191	$6.0	$3.180
OH	Rev 1 Ventures (Columbus)	501c3	29	$159,812	$4.636	$5.0	$7.056
PA	BFTP of Southeastern Pennsylvania (Philadelphia)	501c3	27	$158,693	$4.285	$10.0	$9.924
MI	Ann Arbor SPARK (Ann Arbor)	501c3	19	$137,105	$2.605	$3.5	$5.626
OK	I2E (Oklahoma City)	501c3	19	$128,368	$2.439	$5.9	$3.325
OH	JumpStart (Cleveland)	501c3	50	$126,080	$6.304	$9.0	$15.063
UT	USTAR (Salt Lake City	State	22	$113,400	$2.495	$10.0	$15.105

Note:
1 Connecticut Innovations reduced its number of employees from 49 to 38 in 2016. 44 is the average employment in 2016.
2 The amount invested by organizations is equity investment in companies, except for USTAR, which is its $10 million competitive grant program. Other organizations investment amounts would be higher if grants and loans were included. The amount of investment may not equal total operating expenditures, depending on whether the seed capital comes from an annual appropriation (e.g., CIT) or a larger multi-year seed fund (e.g., Rev 1 Ventures via the Ohio Third Frontier). Investments levels may be higher than total operating expenditures due to reinvestment or returns from earlier investments (e.g., i2E).

Source: TEConomy Partners, LLC (2016). *Compensation Benchmarking and Performance Audit.* December 2016. Conducted on behalf of Connecticut Innovations. Updated with latest available 990 tax filings (2017 or 2016). USTAR data comes from USTAR and is for FY2018. Average annual investment figures come from interviews with leadership of these organizations and from annual reports.

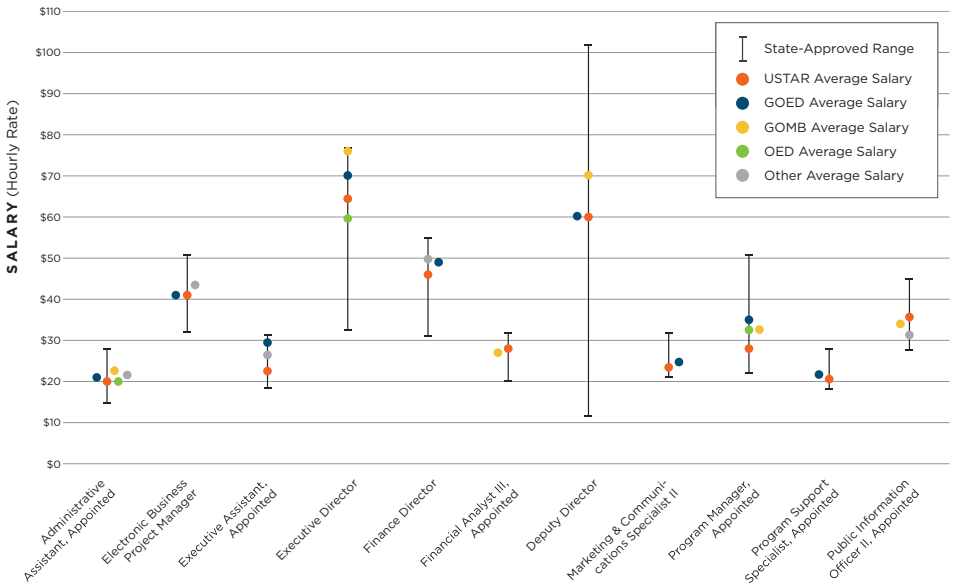
Comparing USTAR salaries to those of other Utah government agencies, nine out of eleven USTAR salaries are lower or the same as peer agencies for the same job title.

The table below compares the average hourly salaries for eleven staff positions at the following agencies:

- Governor's Office of Management and Budget (GOMB),
- Governor's Office of Economic Development (GOED),
- Office of Energy Development (OED).

The figure shows that the USTAR Executive Director salary, in orange, is lower than both the Executive Director for GOMB, in yellow, and GOED, in blue. The USTAR Deputy Director salary is lower than that of the Deputy Director at GOMB and comparable to the salary of the Deputy Director at GOED. The two positions for which USTAR paid slightly higher salaries was for Financial Analyst III, Appointed and Public Information Officer II, Appointed.[14]

FIGURE 22. Comparison of USTAR Salaries with Other Utah Government Agencies



Source: Utah Department of Human Resource Management

14 USTAR increased the salary for the Financial Analyst III position after another Utah government agency tried to recruit this analyst.

In analyzing whether Utah could have a program that provides similar benefits at a lower cost, it is important to go back to the factors that explain why USTAR is effective. Three major factors include:

- USTAR leadership and recruitment of high caliber key staff whose domain expertise and skill sets align with the requirements of its programs,
- USTAR's small size and targeted focus on the performance of its programs, and
- The productive dynamic between the work executed by USTAR staff and the private sector rigor, accountability, and network brought by the USTAR board (the Governing Authority).

Are there programs that could provide similar benefits more effectively at lower cost? **The benchmark data from both within and outside the state indicate that USTAR is lean and salaries are comparable to or lower than that of peer agencies, such as GOMB and GOED.** The conclusion is that USTAR is providing good value.

There is overlap between GOED's Technology Commercialization and Innovation Program (TCIP) and USTAR's Technology Acceleration Program (TAP). Through a signed Memorandum of Understanding between the two agencies in 2016, the parties agreed that their programs would focus on funding technologies at different stages of development, with USTAR's TAP focusing on TRLs 3-5 (proof-of-concept through validation in a relevant environment) and GOED's TCIP focusing on TRLs 6-9 (system prototype through system proven). However, from a startup company's perspective this is still likely to be confusing.

For stronger alignment of its technology-based economic development programs, one option is to bring TCIP under USTAR, since it is the technology-based economic development agency. The staff and infrastructure for managing competitive grant programs is already in place at USTAR.

Another option is for GOED to subsume USTAR. However, looking across the country, TEConomy cannot cite any data and is not aware of any best practice that demonstrates increased program effectiveness when a smaller targeted agency is subsumed by a larger agency that operates a more diverse portfolio of programs (GOED has 84 FTE). There are more examples of state governments spinning out their innovation programs from economic development agencies, because they are not able to recruit the right skill sets or because a 501c3 organization structure provides more flexibility in terms of financing options for investing in startups. Another 501c3 benefit is the ability to staff the board with members who bring relevant industry, investment, or startup expertise and networks.

5 Are there programs that could provide similar benefits more effectively at lower cost?

Answer:

Overall, the data suggests that USTAR is cost effective, with neither its total staff size, average salaries and benefits, or total personnel expenditures being high relative to peer organizations in other states. In fact, USTAR ranks last among the 10 total benchmark organizations for average compensation (salaries and benefit) per employee. There may be strategic reasons for considering a future 501c3 organizational structure if there is consensus that USTAR should evaluate models for investing in companies via equity. However, the benchmark data from other states do not support the idea that outsourcing USTAR program management to a nonprofit entity would be more cost effective than USTAR's current structure. In Utah, since USTAR is a leaner organization with a technology-based economic development mission and key staff who specialize in technology commercialization grant programs, there is a stronger case to move TCIP to USTAR than to move USTAR's programs to GOED if the state is looking to consolidate programs.

6 Are the reporting requirements effective at measuring USTAR's performance?

USTAR spent nine months in 2015 evaluating its entire portfolio of programs against the Governor's and legislature's goals and intent.[15] As part of the 2015 external review, recommendations were made to realign USTAR's programs with its technology-based economic development objectives.[16] The review also recommended a realignment of metrics with programs based on best practices in other states. Finally, the review further recommended that USTAR include a five-year annual reporting requirement as a condition of award for its new grant programs. USTAR implemented these recommendations. The response rate for the past two years' surveys for both of USTAR's new private sector programs (the Technology Acceleration Program and Industry Partnership Program) has been 100 percent.[17]

USTAR's new programs, metrics, and reporting requirements draw on best practices from other states, such as the Ohio Third Frontier's venture financing programs and the Georgia Research Alliance's Eminent Scholars program. The metrics for each of USTAR's current programs are summarized in the figure below.

The challenge with metrics and reporting requirements is to capture economic and financial information that enable policymakers to track performance and impact, while not making the reporting so onerous that no one wants to participate.

USTAR contracts with a third party to collect annual impact data for its private sector clients, and USTAR collects data for the university researchers it funds. Prior to the 2018 General Session changes, which transferred the USTAR research faculty and research buildings to the universities, USTAR also collected data on the tech transfer productivity and impact data for 40 research faculty recruited to Utah during the first phase of the USTAR initiative (2006-2016). Utah State University and the University of Utah had responsibility for collecting these data and transmitting them to USTAR annually per the 2016 USTAR statute reporting requirements. The tech transfer productivity measures included leveraged funding, invention disclosures, patents awarded, and executed licenses.

Overall, the USTAR reporting requirements and impact data are in line with best practices and are appropriate for the mix of program activities. They provide useful information to USTAR, its Governing Authority, the legislature, and the Governor on USTAR's near-term, intermediate, and long-term results aligned to detailed programmatic data on inputs (e.g., size of award, award year/cohort, stage, and tech sector of company, etc.).

15 The 2015 external review of USTAR's programs was performed under the leadership of former Lieutenant Governor Greg Bell, who served as USTAR Governing Authority Chair from 2014-2016, and Executive Director Ivy Estabrooke who was selected by Governor Herbert in 2014.
16 See SRI International (2015). *USTAR Program Assessment and Recommendations.* August 2015.
17 These are the 2017 and 2018 USTAR private sector impact surveys administered by TEConomy Partners, LLC.

TABLE 8. USTAR Program Impact Metrics

	Program Activities	Short-Term "Lead" Indicators (0-5 years)	Long-Term "Lagging" Indicators (5-10 years)

Technology Acceleration Program	• # Applications and awards
	• Value of requests/ awards
	  ▪ Tech sector
	  ▪ Year/Cohort
	  ▪ Source of intellectual property
		• Follow-on investment
		  ▪ Value and source (Federal, private sector, nonprofit, state agency)
		• Product brought to market
			• Annual sales
			• Total employment
			• New hires
			• Salary of new hires

Technology Entrepreneur Services	• Companies assisted
	  ▪ Tech sector
	  ▪ Year/Cohort
	  ▪ Source of intellectual property
	• Type of assistance
	  ▪ Hours spent
	  ▪ Incubation space
	  ▪ Special equipment
	  ▪ Pivotal customer/ investor introduction
		• Follow-on investment
		  ▪ Value and source (Federal, private sector, nonprofit, non-USTAR state agency)
		• Product brought to market
			• Annual sales
			• Total employment
			• New hires
			• Salary of new hires

University Technology Acceleration Grants	• # Applications and awards
	• Value of requests/ awards
	  ▪ Tech sector
	  ▪ Year/Cohort
		• Leveraged funding
		• Dollar value and source (Federal, industry, nonprofit, non-USTAR state agency)
		• Inventions disclosed
		• Patents awarded
		• Licenses executed
		• Students trained
			• Follow-on investment
			• Product brought to market
			• Annual sales
			• Total employment
			• New hires
			• Salary of new hires

Industry Partnership Program	• # Applications and awards
	• Value of requests/ awards
	  ▪ Tech sector
	  ▪ Year/Cohort
	• Size of company
	  ▪ Revenue
		• Follow-on investment
		  ▪ Value and source (Federal, private sector, nonprofit, state agency)
		• Product brought to market
			• Annual sales
			• Total employment
			• New hires
			• Salary of new hires

Technology Acceleration Program Metrics

As shown in the table below a significant amount of data is collected from the annual 8-question USTAR private sector impact survey. The table shows the value of TAP awards that USTAR made to 40 companies representing the Pilot Cohort (in 2016) through Cohort 2. Three companies that participated in the Pilot Cohort and later submitted proposals for Cohort 1 or 2 when the full program was rolled out. Forty-three TAP awards were made to 40 companies.

The breakdown of data by technology sector supports sector-level trends seen at the national level:

- Among the deep technology sectors, Federal funding and private sector investment is highest in the Life Sciences, in both absolute and relative terms (e.g., average follow-on investment).
- The average value of follow-on investment per company was highest in the Life Sciences: General, followed by Life Sciences: Medical Devices, and Big Data and Cyber Systems.
- Total reported sales of a commercialized product were highest in Energy and Cleantech, followed by Big Data and Cyber Systems, and Life Sciences Medical.
- Since few of the companies had products in the market yet, employment growth has been minimal. Energy and Cleantech TAP companies reported the largest number of new hires that paid salaries above the county average, followed by Life Sciences: Medical Devices, and Automation and Robotics.
- One metric that could be added is commercialization rate: within the group of TAP companies, what percentage of companies have introduced products to the market defined as a sale to a customer?

The data can also be analyzed to determine what percentage of companies and which technology sector account for the most total follow-on investment, sales, and new hires. Ohio Third Frontier impact data for its portfolio companies from 2006-2015 indicated that 5 percent of companies accounted for the lion's share of investment, sales, and employment. This is consistent with what is seen nationally and in Utah. In Utah, 96.7 percent of private sector companies have 50 or fewer employees, so if even 5 percent of USTAR TAP companies scaled to become companies with more than 50 employees over 10 years that would be a significant outcome.[18]

18 U.S. Small Business Administration Office of Advocacy (2016). *Utah Small Business Profile 2016*

TABLE 9. Reported Impacts of TAP Companies (Pilot through Cohort 2), by Technology Sector, 2017

Industry Sector	Aerospace and Advanced Materials	Automation and Robotics	Big Data and Cyber Systems	Energy and Cleantech	Life Sciences: General	Life Sciences: Medical Devices
Survey population	4	9	3	8	4	12
Survey respondents	4	9	3	8	4	12
Value of TAP award	$540,389	$1,569,508	$806,842	$1,697,471	$1,130,191	$1,633,295
Follow-on investment						
Total	$998,300	$1,386,000	$1,700,000	$330,000	$3,536,411	$8,308,794
Private investors (e.g., angels)	$600,000	$877,000	$1,300,000	$160,000	$600,000	$5,201,000
Other sources (e.g., convertible notes, loans, etc.)	$0	$70,000	$0	$0	$0	$0
Institutionally-managed venture capital	$0	$250,000	$0	$0	$0	$500,000
Strategic partners	$170,000	$189,000	$400,000	$90,000	$0	$810,000
Federal SBIR/ STTR awards	$228,300	$0	$0	$0	$2,936,411	$1,697,794
Other Federal grants	$0	$0	$0	$0	$0	$0
Other Utah programs	$0	$0	$0	$80,000	$0	$100,000
Sales	$70,000	$76,000	$572,182	$650,000	$0	$110,000
New hires						
Full-time (Avg. Salary)	4 ($107,250)	10 ($99,000)	0 ($0)	16 ($92,813)	2 ($65,000)	14 ($70,964)
Part-time (Avg. Salary)	6 ($18,333)	8 ($76,875)	0 ($0)	6 ($75,000)	4 ($6,500)	23 ($51,757)
High-quality jobs (above county average salary)	4 FT 1 PT	10 FT 7 PT	0 FT 0 PT	16 FT 6 PT	1 FT 0 PT	11 FT 8 PT

Source: TEConomy Partners, LLC

Industry Partnership Program Metrics

The Industry Partnership Program (IPP) is focused on another gap in Utah's innovation ecosystem: Utah's relatively low industry sector R&D performance compared to academic R&D performance. This finding suggests that Utah may have some large life sciences, aerospace, and advanced manufacturing companies, but these companies have their major R&D facilities in other states. It may also stem from the fact that so many of Utah's private sector companies are small companies. They may not have the internal staff to perform R&D in addition to their other duties.

Secondly, companies that are interested in conducting applied R&D projects specific to their production in Utah may not readily know where the requisite technical skill sets reside within Utah academic institutions. Even when a company does know a university faculty member that the company is interested in working with, the overhead rates charged by universities to fully recover costs may appear too high from the company's perspective, not knowing ahead of time whether the collaboration will be productive or not.

Therefore, USTAR's IPP program helps companies identify faculty with skill sets aligned to the needs of their projects and funds half of the project cost to incentivize the collaboration. The uptake of the IPP program has been slower than TAP which could be an indication that existing Utah companies are not performing a lot of R&D, but USTAR hopes to increase program demand through consistent and sustained outreach efforts.

Analysis of the early impact data for the 4 IPP companies indicate that some adjustments should be made to metrics. Thus far, the type of projects undertaken and the goals for the projects are quite varied. IPP is open to both existing companies and startup companies in USTAR's target technology sectors. Since the existing companies will already be generating revenue, follow-on investment is not a meaningful metric. These companies will not be raising venture capital, and other financing mechanisms, such as loans, are available for investing in commercialization projects that show some validation through USTAR support. Similarly, since existing companies will have existing product lines and employees, it is not likely to hire many new employees unless growth in sales is large and sustained.

Therefore, better short-term metrics for IPP are the actual project milestones for each project. Longer term, understanding whether these companies bring new products to market that were supported by IPP grants, and what percentage of a company's sales these new products represent are meaningful metrics to track. Since employment in not always product line specific in larger companies, it is probably better to track total net change in employment by these companies and to understand if the employment growth is tied to growth in sales of new products or other corporate business strategies.

University Technology Acceleration Grants

The UTAG metrics represent the same metrics that university technology transfer offices use to measure technology transfer productivity and the performance of companies that receive proof-of-concept funding. The UTAG metrics also include metrics that university departments track to measure faculty research funding productivity. Because impact reporting involves a significant amount of information management, data checking, and follow up with principal

investigators in the process of data collection, USTAR sees value in having an external third party collect the data, as is done with the collection of private sector impact data.

Technology Support Services

USTAR's Technology Support Services are directed at deep technology startups, and their impact data is collected on an annual basis by a third party. Many companies seek multiple types of assistance from USTAR, e.g., SBIR proposal assistance, access to specialized equipment or incubator space, as well as TAP grants. Companies indicate that all of these different elements add value by providing a comprehensive network of support for deep technology startups. In addition to the same metrics used to measure the performance of companies, helpful metrics include SBIR/STTR proposal win rate for client companies versus the national average (USTAR already tracks this) and possibly qualitative feedback from client companies of USTAR's incubators and regional offices about the effectiveness of these programs, what are strengths, and what are weaknesses.

6 Are the reporting requirements effective at measuring USTAR's performance?

Answer:

Yes. Overall, USTAR reporting requirements and impact data are effective at measuring the near-term, intermediate, and long-term performance of funded companies and projects. The metrics were developed based on best practices in other states and are appropriate for USTAR's mix of program activities. The one program for which adjustments could be considered is USTAR's Industry Partnership Program. Since this program seeks to incentivize innovation activity and industry-university collaboration by existing Utah companies, this evaluation recommends using IPP project commercialization milestones as short-term metrics, dropping the follow-on investment metric (since existing companies raise capital via debt or equity markets), and asking what percentage of a company's sales these new products represent. For the UTAG program, USTAR sees value in having a third party collect the impact data to enable USTAR staff to focus on the proposal review and program management aspects of the program

Conclusion

The data and analysis presented in this evaluation find that USTAR's current programs are strategic, aligned to the state's technology-based economic development goals, and focused on an important market gap that is constraining deep technology startup growth and economic diversification. Since the implementation of the program in 2016, the program data indicate strong demand for USTAR's grant programs and good investment and sales growth performance by USTAR companies.

USTAR is a lean, effective, and outcomes-driven organization. When USTAR is benchmarked against peer organizations in other states, USTAR ranks 7th for total staff size and 10th for average compensation (salaries and benefits) per employee. On a salary by position basis, USTAR salaries are the same or lower than nearly all of the same positions at GOMB or GOED. Nevertheless, USTAR has been able to attract top talent to accomplish a lot in the two years since the 2016 legislative reset.

Notable among USTAR's achievements is the implementation of its new grant programs since 2016, which are characterized by best practices in its peer review process for making funding decisions and its private sector rigor in monitoring and reviewing grant recipient progress toward commercialization outcomes once awards are made. Another is the 2018 decision by the U.S. Air Force to make a major investment in the new USTAR Innovation Center, the incubator and prototyping space in Clearfield. The USAF decision stems from strong alignment of USAF-USTAR goals in wanting to bring together existing companies, startups, government agencies, and academic institutions to advance technology commercialization activity within the composite materials industry vertical.

USTAR's effectiveness is due to both the caliber of its staff, as well as the deep level of engagement by its Governing Authority members—many of whom bring private sector, deep technology, and startup experience and perspectives. USTAR Governing Authority members carve out time from their positions within leading companies and organizations, because they view the USTAR Initiative as a positive and serious investment in the state's technology-based

economy and ecosystem. They take their role in providing strategic direction and oversight to USTAR seriously.

While it is common for states with long-standing technology-based economic development programs to change their focus and portfolio of programs over time, it is rare for states to eliminate their technology-based economic development programs and agencies when they are strategically focused, providing good value for money, and generating impact. Eliminating USTAR would send a strong message that the State of Utah is retreating from its long-term commitment and investment to the growth of its research- and technology-based sectors at a time when states like Wyoming, Virginia, and Massachusetts are increasing investments in theirs.

Appendix

Technology-Based Economic Development Programs

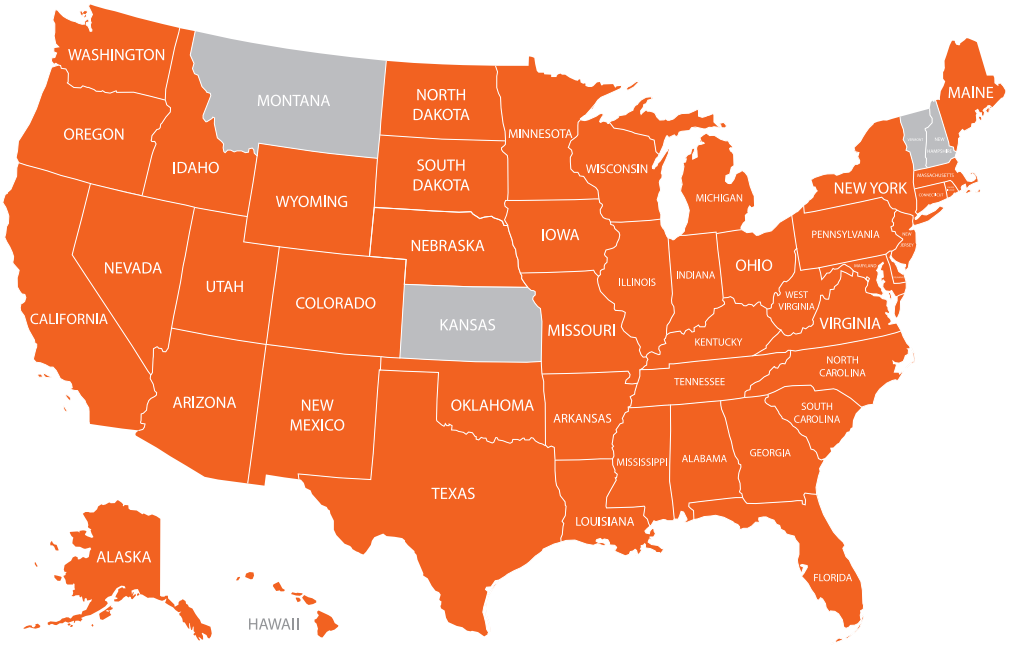
All states provide economic development incentives to retain and recruit larger companies. Traditional economic development programs span workforce development, marketing, site development, tax exemptions/rebates/credits, etc. However, over the past three decades, nearly all states have added technology-based economic development programs to support the growth of "home-grown," scalable companies by local entrepreneurs. A key difference between these startup companies and the larger companies that benefit from traditional economic development and business incentives is that startups are often pre-revenue.

Technology-based economic programs stem from a variety of objectives:

- Recognition of the importance of technological innovation to economic growth and competitiveness,
- Desire to share in the higher-wage job creation associated with the scale up of tech-based startup companies on the Coasts, and
- Desire to leverage state investment in universities for tech transfer and startup activity in addition to workforce development.

Forty-six states have tech-based economic development programs. These programs span building research capacity, commercializing research, promoting entrepreneurship, providing incubation services, increasing access to capital, and building a technically skilled workforce. Individual programs have evolved over time in response to a state's stage of development and identified gaps in a state's innovation infrastructure.

FIGURE 23. States that have TBED Programs



Utah Economic Development Program Expenditures, 2017

Function	Activity	Agency	Program	Total State Funding
Administration	Personnel, operating expenses, info systems, etc.	Governor's Office of Economic Development	Administration	$3,559,700
Broadband	Broadband infrastructure	Governor's Office of Economic Development	Broadband Outreach Center	$378,200
Business Assistance	Not specified	Governor's Office of Economic Development	Business Services	$7,566,600
Film	Major events/ festivals	Governor's Office of Economic Development	Film	$2,987,800
Pass Thru	Not specified	Governor's Office of Economic Development	Various	$8,283,800
Rural Development	Rural Development	Governor's Office of Economic Development	Office of Rural Development	$492,700
Strategic Business Attraction	Corporate recruitment	Governor's Office of Economic Development	Corporate Recruitment	$3,921,600
Tourism	Tourism marketing	Governor's Office of Economic Development	Tourism Marketing Performance	$23,878,000
Tourism	Tourism marketing	Governor's Office of Economic Development	Office of Tourism	$3,916,100
Tourism	Recreation	Governor's Office of Economic Development	Office of Outdoor Recreation	$1,272,000
Tourism	Major events/ festivals	Governor's Office of Economic Development	Pete Suazo Athletic Commission	$325,300
Workforce Preparation	Workforce preparation and development	Governor's Office of Economic Development	STEM Action Center	$14,221,300
TOTAL				**$70,803,100**

Source: Adapted from the Center for Regional Economic Competitiveness and The Council for Community and Economic Research (2015). *Business Incentives and Economic Development Expenditures: An Overview of Utah's Program Investments and Outcomes*, pp.10-11, and updated with 2017 data from the Governor's Office of Economic Development (2018). *2017 Annual Report*, p.49.

Utah Economic Development Tax Expenditures, 2017

Description	Total Funds
Airline purchases of certain products for in-flight use or consumption	$1,900,000
Aircraft parts and equipment for installation in certain aircraft	$7,400,000
Aviation, motor, special fuels (jet, gas, diesel, etc.)	$205,500,000
Commercials, films, and other audio/video sold to broadcasters and others	$6,200,000
Construction materials for life science research facility (material converted to real property only)	$650,000
Economic Development Increment Financing tax credit*	$11,888,714
Fuel sold to a common carrier railroad and used in a locomotive engine	$2,500,000
Machinery or equipment for amusement and recreation (three-year life; business much charge fee for use)	$480,000
Machinery or equipment purchased by the film industry and used to produce certain media	$3,500,000
Machinery, equipment, parts, and materials to a drilling equipment manufacturer	$1,122,000
Machinery, equipment, or parts for electronic financial payment services (three-year life)	$1,700,000
Machinery, equipment, or parts used in qualified research (three-year life)	$13,800,000
Machinery, equipment, or parts to manufacturers and others (three-year economic life)	$136,400,000
Natural gas, electricity, coal, fuel oil, and other fuels for industrial use	$44,100,000
Certain electricity produced from a new alternative energy source	$115,000
Certain products primarily used in farming operations	$65,300,000
Certain products used by a steel mill	$210,000
Fuel cell	$47,000
Hay	$10,300,000
Semiconductor fabricating, processing, research, or development materials	$7,000,000
Electricity to ski resort lifts	$250,000
Ski resort equipment and parts	$72,000
Telecommunications service for purposes of providing telecommunication service	$3,700,000
TOTAL	**$524,134,714**

* The Economic Development Tax Increment Financing (EDTIF) figure represents tax credit rebates for 44 projects in FY2014. In recent years, the "Metrics and Data" chapter of GOED's 2016 Annual Report shows that the maximum cap incentive on approved projects is approximately $50 million a year over project terms that range from 5 to 20 years. (See p.65 for EDTIF FY2015 and FY2016 approved projects.)

Source: Adapted from the Center for Regional Economic Competitiveness and The Council for Community and Economic Research (2015). Business Incentives and Economic Development Expenditures: *An Overview of Utah's Program Investments and Outcomes*, pp.12-13, and updated with 2017 data from the Utah State Tax Commission (2018). *Annual Report FY2016-2017*, pp.63-64.

Reported Impacts of TAP Pilot Cohort, 2016 and 2017

Reported values base year	2016 Impacts (2017 survey)		2017 Impacts (2018 survey)	
	Sum total	Count	Sum total	Count
Survey population		12		12
Survey respondents		12		12
Follow-on investment				
Total	$4,450,000	10	$5,666,984	7
Private investors	$2,645,000	6	$3,805,000	5
Other sources (e.g., convertible notes, loans, etc.)	$30,000	1	$0	0
Institutionally-managed venture capital	$25,000	1	$500,000	1
Strategic partners	$450,000	2	$310,000	1
Federal SBIR/STTR awards	$1,200,000	3	$971,984	2
Other Federal grants or contracts	$0	0	$0	0
Other state programs	$100,000	1	$80,000	1
Sales	$30,000	1	$70,000	1
New hires		10		10
Full-time (Avg. Salary)	18 ($56,821)	8	21 ($90,167)	7
Part-time (Avg. Salary)	21 ($46,867)	9	19 ($64,021)	7
High-quality jobs (above county average salary)	15 FT, 5 PT		18 FT, 13 PT	

Source: TEConomy Partners, LLC (2018). Measuring the Private Sector Impact of USTAR-Supported Programs 2018.

Ohio Third Frontier Impact Metrics, 2006-2015

What should USTAR's expectations of impact be over the longer term? The Ohio Third Frontier, the State of Ohio's set of commercialization and startup financing programs, has invested in early-stage startups since 2006. The figure below shows Ohio Third Frontier data for companies that received an initial investment of $100,000, as well as follow-on rounds, from 2006-2015. There is a "J-curve" effect as time passes and companies gain traction, first with investors, and then in the market via sales of their commercialized product.

FIGURE 24. Ohio Third Frontier Data: "J-curve" Effect on Client Company Follow-On Investment, Sales and New Hires, 2006-2015