2015 USTAR PROSPECTUS

NOVEMBER 2015

USTAR

SRI International

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Dear Reader,

As the Chairman of the Utah Science Technology and Research Initiative (USTAR) Governing Authority (GA), I am pleased to present you with this new prospectus for USTAR.

When USTAR's original prospectus was developed in 2005, the United States economy was thriving, and technology based economic development was booming. After the market and economic crash in 2008, the assumptions underlying the 2005 USTAR prospectus needed to be revisited. In this document, we present a new prospectus that accounts for (1) the current economic climate, (2) data from our current programs and trajectories of other technology based economic development programs in comparable States, (3) the significant changes in the way research is funded by the federal government, corporations and other funders, and (4) major changes in the manner that university-based research is commercialized, including how such research is licensed and by whom the resulting intellectual property is owned.

This prospectus was developed by SRI International, a non-profit independent research organization that provides science policy and economic development advice to States, Federal Agencies and foreign governments on best practices for programs and metrics. This prospectus builds on SRI's assessment of and recommendations for Utah's technology ecosystem and USTAR.

Greg Bell,
USTAR Governing Authority Chairman

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2015 USTAR Prospectus

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SRI International

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Executive Summary

The 2015 USTAR Prospectus projections are based on the actual performance of USTAR client companies and recruited faculty and comparative results from similar programs in other states.

The USTAR program did not achieve the results it projected in its 2005 USTAR Prospectus. Two main reasons were that the 2005 projections did not account for the time it takes for a program focused on university research capacity building to yield private sector economic impacts, nor were the projections informed by the actual performance of similar best practice programs in other states. SRI worked with USTAR to address the program's strategy and focus, and took a data-driven approach to developing more realistic performance projections.

First, SRI ensured that the 2015 Prospectus performance metrics align with the USTAR program's objectives and design. The 2015 Prospectus focuses on key indicators in which the USTAR director, USTAR Governing Authority and Utah legislature would expect to see change over time based on high-quality implementation of the program. The 2015 Prospectus accounts for recent changes in USTAR strategy and incorporates suggested changes to USTAR's program design and metrics put forth in SRI's *USTAR Program Assessment and Recommendations* report.[1]

A second improvement to the 2015 Prospectus is SRI's use of impact data for similar best practice programs in other states to inform our projections for the USTAR program. SRI analyzed the follow-on investment, products sales and job creation data for long-standing, best practice programs in other states (e.g., the Ohio Third Frontier, Pennsylvania's Ben Franklin Technology Partnership, Oklahoma's i2E) to calibrate our projections for USTAR. The result is that the 2015 USTAR Prospectus projections should provide more accurate projections since they are grounded by real-world experience, keeping in mind state differences in the stage of development of the innovation system, industry and technology profile, and overall economic performances. Nevertheless, the similarities among these benchmark programs that focus on startup and early-stage technology companies tend to outweigh macroeconomic differences.

Finally, SRI worked to develop projections of direct impact that are measureable and auditable. These are impacts for which one can survey USTAR client companies and companies that license technologies developed by USTAR-recruited faculty and for which there are administrative records of external research grants awarded to USTAR faculty and technology licenses. SRI used these administrative records and responses to SRI's impact survey to develop baseline data for the 2015 projections of USTAR's forecast impact on startup companies and external research funding at University of Utah and Utah State University.

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[1] SRI International (2015). *USTAR Program Assessment and Recommendations*. Arlington, VA: August 2015.

Projections of Direct Impact

SRI used this analysis of comparative program data and USTAR baseline data to forecast USTAR's direct impact over the next 5, 10 and 15 years. SRI estimates that assuming Utah continues to invest in the USTAR program at approximately $20 million per year (in 2015 dollars), and assuming USTAR shifts its program focus to expand investment in early-stage technology companies and refocus its research capacity building program, then the $383 million in USTAR investment over the next 15 years should generate $548 million of external research funding by USTAR-recruited faculty, $1.236 billion in follow-on investment in early-stage companies, $283 million in sales and nearly 2,000 full-time jobs in these early-stage companies.

Table 1 2015 USTAR Prospectus: Projections of Direct Impacts of USTAR-Recruited Faculty and USTAR New Ventures Program Client Companies

	State	University	Startups		
Year	USTAR Investment	External Research Funding	Follow-on investment	Sales	Full-Time Jobs
	annual	annual	2013-2015 total	annual	annual
2015 baseline	$20,000,000	$29,415,000[1]	$26,449,075[2]	$5,755,000[2]	51[2]
	5-year totals	5-year totals	5-year totals	5-year totals	5-year totals
2020	$109,368,198	$159,042,155	$123,862,036	$27,628,640	200
2025	$126,787,716	$181,445,768	$409,754,545	$81,885,169	434
2030	$146,981,712	$207,707,837	$702,506,556	$173,295,480	739
Total (2016-2030)	**$383,137,262**	**$548,195,761**	**$1,236,123,137**	**$282,809,288**	**1,953**

Note: [1] The 2015 university baseline data are based on SRI's analysis of USTAR-recruited faculty external research notice of award data provided by the University of Utah and the assumption that USTAR-recruited faculty at Utah State University have the same average external research leverage of $795,000 per researcher. SRI calculated the total for 37 USTAR researchers across the two universities. [2] The 2015 baseline data for startup client companies are based on USTAR TOIP client company responses to SRI's impact survey. The client companies surveyed were those that had received services and funding from 2013 to 2015.

Projections of Total Impact

In addition to the direct economic impact generated by USTAR-recruited faculty and USTAR-assisted early-stage companies, the investment in USTAR supports significant indirect and induced economic impacts on Utah's economy. In economics, the idea of the multiplier is that changes in the level of economic activity in one industry impacts a number of other industries throughout the economy.

SRI used IMPLAN, an economic impact modeling software, to calculate these indirect and induced effects to arrive at total economic impact. Using the same assumptions about total program funding and shift in focus of program investments toward early-stage companies, then the $383 million of USTAR investment over the next 15 years should generate:

- $1.256 billion in direct, indirect and induced economic output; 7,844 full-time jobs; and $417 million in wage income through USTAR's investment to date in recruiting "star" faculty and USTAR's continued competitive funding for industry-initiated and other research commercialization projects at Utah colleges and universities
- $573.4 million in direct, indirect and induced economic output; 3,629 full-time jobs; and $190.5 million in wage income through USTAR's targeted business assistance and investment in early-stage technology companies

Table 2 2015 USTAR Prospectus: Projection of Total Impacts on Utah Economy (IMPLAN)

	Universities			Startups		
Year	Total Output [1]	Total Full-Time Jobs [2]	Total Wage Income [3]	Total Output [1]	Total Full-Time Jobs [2]	Total Wage Income [3]
	5-year totals	5-year totals	5-year totals	5-year totals	5-year totals	5-year totals
2020	$364,352,962	2,276	$121,092,552	$83,728,750	530	$27,821,666
2025	$415,677,861	2,569	$138,150,359	$181,133,888	1,146	$60,187,769
2030	$475,842,193	2,972	$158,145,950	$308,564,450	1,953	$102,530,818
Total (2016-2030)	**$1,255,873,016**	**7,844**	**$417,388,361**	**$573,427,088**	**3,629**	**$190,540,253**

Note: [1] Total output represents the value of industry production measured by sales or revenue and includes direct, indirect and induced output. [2] Total jobs are full-time jobs and includes direct, indirect and induced jobs. [3] Total wage income includes all forms of employment income (e.g., wages, benefits and proprietor income) for direct, indirect and induced jobs.
Source: SRI calculations using IMPLAN.

Analysis of 2005 USTAR Prospectus

2005 Prospectus projections were overly optimistic and not benchmarked against the experience of similar programs in other states

The 2012 audit of the USTAR Initiative showed that the program's focus on star researcher recruitment at the University of Utah and Utah State University was misaligned with the metrics and performance expectations set forth in the original 2005 USTAR Prospectus. SRI's analysis found that, in addition to program misalignment with program objectives and reporting metrics, the discrepancies between the 2005 Prospectus projections and actual program performance stem from two major sources:

- No benchmarking against the performance of similar science, technology and innovation programs in other states that collect data on direct impact metrics. These metrics are typically external research dollars leveraged, technology licenses, and spin-out companies for university-focused programs and follow-on investment, sales of commercialized products, and jobs for programs that support and invest in early-stage technology companies.

- The reliance on economic impact modeling software to project jobs, wages and taxes without an evidence-based analytical framework for thinking about what direct impact data should serve as inputs into these models.

Resetting Expectations

Going forward, SRI has recommended that in addition to refocusing USTAR's programs to address innovation system gaps closer to the market, the State of Utah also consider changes to the USTAR statute. **Certain aspects of the USTAR program's implementation—in particular, USTAR ownership of intellectual property—represent a departure from reforms to Federal law in the early 1980s aimed at improving technology commercialization from federally-sponsored research at universities.** Several states currently or have in the past funded programs that seek to recruit "star" research talent, e.g., Georgia Research Alliance's Eminent Scholars, Ohio Research Scholars, University of Texas System STARs, etc. None of these state S&T programs require that state agencies, or the nonprofit intermediary organizations through which some of them operate, own intellectual property resulting from the state investments.

The absence of an intellectual property claim by these state programs is largely out of recognition that more technology will transfer from government-sponsored research to private companies to the marketplace if the intellectual property resides with the research performer rather than with the government. This insight is codified in the Bayh-Dole Act of 1980, the purpose of which was to reform U.S. patent policy for federally sponsored research at universities and federal laboratories. As a U.S. Government Accountability Office (GAO) report points out, "At the time [that the Bayh-Dole Act was being debated in the late 1970s], fewer than 5% of the 28,000 patents being held by federal agencies had been licensed, compared with 25% to 30% of the small number of federal patents for which the government had allowed companies to retain title to the invention."[2]

The University of Utah and Utah State University attract approximately $400 million[3] of research funding annually from Federal agencies including the National Institutes of Health, the Department of Defense, the Department of Agriculture, the Department of Energy, the National Science Foundation, etc. The passage of Bayh-Dole resulted in the ability of universities, non-profit research institutes, and small businesses to patent, license and commercialize their federally funded inventions. USTAR is a rare example of a state science, technology and innovation agency that seeks to retain ownership of

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[2] U.S. General Accounting Office (1998). "Technology Transfer: Administration of the Bayh-Dole Act by Research Universities," May 1998, p.3, http://www.gao.gov/archive/1998/rc98126.pdf.

[3] National Science Foundation, National Center for Science and Engineering Statistics (2015). "Federally funded R&D expenditures, by federal agency, 2013," Higher Education R&D Survey 2014.

intellectual property, and changes to the statute should be considered to bring USTAR in alignment with Bayh-Dole.

Secondly, there is an important misunderstanding about the source of economic benefit to the State of Utah from the USTAR program. **The expectation that a major source of financial return from the USTAR program to the State of Utah is licensing revenue is not based on any data or evidence nationally.** In the U.S., 85% of university tech transfer offices do not break even—the patent filing costs, legal counsel fees and tech transfer office expenses outweigh the licensing revenues.[4] Licensing revenue tend to be heavily skewed toward a small number of top licenses (mostly new drugs) which generate the largest share of gross income. In fact, many universities have found that revenue accruing to the university from large companies' sponsoring of university research projects far exceeds revenues generated from licenses. Additionally, there are tangible benefits that go beyond the direct financial return to the university from improving research collaboration ties with small and medium-sized companies located in close proximity to the university. These benefits include positive workforce impacts, stronger retention of local companies, and the ability to go after large grants that require university-industry partnerships. Consequently, some universities—most notably Penn State University and the University of Minnesota[5], in recent years—are making university ownership of intellectual property and tough licensing terms secondary to trying to attract more industry-sponsored research.

Finally, **although the creation of high-quality, high-wage jobs is always a long-term desired outcome of state economic development initiatives, jobs is not the lead, short-term indicator for economic development initiatives focused on technology commercialization and support for early-stage companies.** The lead indicator for these programs in the first five years is follow-on investment, followed by product commercialization and sales in the first ten years, and then more significant job creation as sales grow, which can be 10 to 15 years out. Invention is different from innovation (i.e., getting a product into the marketplace). Innovation is different from creating a successful, scalable company. Each step requires different skill sets, involves a great deal of risk, and requires different measures of success.

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[4] Valdivia, Walter (2013). "University Start-Ups: Critical for Improving Technology Transfer," Center for Technology Innovation at Brookings, November 2013, p.9.

[5] Office of the Vice President for Research at Penn State (2014). "Penn State's Approach to IP from Company Sponsored Research," http://www.research.psu.edu/patents/policies/penn-states-approach-to-ip-from-company-sponsored-research

2Market Information, Inc. (2014). "U Minn's sponsored research agreement model is a hit with corporations," *Technology Transfer Tactics*, 8 (1). http://www.research.umn.edu/techcomm/documents/news/TechnologyTransferTactics.pdf

Approach to 2015 USTAR Prospectus

The 2015 USTAR Prospectus provides realistic projections based on the actual performance of USTAR client companies and recruited faculty and comparative results from best practice programs in other states

SRI started by asking: What are the key questions that the USTAR director, USTAR Governing Authority, and legislators need answered to provide accountability and to serve as good stewards of taxpayer money? They include the following questions:

- **What are realistic expectations of external research funding resulting from the recruitment of star faculty?** If researchers can't attract funding, then none of the other desired impacts are possible—e.g., invention disclosures, licensing activity, and startup company formation.
- **What are realistic expectations of follow-on investment in early-stage Utah companies resulting from Utah's assistance and investments in these companies?** If early-stage companies can't attract follow-on funding, this suggests there may not be a market for what the company is trying to sell.
- **What is a reasonable timeline for seeing other desirable impacts?** One would expect to see trends in investment, sales and job growth of early-stage companies over time.
- While acknowledging there are significant differences across states in the stage of development of the regional innovation systems, their industry and technology profiles, and overall economic performance, **what has been the experience and trajectory of early-stage companies in other states that received similar assistance and investment from state programs?**

Key Assumptions

SRI developed estimated impacts of the USTAR program for 5, 10 and 15 years into the future based on the following assumptions:

1. Going forward, the legislature continues funding for USTAR at approximately $20 million per year (in 2015 dollars and scaling for inflation), but increases funding for investment in technology commercialization and early-stage companies (to $10 million in 2015 dollars) and decreases funding for commercially-oriented research at University of Utah and Utah State University by not recruiting any new faculty outside of replacing faculty who leave (to $10 million in 2015 dollars).
2. The USTAR director, USTAR Governing Authority and Utah legislature are interested in direct program impacts that can be measured and are auditable—i.e., impacts for which one can survey USTAR client companies and companies that license technologies developed by USTAR faculty and for which there are administrative records of external research grants leveraged by USTAR-recruited faculty and licensing activity resulting from any intellectual property.

3. As made clear by similar science, technology and innovation programs in other states, jobs is not the lead, short-term indicator for economic development initiatives focused on technology commercialization and support for early-stage companies. The lead indicator for these programs in the first five years is follow-on investment, followed by product commercialization and sales in the first ten years, and then more significant job creation as sales grow, which can be 10 to 15 years out. On the university side, external research funding is the lead indicator for research capacity building, followed by invention disclosures, technology licenses, and product commercialization by startup or existing companies.

2015 USTAR Prospectus: Forecast Impact

SRI took a data-driven approach to developing the 2015 Prospectus informed by both the baseline impact data currently being collected by USTAR and comparative results from best practice science, technology and innovation programs in other states.

Baseline Data

Startup Companies

To develop projections for early-stage client companies, SRI first developed baseline data using findings from SRI's survey of USTAR Technology Outreach and Innovation Program (TOIP) client companies about follow-on investment, sales of commercialized products, and jobs that these companies attributed to assistance provided by USTAR. Ninety-four out of 376 total early-stage companies that received USTAR TOIP assistance from 2013 to 2015 responded to the survey. These 94 companies reported $26.4 million in follow-on investment (cumulative to date), $5.8 million in product sales in 2015, 51 full-time jobs, and 63 part-time jobs in 2015. These figures are in line with what one would expect to see from largely pre-revenue startup and early-stage companies focused on commercializing products.

Table 3 USTAR Technology Outreach & Innovation Program Impact, 2013-2015

	2013-2015	2015		
Responding companies	Follow-on investment	Product Sales	Full-time jobs	Part-time jobs (including consultants)
94	$26,449,050	$5,755,000	51	63

Source: Reported impacts from SRI's survey of 376 USTAR TOIP client companies that received TOIP assistance and funding from 2013-2015. See SRI International (2015). "Measuring the Impact of USTAR's Technology Outreach and Innovation Program: Baseline Impact and Methodology."

Universities: External Research Funding

To develop projections for universities, SRI analyzed two types of data. The first was external research funding data provided by the University of Utah for USTAR-recruited faculty. These data represent the total value of research award notices from federal, industry, and other sources to USTAR-recruited faculty in FY2015. The average amount of external research dollars per USTAR-recruited faculty in FY2015 was $795,000 per researcher. SRI assumed the same average for Utah State's USTAR-recruited faculty in order to calculate a total value for the 37 USTAR researchers across the two universities: approximately $29.4 million in external research funding from Federal, industry and other sources.

Table 4 External Research Funding Impact for USTAR-Recruited Faculty, FY2015

University	USTAR-recruited Faculty	Total Value	Average per Faculty
University of Utah	30	$23,836,935 [1]	$795,000 [1]
Utah State University	7	$5,565,000 [2]	$795,000 [2]
Total	**37**	**$29,415,000 [2]**	**$795,000 [2]**

Source: [1] University of Utah (2015). "Leveraged Funding Report: Awards FY2015."; [2] SRI estimate based on the assumption that Utah State University's USTAR-recruited faculty have the same average external funding per researcher of $795,000.

Universities: Technology Licensing to Spinout Companies

The second type of data was provided by the technology transfer offices at the University of Utah and Utah State University. These offices provided impact data for technologies developed by USTAR-recruited faculty and licensed to Utah spin-out and startup companies as well as to existing companies, which can be either small, medium or large companies but with "existing" defined as being established based on fundamental technology not developed by USTAR-recruited faculty. As with all technology commercialization, there is a high degree of technical and market risk involved, so many licenses are terminated if companies find it difficult to get these technologies into the marketplace (e.g., either due to technical, cost, manufacturing or sales challenges).

The table below shows that from 2008-2014, invention disclosures were filed and licenses negotiated with companies for:

- 16 technologies developed by USTAR-recruited faculty at the University of Utah
  - 4 out of 16 of the University of Utah licenses had been terminated by 2014
- 12 technologies developed by USTAR faculty at Utah State University
  - 4 out of 12 of the Utah State University licenses had been terminated by 2014

University of Utah had 9 new companies that formed based on technology developed by USTAR-recruited faculty, and Utah State University had 6 new companies that formed over this 7-year period (2008-2014):

- 7 of the 9 startup companies based on University of Utah technologies still had active licensing agreements in 2014, and
- 4 out of 6 startup companies based on Utah State University technologies still had active licenses.

It is assumed that startup companies that terminated licenses likely went out of businesses, since they were founded based upon these licensed technologies.

The 11 startup companies with active licenses in 2014 raised a combined $7.56 million of follow-on investment from private, federal and other sources from 2008-2014. At least one of the startup companies based on a university technology license received assistance from USTAR's TOIP. Comparing the TOIP and university tech transfer office impact data indicates that, on average, university spin-off companies raised more follow-on investment, but had significantly less product sales. This result is in line with expectations, since companies based on university-originated technologies are usually further upstream and more capital-intensive than TOIP client companies overall, which include a number of software and other IT companies.

Based on the 7 years of impact data (2008-2014), SRI assumes that approximately two startup companies will spin out of the universities each year based on USTAR-recruited faculty intellectual property, but that a third to half of these companies will not survive past 5 to 10 years. Since USTAR's TOIP is focused on providing targeted business support, networks and investment capital to such startups, for the forecasting of impacts, SRI groups these university spinouts with TOIP client companies.

University Technology Licensing to Existing Companies

Existing companies tend to self-finance technology commercialization activities, and they reported significantly less follow-on investment ($725,000 in total from 2008-2014). One existing company reported $2 million of products sales based on a USTAR faculty technology from the University of Utah. The 11 startup companies generated 17 full-time and 7.5 part-time jobs supported through follow-on investment in the company and product sales. The 9 existing companies attributed 2 new full-time jobs and 4 part-time jobs to product sales from commercialized technologies.

Table 5 Baseline Impact of Licensing of Technologies Developed by USTAR-Recruited Faculty, 2008-2014

University of Utah[1]							
Total Licenses	Active Licenses	Type of Company	Active Licenses	Follow-on Investment	Product Sales	Full-time Jobs	Part-time Jobs
2008-14	2014		2014	2008-14	2014	2014	2014
16	12	Startup	7	$3,161,500	$0	11	5.5
		Existing	5	$500,000	$2,000,000	2	3
Utah State University[2]							
12	8	Startup	4	$4,400,000	$140,000	6	2
		Existing	4	$224,809	$32,847	0	1
Total							
28	20	Startup	11	$7,561,500	$140,000	17	7.5
		Existing	9	$724,809	$2,032,847	2	4

Source: [1] University of Utah Technology and Venture Commercialization Office (2015); [2] Utah State University Innovation and Commercialization Services Office (2015).

Projections of Direct Impact

SRI used the aforementioned impact data as a baseline to forecast USTAR's direct impact over the next 5, 10 and 15 years. Utah technology startups—which are predominantly pre-revenue companies—have a modest employment impact in the short-term by hiring both full-time and part-time employees as they raise private follow-on investment to commercialize their technologies. SRI did not include part-time jobs in our forecast, because these jobs range from higher wage consultants, accountants, etc., to graduate students. Part-time employees constitute such a diverse group that it's difficult to make representative assumptions for forecasting purposes.

SRI estimates that if the State of Utah continues to invest in the USTAR program at approximately $20 million per year (in 2015 dollars), and if USTAR shifts its program focus to expand investment in early-stage technology companies and refocus its research-capacity building program, then the $383 million in USTAR investment over the next 15 years should generate $548 million of external research funding by USTAR-recruited faculty, $1.236 billion in follow-on investment in early-stage companies, $283 million in sales and nearly 2,000 full-time jobs in these early-stage companies.

Table 6 2015 USTAR Prospectus: Projections of Direct Impacts on Universities and Startup Companies

	State	University	Startups		
Year	USTAR Investment	External Research Funding	Follow-on investment	Sales	Full-Time Jobs
	annual	annual	2013-2015 total	annual	annual
2015 baseline	$20,000,000	$29,415,000[1]	$26,449,075[2]	$5,755,000[2]	51[2]
	5-year totals	5-year totals	5-year totals	5-year totals	5-year totals
2020	$109,368,198	$159,042,155	$123,862,036	$27,628,640	200
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2030	$146,981,712	$207,707,837	$702,506,556	$173,295,480	739
Total (2016-2030)	**$383,137,262**	**$548,195,761**	**$1,236,123,137**	**$282,809,288**	**1,953**

Note: [1] The 2015 university baseline data are based on SRI's analysis of USTAR-recruited faculty external research notice of award data provided by the University of Utah and the assumption that USTAR-recruited faculty at Utah State University have the same average external research leverage of $795,000 per researcher. SRI calculated the total for 37 USTAR researchers across the two universities. [2] The 2015 baseline data for startup client companies are based on USTAR TOIP client company responses to SRI's impact survey. The client companies surveyed were those that had received services and funding from 2013 to 2015.

Source: SRI International

Projections of Total Impact

In addition to the direct economic impact generated by USTAR-recruited faculty and USTAR-assisted early-stage companies, the investment in USTAR supports significant indirect and induced economic impacts on Utah's economy. In economics, the idea of the multiplier is that changes in the level of economic activity in one industry impacts a number of other industries throughout the economy.

For example, early-stage Utah companies spend their follow-on investment dollars to purchase goods and services to support their technology commercialization activities. Likewise, universities spend some portion of external research dollars on goods and services outside the university to support research and commercialization activities. These are both examples of "indirect" effects. In addition, individuals employed by early-stage companies and universities spend their disposable income on personal goods and services, and this stimulates economic activity in a myriad of totally unrelated industries—these are "induced" effects.

SRI used our projections of "external research funding" and USTAR client company "full-time jobs" presented in the table above to calculate the total economic impact of the USTAR program on Utah's economy. We used IMPLAN, an economic impact modeling software, to calculate these indirect and induced effects to arrive at total economic impact.

SRI estimates that if the State of Utah continues to invest in the USTAR program at approximately $20 million per year (in 2015 dollars), and if USTAR shifts its program focus to expand investment in early-

stage technology companies and refocus its research-capacity building program, then the $383 million of USTAR investment over the next 15 years should generate:

- $1.256 billion in total economic output; 7,844 full-time jobs; and $417 million in wage income through USTAR's investment to date in recruiting "star" faculty and USTAR's competitive and merit-based support for industry-initiated and other research commercialization projects at universities
- $573.4 million in total economic output; 3,629 full-time jobs; and $190.5 million in wage income through USTAR's targeted business assistance and investment in early-stage technology companies

Table 7 2015 USTAR Prospectus: Projections of Total Impacts on Utah Economy (IMPLAN)

	Universities			Startups		
Year	Total Output [1]	Total Full-Time Jobs [2]	Total Wage Income [3]	Total Output [1]	Total Full-Time Jobs [2]	Total Wage Income [3]
	5-year totals	5-year totals	5-year totals	5-year totals	5-year totals	5-year totals
2020	$364,352,962	2,276	$121,092,552	$83,728,750	530	$27,821,666
2025	$415,677,861	2,569	$138,150,359	$181,133,888	1,146	$60,187,769
2030	$475,842,193	2,972	$158,145,950	$308,564,450	1,953	$102,530,818
Total (2016-2030)	**$1,255,873,016**	**7,844**	**$417,388,361**	**$573,427,088**	**3,629**	**$190,540,253**

Note: [1] Total output represents the value of industry production measured by sales or revenue and includes direct, indirect and induced output. [2] Total jobs are full-time jobs and includes direct, indirect and induced jobs. [3] Total wage income includes all forms of employment income (e.g., wages, benefits and proprietor income) for direct, indirect and induced jobs.
Source: SRI calculations using IMPLAN

Methodology

As noted, SRI put a great deal of emphasis on using a data-driven approach to developing the 2015 USTAR Prospectus informed by the comparative results of states with best practice science, technology and innovation programs. A second SRI goal was to develop projections of direct program impacts that can be measured and are auditable. These are impacts for which one can survey USTAR client companies and companies that license technologies developed by USTAR faculty and for which there are administrative records of external research grants leveraged. Finally, we wanted to develop projections for metrics that are aligned to USTAR's program objectives and program design going forward. The primary, lead metric on the university side is external research funding leveraged by USTAR researchers, followed by invention disclosures, and technology licenses to companies in the medium- to long-term. The lead metric on the startup side is follow-on investment in companies followed by product sales in the medium-term and employment in the longer term as sales ramp up.

This section describes SRI's approach to constructing our direct impact projections for external research funding on the university side and follow-on investment, sales and employment on the startup side. University spinouts and product commercialization sales by existing companies that license technologies developed by USTAR-recruited faculty fall under the startup impacts category.

External Research Funding Leveraged by USTAR Researchers

SRI constructed the 5, 10 and 15-year projection of external research funding by USTAR researchers. We used University of Utah's FY2015 external research funding awards data for its USTAR faculty as our baseline ($795,000 per researcher). We further assumed that outside of replacing USTAR faculty that leave, there will be no net additions of faculty over the next 15 years and that R&D funding per USTAR researcher stays relatively constant over time. With regard to the latter point, it is likely that federal R&D funding for universities will slow, and possibly even decrease in real terms over the next 15 years, so even if USTAR researchers become slightly more productive they will be maintaining their share of a decreasing pie.

SRI analyzed similar data collected by NSF for all academic institutions of higher education with research expenditures in S&E fields over $150,000 and total number of academic researchers in each state to find the amount of external research funding leveraged per researcher annually.[6] We used these data to develop a Utah benchmark ($158,000 in academic R&D funding in S&E fields per S&E researcher), a national benchmark ($194,000 in academic R&D funding in S&E fields per S&E researcher), and to

[6] NSF's Higher Education Research and Development (HERD) Survey is a census of all academic institutions that grant bachelor's degrees or higher and report at least $150,000 in R&D. For 2013 (the most recent year for which data are available), the surveyed institutions in Utah were University of Utah, Utah State University, Brigham Young University, Weber State University, and Utah Valley University. The latest year for which S&E doctorates in academia data are available is 2010.

calculate historical growth rates in the ratio of academic R&D funding in S&E fields per S&E researcher over time. From 2003 to 2010, R&D funding per researcher grew each year by 1.4% in Utah and by 3.8% nationally. SRI used an average of these growth rates (2.6%) to project the growth in USTAR researcher research funding productivity.

The projections assume a constant total of 37 USTAR researchers at the University of Utah and Utah State University; if the number of researchers hired by Utah universities through the USTAR program surpasses or falls below this level, then the total R&D funding will increase or decrease accordingly.

Follow-on Investment, Sales and Jobs impacts of USTAR Client Companies

The lead indicator for startup and early-stage technology companies is follow-on investment. The ability to attract follow-on rounds of investment from the private sector, competitive federal programs and others indicate that these investors also recognize a market opportunity and pathway to market for this product. Sales of commercialized technologies is a medium-term metric for both early-stage companies and existing companies that may license technologies developed by USTAR-recruited faculty. Jobs are a lagging indicator, since significant growth in product sales are required to generate employment growth. The experience of other similar state programs, such as the Ohio Third Frontier, Pennsylvania's Ben Franklin Technology Partners, and Oklahoma's i2E show that it can take ten or more years before early-stage companies experience substantial sales or jobs growth, depending on the technology sector.

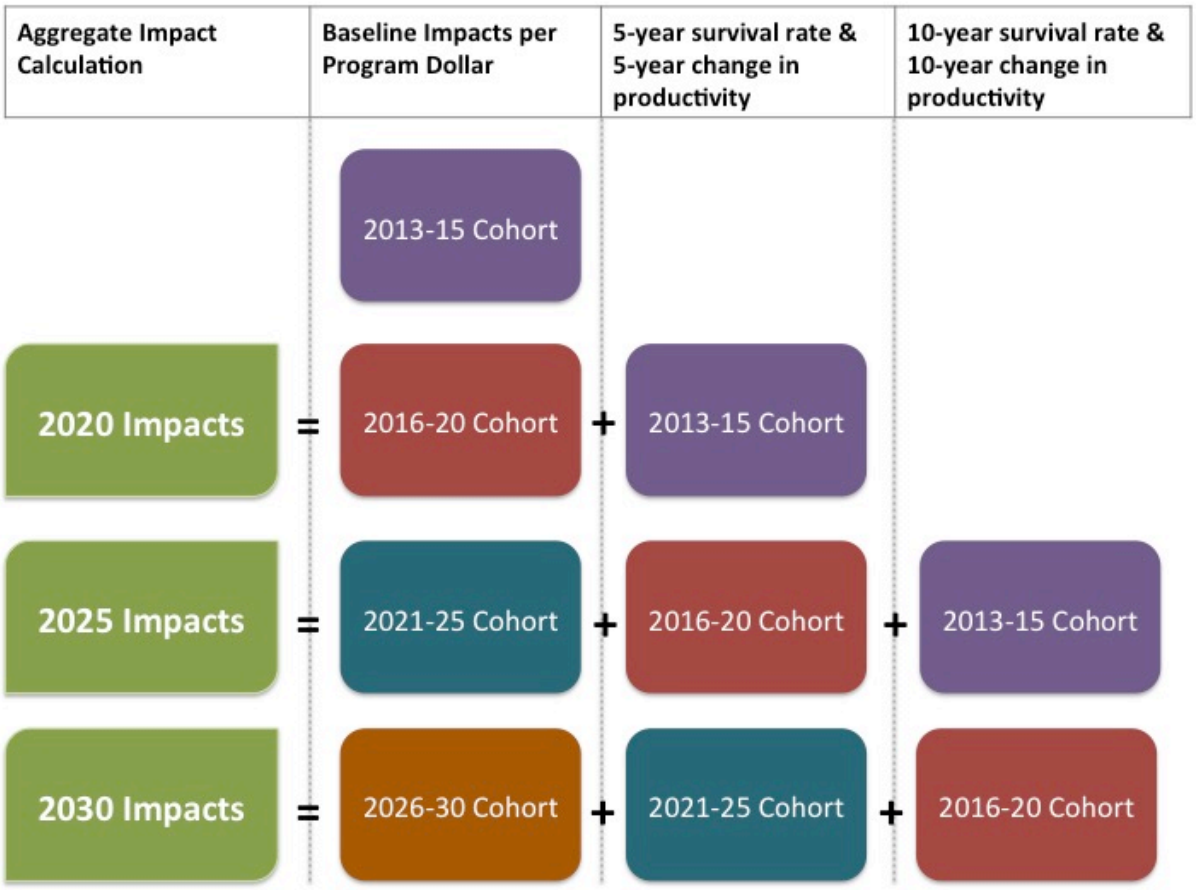
SRI constructed its 2020, 2025 and 2030 projections of follow-on investment, product sales and jobs growth using three variables:

- **Baseline productivity** (impacts per program dollar) of new client companies. This baseline productivity was calculated using data from SRI's 2015 impact study of the USTAR TOIP program, which found impacts per program dollar for follow-on investment, jobs growth and sales for USTAR client companies from 2013-2015.
- **Change in productivity** (change in impacts per program dollar) of client companies 5 and 10 years after receiving program services. Change in productivity was calculated using impact data from the Ohio Third Frontier (OTF) Entrepreneurial Signature Program. OTF has data on both annual program impacts and impacts per cohort (client companies from specific years of the program). The cohort data shows how firms' productivity changes (i.e., creates more impacts per program dollar) over time, and using this data SRI was able to estimate the increase in productivity of client companies over the baseline level five years and ten years after first receiving services from USTAR. SRI assumed that USTAR would not track company impacts more than 10 years after they received USTAR services. The OTF impact data is inherently "lumpy" – meaning that, while there is overall growth in impacts per program dollar over time, the data can show major spikes in impacts from one year to the next because a single successful firm can generate huge impacts in follow-on, jobs and/or revenue and skew the impacts the entire cohort upwards. SRI used these lumps in the data to create bounds for the projections (high

change in productivity vs. low change in productivity) and used an average of the high and low bounds to create the final projection estimates.

- **Survival rate** of client companies 5 and 10 years after receiving program services. Data for survival rates of companies after five years came from Shikhar Ghosh of the Harvard Business School[7] and from the U.S. Census Business Dynamics Statistics (BDS), while survival rates for companies after ten years came from BDS. SRI created a range in firm survival rates after 5 years using the HBR rate as the low rate and the BDS rate as the high rate, then took an average of the two rates for its final projections. Survival rates for companies after ten years came from BDS. SRI assumed that USTAR would not track company impacts more than 10 years after they received USTAR services.

Figure 1 SRI Model for Calculating Projected Impacts for USTAR New Ventures Program in 2020, 2025 and 2030



[7] See Blank, Steve (2013), "Why the Lean Start-Up Changes Everything," Harvard Business Review, May 2013, https://hbr.org/2013/05/why-the-lean-start-up-changes-everything/ar/1 or Gage, Deborah (2012), "The Venture Capital Secret: 3 Out of 4 Start-Ups Fail," Wall Street Journal, 20 Sept. 2012, http://www.wsj.com/articles/SB10000872396390443720204578004980476429190.

Total Impacts on Utah Economy (modeled in IMPLAN)

To create projections for total impacts (Table 7 of this document), SRI used IMPLAN, an economic impact analysis and modeling software package. IMPLAN utilizes a database that contains county, state, zip code, and federal economic statistics derived from the U.S. Bureau of Economic Analysis input-output tables and other public data sources.

To calculate the total impacts of university external research funding using IMPLAN, SRI inputted our projections of the amount of external research dollars generated by USTAR faculty over the next 15 years. The research funding was entered as an institution spending pattern in IMPLAN's "Scientific research and development" industry sector code. To calculate total impacts on the startup side, SRI inputted our projections of direct full-time jobs added by USTAR client companies over the next 15 years based on the recent performance of USTAR TOIP client companies and the performance of similar state programs. The direct jobs were entered as an industry change in IMPLAN's "Scientific research and development" industry sector code.

Using these models, IMPLAN calculated projections of total economic output supported by these university and startup company research activities on Utah's economy, as well as total jobs supported (which includes direct, indirect, and induced jobs across many different industry sectors) and wage income related to these jobs.

Appendix

Model for New Ventures Program direct impacts projections

To create projections for impacts for follow-on investment, jobs growth and sales in USTAR client companies for 2020, 2025, and 2030, SRI modeled the following:

- **Baseline productivity** rates were:
  - $2 of follow on investment per program dollar
  - 4 jobs per $1 million program dollars
  - $0.5 of sales per program dollar
- **Change in productivity** rates after 5 years were:
  - Follow-on investment
    - 300% increase in follow-on per program dollar after 5 years (low estimate)
    - 500% increase in follow-on per program dollar after 5 years (high estimate)
  - Jobs
    - 80% increase in jobs per $1 million program dollars after 5 years (low estimate)
    - 200% increase in jobs per $1 million program dollars after 5 years (high estimate)
  - Sales
    - 160% increase in sales per program dollar after 5 years (low estimate)
    - 400% increase in sales per program dollar after 5 years (high estimate)

- **Changes in productivity** rates after 10 years were:
  - Follow-on investment
    - 600% increase in follow-on per program dollar from year five to year 10 (low estimate)
    - 800% increase in follow-on per program dollar from year 5 to year 10 (high estimate)
  - Jobs
    - 230% increase in jobs per $1 million program dollars from year 5 to year 10 (low estimate)
    - 700% increase in jobs per $1 million program dollars from year 5 to year 10 (high estimate)
  - Sales
    - 500% increase in sales per program dollar from year 5 to year 10 (low estimate)
    - 900% increase in sales per program dollar from year 5 to year 10 (high estimate)

- **Survival rates** for client companies after 5 years were:
  - 25% (low estimate)
  - 40% (high estimate)

- **Survival rates** from client companies from year 5 to year 10 were:
  - 60%

SRI's projections model is also based the following assumptions:

- Annual New Ventures Program funding for USTAR from 2016-2020 will be $8 million annually in 2015 dollars. From 2022-2030, annual funding will be $10 million in 2015 dollars.
- The projections model assumes an average inflation rate of 3% over the projected period of 2016 – 2030. This is based on the 50-year inflation average calculated using U.S. Bureau of Economic Analysis annual GDP data.
- USTAR will cease tracking impact data from a company 10 years after it receives services from the program. Tracking data from companies gets increasingly difficult the further removed the company is from the time it received services. For this reason, it is common practice of entrepreneurship programs to stop tracking impact data from client companies after 10 years.

The **2020 impacts** for follow-on investment, jobs, and sales in client companies were calculated using the following formula:

$$(F_{2020} * P_0) + (C_{2015} * \ S_5 * \ P_5)$$

F_{2020}= USTAR entrepreneurship support and investment funding from 2016 – 2020, adjusted for inflation

P_0 = Baseline productivity (based on USTAR TOIP Impact study data).

C_{2015} = Impacts from USTAR companies from the 2010-2015 cohort

S_5 = Survival rate of client companies after 5 years (from Harvard Business Review and BDS)

P_5 = change in productivity of client companies after 5 years (from OTF cohort data)

The **2025 impacts** for follow-on investment, jobs, and sales in client companies were calculated using the following formula:

$$(F_{2025} * P_0) + (C_{2020} * \ S_5 * \ P_5) + \ (C_{2015} * \ S_{10} * \ P_{10})$$

F_{2025} = USTAR entrepreneurship support and investment funding from 2021-2025, adjusted for inflation

P_0 = Baseline productivity

C_{2020} = Impacts from USTAR companies from the 2016-2020 cohort

S_5 = Survival rate of client companies after 5 years

P_5 = change in productivity of client companies after 5 years

C_{2015} = Impacts from USTAR companies from the 2010-2015 cohort

S_{10} = Survival rate of client companies after 10 years

P_{10} = change in productivity of client companies after 10 years

The **2030 impacts** for follow-on investment, jobs, and sales in client companies were calculated using the following formula:

$$(F_{2030} * P_0) + (C_{2025} * \ S_5 * \ P_5) + \ (C_{2020} * \ S_{10} * \ P_{10})$$

F_{2025} = USTAR entrepreneurship support and investment funding from 2026-2030, adjusted for inflation

P_0 = Baseline productivity

C_{2025} = Impacts from USTAR companies from the 2021-2025 cohort

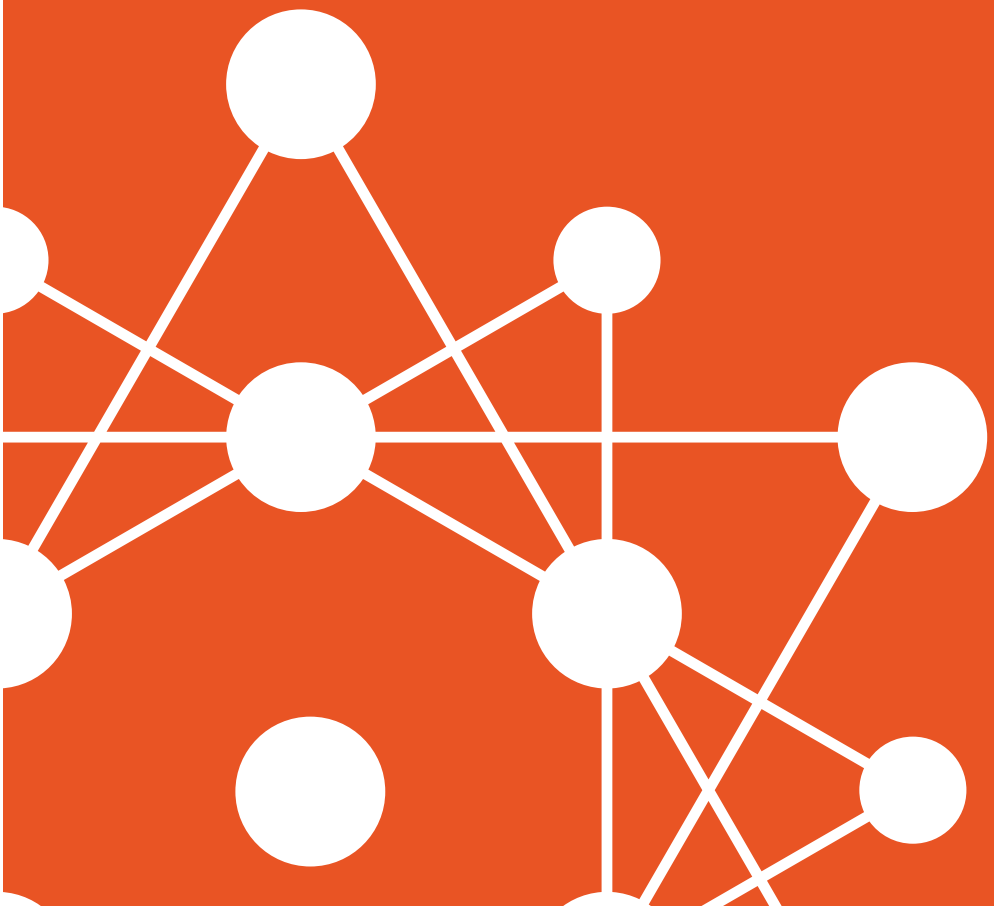
S_5 = Survival rate of client companies after 5 years

P_5 = change in productivity of client companies after 5 years

C_{2020} = Impacts from USTAR companies from the 2016-2020 cohort

S_{10} = Survival rate of client companies after 10 years

P_{10} = change in productivity of client companies after 10 years



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