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Economic Contribution of Federal Funding for Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) Programs

Minnesota, Fiscal Years 1983-2015



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EXECUTIVE SUMMARY: ECONOMIC CONTRIBUTION OF FEDERAL FUNDING FOR SMALL BUSINESS INNOVATION RESEARCH (SBIR) AND SMALL BUSINESS TECHNOLOGY TRANSFER (STTR) PROGRAMS

The mission of the SBIR/STTR programs is to support scientific excellence and technological innovation through the investment of Federal research funds in critical American priorities to build a strong national economy, one small business at a time. In Minnesota, the Minnesota High Tech Association is home to MN-SBIR and helps small businesses access SBIR/STTR funding.

Program goals for small businesses are to meet Federal research and development needs; increase private-sector commercialization of innovation derived from Federal research and development funding; stimulate technological innovation; foster and encourage participation in innovation and entrepreneurship by socially and economically disadvantaged persons; and foster technology transfer through cooperative R&D between small businesses and research institutions (required for STTR).

Output Effects: Between fiscal years 1983 and 2015, Minnesota small businesses awarded SBIR/STTR funding generated an estimated \$2.1 billion (in 2017 dollars) of economic activity. Of this, \$1.1 billion was directly from SBIR/STTR awards and the private investments resulting from the awards. The other \$1.0 billion in activity occurred in other industries across the state that supported the small businesses and their employees.

Employment Effects: Between fiscal years 1983 and 2015, federal SBIR/STTR awards, combined with private investments, supported an estimated 10,770 full-time, part-time, and seasonal jobs in Minnesota. Of these jobs, an estimated 3,997 were at small businesses receiving federal SBIR/STTR awards. The remaining 6,773 jobs were in other industries, particularly those that supported the SBIR/STTR awardees and their employees.

Labor Income Effects: Between fiscal years 1983 and 2015, federal SBIR/STTR awards and private investments generated an estimated \$766.4 million in labor income in Minnesota. Of this, \$392.9 million went to employees at SBIR/STTR-awarded businesses. The remaining \$373.5 million of labor income was across all industries. Labor income includes wages, salaries, and benefits.

Economic Contribution in 2015: In fiscal year 2015, the total economic contribution of funding received by Minnesota SBIR/STTR awardees was an estimated \$58.8 million. This includes \$21.5 million in labor income. The funding supported an estimated 289 jobs across all industries in Minnesota.

In fiscal year 2015, \$29.3 million, through 73 SBIR/STTR awards, was distributed. SBIR/STTR awardees created an estimated 110 jobs and \$11.0 million in labor income with those funds.

Top Industries Impacted in 2015: In fiscal year 2015, the scientific research and development and electromedical and electrotherapeutic apparatus manufacturing industries received the highest award amounts. The industries benefiting the most from the secondary effects of award spending included the employment services and real estate industries.

Notes on the Analysis: This analysis includes federal SBIR/STTR awards and private investments leveraged by those businesses due, in part, to the awards and success of the small businesses. However, the analysis only includes private investment documented by MN-SBIR. It is likely not all private investment has been captured, making this a conservative analysis.

PROJECT OVERVIEW

Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) programs expand funding opportunities for Minnesota small businesses. The goal is to support innovation, research, and the commercialization of ideas and concepts.

The SBIR program resulted from national efforts to help small businesses bring innovative ideas from concept to commercialization. The program was piloted in the 1970s with the National Science Foundation (NSF). Its goal was to convert government research and development into public benefit through technical innovation and commercial applications. The pilot program was successful, culminating when President Reagan signed a government-wide SBIR program into law in 1982.¹

The Small Business Innovation Development Act of 1982 (Public Law 97-219) directed the U.S. Small Business Administration (SBA) to fully establish the SBIR program. Congress reauthorized the SBIR program in 1986, and again in 1993, extending it to October 1, 2000. On December 21, 2000, Public Law 106-554 was signed reauthorizing the SBIR program through September 30, 2008.

Modeled after the SBIR program, STTR was established as a pilot program by the Small Business Technology Transfer Act of 1992 (P.L. 102-564, Title II). Government agencies with research and development (R&D) budgets of \$1 billion or more are required to set aside a portion of these funds to finance STTR activity. The goal of the STTR program is to facilitate the transfer of technology developed by a research institution through the entrepreneurship of a small business. The program was reauthorized with the Small Business Reauthorization Act of 1997 and again with the Small Business Technology Transfer Program Reauthorization Act of 2001.

In 2009, Congress could not agree on reauthorization and the SBIR/STTR programs were extended by a series of continuing resolutions. In December 2011, the 2012 National Defense Authorization Act (NDAA) reauthorized the SBIR/STTR programs until 2017. The 2017 NDAA then extended the lifespan of the programs through September 30, 2022.

Minnesota businesses receive SBIR/STTR competitive funding from any 1 of 11 federal agencies required by law to administer a SBIR program. They also receive funding from five federal agencies required by law to administer a STTR program. MN-SBIR provides support for the program in Minnesota and is funded, in part, through a Cooperative Agreement with the U.S. Small Business Administration, Minnesota Department of Employment and Economic Development, University of Minnesota, Office of Technology Commercialization, and the Minnesota High Tech Association. The goal of MN-SBIR is to help qualified small businesses receive federal SBIR/STTR funding across the spectrum of science and technology, and across many industrial domains.²

SBIR/STTR awards create economic activity in Minnesota—including additional output (or sales) in the economy, jobs, and labor income. The new sales, jobs, and labor income injected into the economy, in turn, result in additional economic activity for the businesses and industries that support small businesses and their employees. Input-output models can capture these secondary effects.

In 2015, MN-SBIR hired University of Minnesota Extension to quantify the economic contribution of federal SBIR/STTR funding between 1983 and 2014. The study determined that, between 1983 and 2014, businesses receiving federal funding generated an estimated \$1.4 billion (in 2015 dollars) of economic activity in Minnesota. This included an estimated \$510.2 million (in 2015 dollars) in labor

¹ The history of the SBIR program is available at <https://www.sbir.gov/birth-and-history-of-the-sbir-program>.

² Learn more about the Minnesota High Tech association at <http://www.mhta.org/mnsbir/>

income. The funding supported employment for 7,790 people. The total impact is the summation of annual impacts. This should be considered when interpreting the results.

MN-SBIR was also interested in updating the analysis to include fiscal year 2015 awards. In addition, the previous analysis only included economic activity generated by spending of SBIR/STTR awards. Many companies, however, leverage SBIR/STTR awards to attract private investments. Private investments may come as a direct investment in the business or as taking the company from private to public ownership. Extension was unable to quantify the impact of private investments in the previous analysis. For this analysis, however, MN-SBIR provided the data necessary to analyze this second component.

This report has two sections. The first section looks at the economic contribution of the programs during the course of their history in Minnesota (1983-2015). It includes both federal SBIR/STTR awards and private investments. The second section examines the economic contribution of SBIR/STTR awards in Minnesota in 2015.

The years discussed in this analysis reflect the federal fiscal year, which runs from October 1 to September 30.

ECONOMIC CONTRIBUTION FISCAL YEARS 1983-2015

To quantify total economic contribution, Extension measured the direct, indirect, and induced effects of the Minnesota SBIR/STTR awards. Direct effects are those generated by spending of the awards and private investments earned by the companies receiving them. Indirect and induced effects are the secondary impacts created in the economy due to direct spending. For example, a business receives an award for R&D and purchases a critical laboratory instrument. Thus, a medical manufacturer receives an additional sale. The effect on the medical manufacturer is a secondary effect. Input-output models measure indirect and induced effects. Extension used the IMPLAN model in this analysis.³

Direct Effects

Between fiscal years 1983 and 2015, Minnesota small businesses received nearly \$1.1 billion (in inflation-adjusted 2017 dollars) of funding from the SBIR/STTR programs (Table 1).⁴ This includes both direct SBIR/STTR awards and private investments. The IMPLAN model showed that, of the \$1.1 billion, an estimated \$392.9 million was distributed as income to employees. SBIR/STTR awardees employed an estimated 4,000 people through awards and private investment.⁵

As these are direct effects, they are the impacts at businesses receiving federal awards and private investment. **The effects are annual.** This means the impacts are only within the year the award or investments were provided.⁶

³ Extension used the IMPLAN model version 3.0 with type SAM multipliers (www.implan.com).

⁴ The analysis spans multiple years. To allow for correct comparisons, all dollar values were converted to 2017 dollars using the inflation feature in the IMPLAN model.

⁵ In this analysis, one job is one job, whether it is full-time, part-time, or seasonal.

⁶ This analysis examines the impact of the award/investment. Impacts are only for the year in which the award/investment was provided. It could be the award/investment spurred company growth and jobs were retained, but we do not have sufficient data to make that claim here.

Table 1: Direct Effect, Funding Received by Minnesota SBIR/STTR Awardees, Fiscal Years 1983-2015 (Output, labor income in millions of 2017 dollars)

Year	Output	Employment	Labor Income	Grants (#)
Total	\$1,052.3	3,997	\$392.9	2,236
2015	\$29.3	110	\$11.0	73
2014	\$48.5	279	\$23.4	74
2013	\$32.3	130	\$12.1	63
2012	\$43.2	216	\$18.8	80
2011	\$26.0	107	\$10.0	73
2010	\$41.6	206	\$18.0	84
2009	\$46.9	234	\$20.3	87
2008	\$68.2	247	\$22.5	80
2007	\$75.6	242	\$23.9	88
2006	\$34.0	136	\$12.8	105
2005	\$50.7	175	\$17.6	91
2004	\$41.3	161	\$15.8	83
2003	\$46.4	179	\$17.0	124
2002	\$58.4	186	\$19.9	114
2001	\$31.4	108	\$11.2	87
2000	\$46.6	135	\$15.8	79
1999	\$49.8	127	\$15.5	68
1998	\$39.3	102	\$12.6	77
1997	\$47.3	161	\$19.1	81
1996	\$50.4	165	\$18.5	76
1995	\$34.5	129	\$14.2	88
1994	\$13.1	55	\$5.0	66
1993	\$12.5	56	\$5.3	50
1992	\$11.2	47	\$4.3	45
1991	\$12.3	51	\$4.8	51
1990	\$15.2	61	\$5.7	55
1989	\$8.6	35	\$3.3	38
1988	\$10.0	42	\$3.9	41
1987	\$6.6	27	\$2.5	33
1986	\$10.4	43	\$4.0	31
1985	\$6.2	26	\$2.4	30

1984	\$3.9	16	\$1.5	15
1983	\$0.6	3	\$0.2	6

Includes SBIR/STTR awards and private investments

Source: Output from MN-SBIR, employment, and labor income estimates by Extension from IMPLAN

Indirect and Induced Effects

SBIR/STTR awards and private investments received by small businesses are direct effects. After quantifying the direct effect for each year, data is entered into an input-output model. Input-output models trace the flow of dollars throughout a local economy. The model then estimates the indirect and induced, or ripple, effects of an economic activity.

Indirect effects are those associated with a change in economic activity due to spending for goods and services directly tied to the small businesses receiving SBIR/STTR awards or private investments. In this case, these are the changes in the local economy occurring because businesses need to purchase inputs (raw goods) and related services (for example, training and accounting). These are business-to-business effects.

Induced effects are those associated with a change in economic activity due to spending by the employees of businesses (labor) and by households. Primarily, in this study, these are economic changes related to spending by the new employees hired by businesses receiving SBIR/STTR funding or private investments. It also includes household spending related to indirect effects. These are business-to-consumer effects.

Total Effects

Between fiscal years 1983 and 2015, SBIR/STTR awards and private investments in Minnesota generated an estimated \$2.1 billion (in 2017 dollars) of economic activity (Table 2). This includes \$766.4 million in labor income. SBIR/STTR awards supported employment for an estimated 10,770 people.

The total contribution is a sum of annual contributions. The impact of the SBIR/STTR awards and private investments should be considered annually, as a business could receive multiple awards and investments over multiple years. The awards and investments are measured in the year they were received. This is especially important when interpreting employment. One employee can be included in multiple years if the business received funding during multiple years.

On average, the total contribution per employee was \$195,970. In other words, each employee funded via SBIR/STTR awards or private investments generated an estimated \$195,970 in the economy.

Table 2: Total Economic Contribution (Direct, Indirect, and Induced Effects), Funding Received by Minnesota SBIR/STTR Awardees, Fiscal Years 1983-2015 (Output, labor income in millions of 2017 dollars)

Year	Output	Employment	Labor Income	Average per Employee
Total	\$2,110.6	10,770	\$766.4	\$195,970
2015	\$58.8	289	\$21.5	\$203,460

2014	\$102.4	638	\$42.5	\$160,502
2013	\$65.7	347	\$23.9	\$189,337
2012	\$89.7	522	\$35.2	\$171,839
2011	\$53.2	284	\$19.6	\$187,324
2010	\$85.5	495	\$33.5	\$172,727
2009	\$97.3	566	\$38.2	\$171,908
2008	\$131.9	647	\$44.9	\$203,864
2007	\$145.7	678	\$48.6	\$214,897
2006	\$69.3	363	\$25.2	\$190,909
2005	\$99.6	488	\$34.9	\$204,098
2004	\$85.9	451	\$31.5	\$190,466
2003	\$93.8	484	\$33.8	\$193,802
2002	\$114.8	539	\$40.0	\$212,987
2001	\$63.6	310	\$22.6	\$205,161
2000	\$94.2	435	\$32.7	\$216,552
1999	\$96.2	420	\$31.8	\$229,048
1998	\$72.0	306	\$24.0	\$235,294
1997	\$94.8	463	\$35.7	\$204,752
1996	\$99.1	472	\$35.7	\$209,958
1995	\$70.3	356	\$26.7	\$197,472
1994	\$27.0	145	\$10.0	\$186,060
1993	\$25.8	144	\$10.0	\$179,340
1992	\$23.0	124	\$8.5	\$185,430
1991	\$25.2	136	\$9.3	\$185,325
1990	\$30.8	162	\$11.1	\$189,945
1989	\$17.8	94	\$6.5	\$188,790
1988	\$20.5	110	\$7.6	\$186,165
1987	\$13.4	71	\$4.9	\$189,315
1986	\$21.3	114	\$7.9	\$187,005
1985	\$12.7	68	\$4.7	\$186,795
1984	\$7.9	42	\$2.9	\$187,530
1983	\$1.4	7	\$0.5	\$194,985

Includes SBIR/STTR awards and private investments
Source: University of Minnesota Extension estimates

ECONOMIC CONTRIBUTION FISCAL YEAR 2015

In fiscal year 2015, Minnesota small businesses were competitively awarded \$29.3 million in SBIR/STTR awards, totaling 73 awards and creating an estimated 110 jobs and \$11.0 million in labor income (Table 3).

In fiscal year 2015, the total economic contribution of funding received by Minnesota SBIR/STTR awardees was an estimated \$58.8 million. This includes \$21.5 million in labor income. The funding supported an estimated 289 jobs across all industries in Minnesota.

Table 3: Total Economic Contribution, Funding Received by Minnesota SBIR/STTR Awardees, Fiscal Year 2015 (Output, labor income in millions of 2017 dollars)

	Output	Employment	Labor Income
Direct	\$29.3	110	\$11.0
Indirect/Induced	\$29.5	179	\$10.5
Total	\$58.8	289	\$21.5

Estimates by University of Minnesota Extension

Direct Effect by Industry

SBIR/STTR awards are given to businesses in a variety of industries in Minnesota. The industry receiving the highest amount of funding in fiscal year 2015 was scientific research and development (including medical, biotechnology, defense, agriculture, energy, etc.). Businesses in this industry were awarded \$11.0 million in 2015 (Table 4). Other top industries with awards included electromedical and electrotherapeutic apparatus manufacturing and custom computer programming.⁷

Table 4: Direct Effect by Industry, Funding Received by Minnesota SBIR/STTR Awardees, Fiscal Year 2015 (Output, labor income in millions of 2017 dollars)

Industry	Output	Employment	Labor Income
Scientific research and development	\$11.0	42	\$4.0
Electromedical and electrotherapeutic apparatus manufacturing	\$4.1	7	\$1.2
Custom computer programming	\$2.4	11	\$1.2

⁷ Extension classified the nature of the companies based on information provided by MN-SBIR. Electromedical and electrotherapeutic apparatus manufacturing includes magnetic resonance imaging equipment, medical ultrasound equipment, pacemakers, hearing aids, electrocardiographs, and electromedical endoscopic equipment. Custom computer programming includes firms engaged in writing, modifying, testing, and supporting software to meet the needs of a particular customer. For more information, visit www.naics.com.

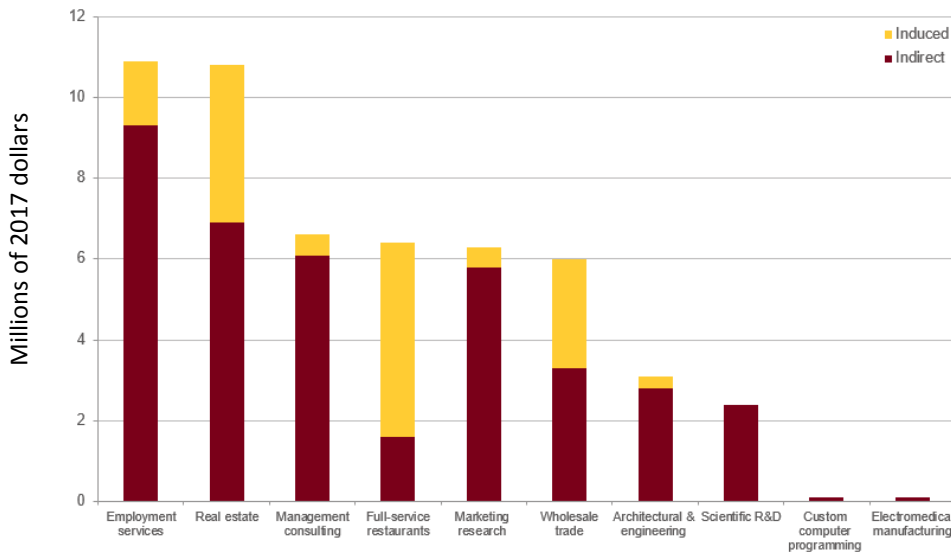
Wholesale trade	\$2.2	8	\$0.9
Electronic measurement and control device manufacturing	\$1.9	5	\$0.6
Management consulting services	\$1.5	12	\$1.0
All other	\$6.2	25	\$2.1
Total	\$29.3	110	\$11.0

Estimates by University of Minnesota Extension

Top Industries Impacted

Other key industries in Minnesota also benefited from SBIR/STTR funding. The most significant 2015 secondary effects were in the employment services and real estate industries (Chart 1).⁸

Chart 1: Top Industries Impacted, Funding Received by Minnesota SBIR/STTR Awardees, Fiscal Year 2015

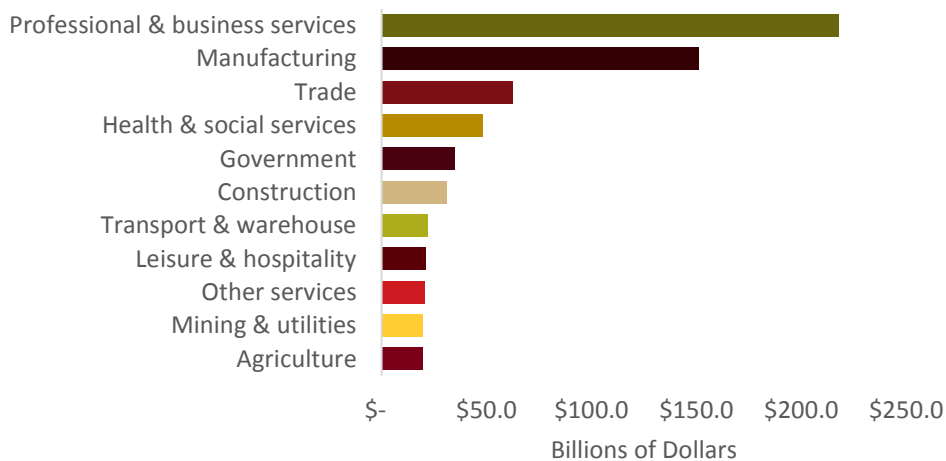


SBIR/STTR IN THE CONTEXT OF THE MINNESOTA ECONOMY

In 2015, businesses and enterprises in Minnesota created \$649.3 billion of output. The professional and business services industry, the largest industry, generated \$218.0 billion of total output (Chart 2). In comparison, the SBIR/STTR awards generated \$58.8 million of economic activity in 2015.

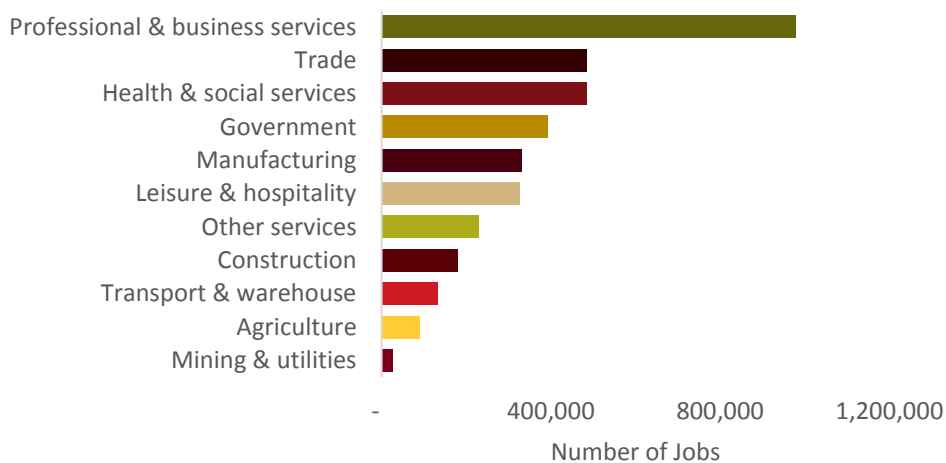
⁸ It is not unusual to see employment services as a high impact category. Coming out of the Great Recession, many employers used employment services to hire people on a temporary basis before hiring them permanently.

Chart 2: Output by Industry, Minnesota, 2015



In 2015, there were 3.7 million jobs at Minnesota businesses and enterprises. Nearly 1 million of these jobs were in the professional and business services industry (Chart 3). Minnesota SBIR/STTR awards supported 289 of the 3.7 million jobs.

Chart 3: Employment by Industry, Minnesota, 2015



NOTES ON THE ANALYSIS

In interpreting this analysis, readers should note several elements of this study. First, private investments included in the analysis are those documented by MN-SBIR. It is likely private investments occurred that were not reported or documented. Thus, the analysis is conservative.

Second, an innovative concept may take time to develop into a commercialized product of appeal to private investors. There are fewer documented private investments in recent years (2010-2015). This may be the result of a product not being developed to the point of attracting investors, or the state of the current investment climate, or the fact that the business remained privately-held without additional investments.

APPENDIX: METHODS AND TERMS

Special models, called input-output models, exist to conduct economic contribution analysis. There are several input-output models available. IMPLAN (Impact Analysis for PLANning) is one such model. Many economists use IMPLAN for economic contribution analysis because it can measure output and employment impacts, is available on a county-by-county basis, and is flexible for the user. IMPLAN has some limitations and qualifications, but it is one of the best tools available to economists for input-output modeling. Understanding the IMPLAN tool, its capabilities, and its limitations helps ensure the best results from the model.

One of the most critical aspects of understanding economic contribution analysis is the distinction between the “local” and “non-local” economy. The local economy is identified as part of the model-building process. Either the group requesting the study or the analyst defines the local area. Typically, the study area (the local economy) is a county or a group of counties that share economic linkages. In this study, the study area is the entire state of Minnesota.

A few definitions are essential to properly read the results of an IMPLAN analysis. The terms and their definitions are provided below.

Output

Output is the "quantity of goods or services produced in a given time period by a firm, industry, or country," whether consumed or used for further production. The concept of national output is essential in the field of macroeconomics.

Output represents the value of industry production. In IMPLAN, these are annual production estimates for the year of the data set and are in producer prices. Output is measured in dollars and is equivalent to total sales.

Employment

Employment includes full- and part-time workers, as well as seasonal workers. Employment is measured in annual average jobs, not full-time equivalents (FTEs). IMPLAN includes total wage and salaried employees, as well as the self-employed, in employment estimates. Because employment is measured in jobs and not in dollar values, it tends to be a very stable metric.

Labor Income

Labor income includes all forms of employment income, including employee compensation (wages, salaries, and benefits) and proprietor income. Labor income measures the value added to the product by the labor component.

Direct Impact

Direct impact is equivalent to the initial activity in the economy. In this study, it is the expenditures of businesses receiving SBIR/STTR awards.

Indirect Impact

The indirect impact is the summation of changes in the local economy that occur due to spending for inputs (goods and services) by the industry or industries directly impacted. For instance, if

employment in a manufacturing plant increases by 100 jobs, this implies a corresponding increase in output by the plant. As the plant increases output, it must also purchase more inputs, such as electricity, steel, and equipment. As the plant increases purchases of these items, its suppliers must also increase production, and so forth. As these ripples move through the economy, they can be captured and measured. Ripples related to the purchase of goods and services are indirect impacts. In this study, indirect impacts are those associated with spending by small businesses to purchase inputs.

Induced Impact

The induced impact is the summation of changes in the local economy that occur due to spending by labor; that is, spending by employees in the industry or industries directly impacted. For instance, if employment in a manufacturing plant increases by 100 jobs, the new employees will have more money to purchase housing, buy groceries, and go out to dinner. As they spend their new income, more activity occurs in the local economy. This can be quantified and is called the induced impact. Primarily, in this study, the induced impacts are those economic changes related to spending by employees of small businesses receiving federal funding.