

October 19, 2016

Research Report

**Estimating the Value of the  
Natural Resources Research Institute  
In  
The Arrowhead Region and Minnesota**

For the  
Natural Resources Research Institute

Bureau of Business and  
Economic Research

**Labovitz School**  
OF BUSINESS AND ECONOMICS

UNIVERSITY OF MINNESOTA DULUTH

Driven to Discover

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## Table of Contents

|   |     |
|---|-----|
| Report Title Page .....                           | i   |
| Research Team .....                               | ii  |
| Table of Contents .....                           | iii |
| Table of Figures .....                            | iii |
| Table of Tables .....                             | v   |
| Executive Summary .....                           | vi  |
| I. Project Description .....                      | 1   |
| II. Economic Impacts .....                        | 2   |
| Input-Output Modeling .....                       | 2   |
| Funding Sources .....                             | 3   |
| Expenditures .....                                | 5   |
| Results .....                                     | 7   |
| Arrowhead Region .....                            | 7   |
| State of Minnesota .....                          | 8   |
| III. Other Impacts .....                          | 10  |
| Agency Survey Results .....                       | 10  |
| Business Survey Results .....                     | 17  |
| Notable Examples .....                            | 25  |
| Appendix A: Definitions Used in this Report ..... | 27  |
| APPENDIX B: IMPLAN Assumptions .....              | 28  |
| APPENDIX C: Detailed Inputs .....                 | 29  |

## Table of Figures

|  |   |
|--|---|
| Figure 1. Arrowhead Region and Minnesota .....   | 2 |
| Figure 2. Total Budget and Funding Sources, 2016 Fiscal Year .....                               | 3 |
| Figure 3. All grants and contracts, FY2016 .....   | 4 |
| Figure 4. New grants and contracts, FY2016 .....   | 4 |
| Figure 5. All state and federal competitive grants and contracts by funding source, FY2016 ..... | 4 |

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|   |    |
|---|----|
| Figure 6. Top 15 Industries Impacted by NRRI Operations in the Arrowhead Region, by Total Output, FY2016..... | 8  |
| Figure 7. Top 15 Industries Impacted by NRRI Operations in Minnesota, by Total Output, FY2016.....            | 9  |
| Figure 8. What type of agency do you work for? .....  | 10 |
| Figure 9. What is your primary role at this agency? .....   | 11 |
| Figure 10. In the past year, on how many projects have you partnered with the NRRI? .....                     | 11 |
| Figure 11. How did your agency connect with the NRRI? .....   | 12 |
| Figure 12. What services did NRRI provide to your agency? .....   | 12 |
| Figure 13. What industry/business segment(s) benefited from the work NRRI did for your agency? .              | 13 |
| Figure 14. Generally, can the work done by the NRRI be reflected in time and/or cost savings? .....           | 14 |
| Figure 15. Please estimate the cost savings that can be attributed to your partnership(s) with the NRRI.....  | 14 |
| Figure 16. Overall, how many agency programs or policies, by your estimate, have been impacted .              | 15 |
| Figure 17. Agency Benefits Received by Percentage of Respondents .....  | 16 |
| Figure 18. In which industry segment is your business classified? .....                                       | 17 |
| Figure 19. In the past year, on how many projects have you partnered with the NRRI? .....                     | 18 |
| Figure 20. What services did NRRI provide to your business? .....   | 18 |
| Figure 21. Please estimate your business’s annual revenue.....  | 19 |
| Figure 22. If you had to hire employees with NRRI’s level of expertise.....                                   | 19 |
| Figure 23. Did the assistance provided by the NRRI result in any of the following? .....                      | 20 |
| Figure 24. Please estimate the total number of new or retained jobs .....                                     | 21 |
| Figure 25. Please estimate the percentage increase in revenue .....   | 22 |
| Figure 26. Please estimate the percentage increase in profit.....   | 22 |
| Figure 27. Business Benefits Received by Percentage of Respondents .....                                      | 24 |
| Figure 28. Breakdown of NRRI Sponsored Expenses, FY2016.....  | 30 |

## **Table of Tables**

|  |    |
|--|----|
| Table 1. Summary of Total Operating and Grant Funded Expenditures.....   | 5  |
| Table 2. IMPLAN Commodities Used in Modeling NRRRI Impact .....  | 6  |
| Table 3. Total Economic Impact of the NRRRI Organization on the Arrowhead Region, FY2016.....                      | 7  |
| Table 4. Total Economic Impact of the NRRRI Organization on State of Minnesota .....                               | 8  |
| Table 5. Please rank the following NRRRI attributes in order of their importance to you and your agency.           | 13 |
| Table 6. Please rank the following NRRRI attributes in order of their importance to you and your<br>business ..... | 23 |
| Table 7. Breakdown of NRRRI Non-Sponsored Expenditures, FY2014-2016 .....  | 29 |

## Executive Summary

Formed in the early 1980s, the Natural Resources Research Institute (NRRI) was established as an entity of the University of Minnesota Duluth. The NRRI was charged with researching resources such as peat, biomass, forest products, water, and minerals for future sustainability and to improve economic vitality of the region. Currently, the NRRI has a staff of approximately 130 and an annual budget of approximately \$16 million, of which more than half (\$9.7 million) comes from competitive grants and contracts, roughly 12% of from university funding (i.e. tuition-driven operations and maintenance), and 14% from state mandated funding to provide research support.

The NRRI contacted the Bureau of Business and Economic Research (BBER) at UMD's Labovitz School of Business and Economics to estimate the value of the organization. The analysis includes the organization's economic impacts using the IMPLAN modeling software as well its impacts on business and agency partners, based on feedback from client surveys.

Based on the results produced by this analysis, it is estimated that more than 200 new jobs in the Arrowhead region can be attributed to spending and operations by the NRRI during fiscal year 2016. In addition, the NRRI contributed roughly \$18.2 million to wages and benefits and \$18 million in Value Added impact to the Arrowhead region's economy. In total, the NRRI is estimated to have increased local output by a total of approximately \$28 million throughout the Arrowhead.

Economic impacts for the state are even larger than the impacts for the Arrowhead region. Results suggest that the NRRI organization contributed more than 250 new jobs in the state, \$17.5 million in wages, more than \$23 million to the state's gross regional product and nearly \$35 million in total output statewide during fiscal year 2016.

These findings highlight the amount by which the

NRRI is able to leverage the state base funding they receive, roughly \$2.4 million in FY2016, to earn a competitive grants and contracts (\$9.7 million in FY2016) and then how those funds spur economic activity throughout the Arrowhead region and the state. The initial state funding, through the work of the agency and the multiplying effect of the local economy, leads to a total economic impact of more than \$28 million in the Arrowhead region and nearly \$35 million statewide.

But the NRRI has value beyond the economic impacts that its organization provides to the region and the state. To estimate these other impacts, two surveys were distributed with questions about the types of services the NRRI provided, whether projects resulted in additional jobs or cost savings, and general measures of satisfaction.

Surveyed agency partners reported average cost savings of between \$40,000 and \$50,000, and time savings of about 6 months, as a result of their partnership with the NRRI. In addition, based on estimates given, it can be assumed that between 117 and 180 agency programs or policies have been impacted by the work performed by NRRI personnel. Similarly, the average business partner is estimated to have saved between \$60,000 and \$100,000 in internal hiring costs as a result of partnering with the NRRI, and estimated between 7 and 12 new or retained jobs as a result of their partnership with the NRRI.

Finally, both surveys asked clients if they would use the NRRI's services again in the future. Of those who responded, 98% answered yes. In addition, the survey commentary suggests that clients have felt a benefit from the NRRI and value the experience of working with them. In general, respondents' comments indicated a high level of satisfaction with NRRI's extensive research, innovation, product development and prototyping, and consulting.



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# Estimating the Value of the Natural Resources Research Institute in the Arrowhead Region and Minnesota

## I. Project Description

Formed in the early 1980s in response to the declining economy brought on by difficulties in several of Northeastern Minnesota's industries, the Natural Resources Research Institute (NRRI) was established by the Minnesota State Legislature as an entity of the University of Minnesota Duluth. The NRRI was charged with researching resources such as peat, biomass, forest products, water, and minerals for future sustainability and to improve economic vitality of the region.

Currently, with a staff of approximately 130 (including seasonal workers, part-time student workers, adjunct professors, and visiting scientists) and an annual budget of approximately \$16 million, the NRRI has six areas of strategic research initiatives: 1) Biomass Renewable Energy, 2) Water Resource Management, 3) Minerals Metallurgy & Mining, 4) Business & Entrepreneurial Support, 5) Wood Utilization, Materials & Bioeconomy, 6) Forestry & Land Resource Management.

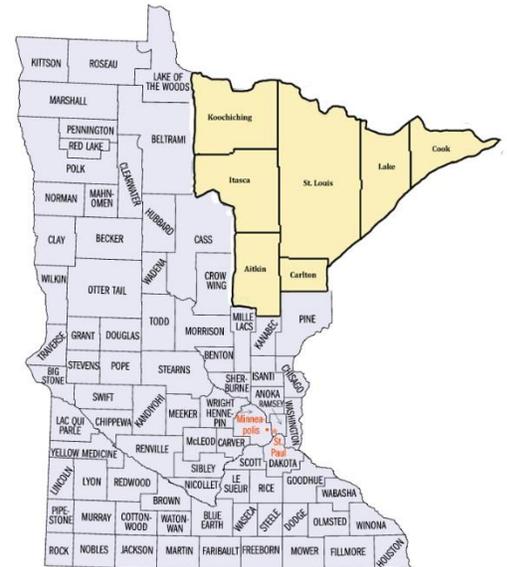
In February 2016, the NRRI contacted the Bureau of Business and Economic Research (BBER) at UMD's Labovitz School of Business and Economics to estimate the value of the organization. The analysis includes the organization's economic impacts as well its impacts on business and agency partners, based on feedback from client surveys.

The research objectives of this study included the following:

- To review the NRRI's operational expenditures and develop an industry spending plan for the organization using IMPLAN's analysis-by-parts method.
- To survey NRRI clients to estimate the impact of the organization on its partners, through increased employment, output, wages, and productivity.
- To estimate the impact of the NRRI's grant funding on the Arrowhead region and the state of Minnesota.
- To calculate combined direct, indirect, and induced impact of the organization, using the inputs listed above (operational expenses, client output, and grant funds).
- To calculate the return on investment using current state funding levels and economic impact results.

The geographic scope for this economic impact analysis is the Arrowhead region of Minnesota (the seven counties of Aitkin, Carlton, Cook, Itasca, Koochiching, Lake, and St. Louis) and the state of Minnesota as a whole (see Figure 1).

**Figure 1. Arrowhead Region and Minnesota**



SOURCES: WIKIPEDIA, YELLOW MAPS, BBER

## II. Economic Impacts

For the economic impact modeling, the NRRI provided the BBER with budget information, including revenue sources, grant and contract details, and typical annual expenditures. Throughout the project, the BBER worked closely with the NRRI staff to ensure the accuracy of the assumptions and resulting models. The following section summarizes the inputs and methodology used for evaluating the economic impact of the organization, as well as the results of modeling.

### Input-Output Modeling

This study uses the IMPLAN Group’s input-output modeling data and software (IMPLAN version 3.1). The IMPLAN database contains county, state, zip code, and federal economic statistics, which are specialized by region, not estimated from national averages. Using classic input-output analysis in combination with region-specific social accounting matrices and multiplier models, IMPLAN provides a highly accurate and adaptable model for its users. IMPLAN data files use the following federal government data sources:

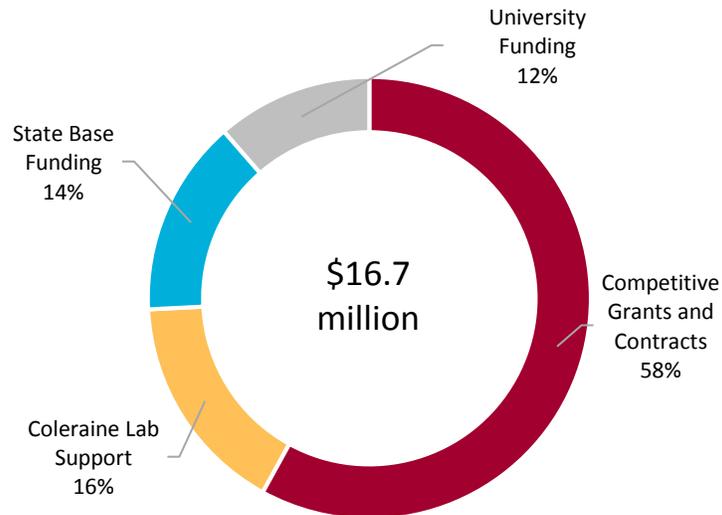
- U.S. Bureau of Economic Analysis Benchmark Input-Output Accounts of the U.S.
- U.S. Bureau of Economic Analysis Output Estimates
- U.S. Bureau of Economic Analysis Regional Economic Information Systems (REIS) Program
- U.S. Bureau of Labor Statistics Covered Employment and Wages (CEW) Program
- U.S. Bureau of Labor Statistics Consumer Expenditure Survey
- U.S. Census Bureau County Business Patterns
- U.S. Census Bureau Decennial Census and Population Surveys
- U.S. Census Bureau Economic Censuses and Surveys
- U.S. Department of Agriculture Census

IMPLAN data files consist of the following components: employment, industry output, value added, institutional demands, national structural matrices, and inter-institutional transfers. Economic impacts are made up of direct, indirect, and induced impacts. The data used was the most recent IMPLAN data available, which is for the year 2014. All data are reported in 2016 dollars. More details on the assumptions and limitations of these models can be found in Appendix B, IMPLAN Assumptions.

## Funding Sources

While the NRRI's funding and revenue sources are not used in the impact modeling, they provide a unique perspective on the NRRI as an organization. In the 2016 fiscal year (which spans July 2015 – June 2016), the NRRI's budget totaled \$16.7 million.

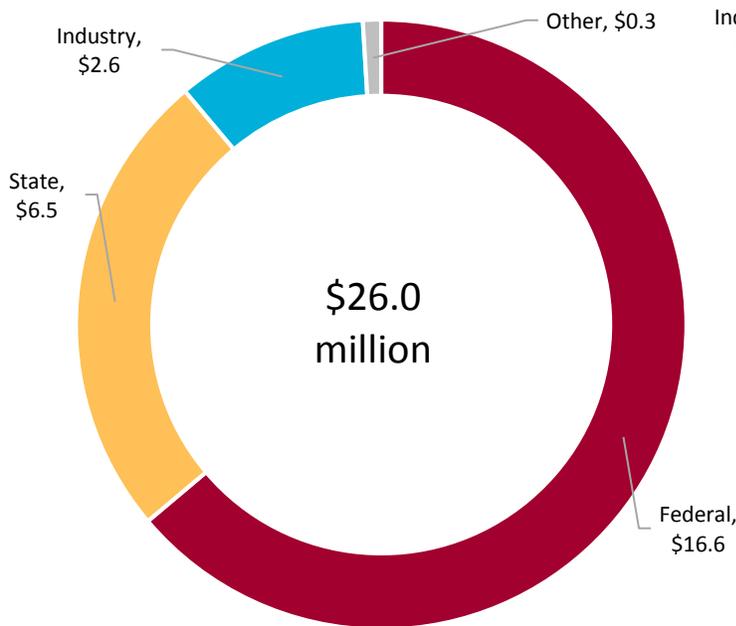
Figure 2. Total Budget and Funding Sources, 2016 Fiscal Year



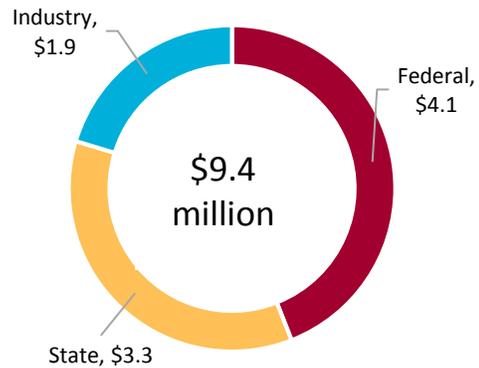
SOURCE: NRRI

As shown in Figure 2, more than half (\$9.7 million) of the NRRI's total budget of \$16.7 million came from competitive grants and contracts. Roughly 16% of the organization's budget came from the Coleraine Lab Support trust fund, a permanent university fund dedicated to the NRRI's Coleraine lab, which specializes in iron ore-related research. In addition, the NRRI received 12% of its annual budget from university funding (i.e. tuition-driven operations and maintenance) and 14% from state mandated funding to provide research support.

**Figure 3. All grants and contracts, FY2016**



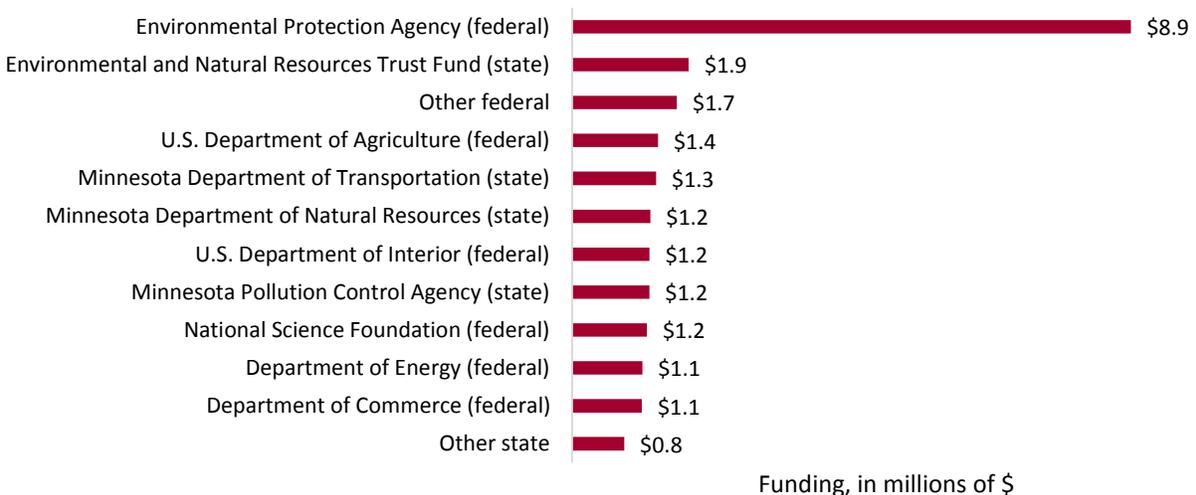
**Figure 4. New grants and contracts, FY2016**



SOURCE: NRRI

Budgeting for an organization like the NRRI is a complicated exercise, as many of the organization’s grants and contracts extend for multiple years. For example, in the 2016 fiscal year, the NRRI had nearly \$26 million in active competitive grants and contracts, but only \$9.4 million of those grants and contracts were new for 2016. Figures 3 and 4 show more detail on NRRI’s grants and contracts for FY2016. In both cases, the largest share of funding was from federal sources, followed by state and then industry. However, the new grants and contracts have a larger share of state and industry funds, compared with all ongoing grants and contracts.

**Figure 5. All state and federal competitive grants and contracts by funding source, FY2016**



SOURCE: NRRI, 2016

Figure 5 on the previous page provides more detail into the state and federal funding sources. The Environmental Protection Agency (EPA) is the NRRI's largest source of competitive grant funding by far, contributing \$8.9 million in funding to support NRRI research. All of the other competitive funding sources range in magnitude from between \$0.8 million and \$1.9 million.

One final source of funding that should be mentioned is income from royalties. Over the past ten years, the NRRI has had more than 30 patents issued and has earned more than \$850,000 in royalties during that time. These royalties are distributed to the University's public endowment fund (PUF) for investment, and a portion of those funds are reallocated to the NRRI annually.<sup>1</sup>

These revenue details help to highlight the amount by which the NRRI is able to leverage the state base funding they receive, roughly \$2.4 million in FY2016, to earn a significantly larger amount of competitive grants and contracts (\$9.7 million in FY2016).

## Expenditures

The NRRI's annual expenditures represent the organization's economic contribution to the Arrowhead region and the state of Minnesota through wages, equipment, utilities, and other local spending. The economic impacts resulting from the NRRI's operations were calculated using FY2016 expenditures (highlighted in Table 1 below) provided by the University of Minnesota's Finance Department and the NRRI's Finance Manager.

**Table 1. Summary of Total Operating and Grant Funded Expenditures**

|                              | <i>Actuals 2014</i> | <i>Actuals 2015</i> | <i>Year To Date Actuals 2016</i> |
|------------------------------|---------------------|---------------------|----------------------------------|
| Operating Expenditures       | \$10,968,845        | \$11,407,845        | \$10,915,242                     |
| Sponsored Grant Expenditures | \$4,125,682         | \$4,458,078         | \$5,483,320                      |
| Total                        | \$15,094,527        | \$15,865,923        | \$16,398,562                     |

SOURCE: NRRI

Table 1 shows the organization's annual expenditures over the past three years, broken out by type of expenditure. Operating expenditures represent the organization's base operations. These expenses include salaries, fringe, supplies, capital, rent, utilities, and other essential functions. The sponsored expenditures are treated differently, as sponsored funding comes from grants and contracts, some of which span multiple years. Hence, sponsored grant expenditures cover costs specifically related to those projects, including staff, travel, consulting services, and specialized supplies and equipment. One notable point regarding the NRRI's expenditures is the significant portion that is dedicated to employee salaries and fringe benefits. More than 60% of the NRRI's \$16 million budget is spent on wages, a rate much higher than is typical for other research and development firms. More details for each of these items can be found in Appendix C, Detailed Inputs.

The IMPLAN industry most representative of the NRRI is industry 456, scientific research and development services. This industry includes private research and development laboratories and institutions. However, the NRRI's revenue sources and expenditures are likely to be very different from other businesses and industries within this sector, as they are also part of a larger educational institution. Rather than use IMPLAN's default spending pattern for this industry (which is developed using an aggregate of all facilities included in industry 456), the BBER modeled the NRRI's operations using a technique called Analysis by Parts.

<sup>1</sup> Royalty funds are included in the competitive grants and contracts portion of the budget (see Figure 2, page 3).

This technique, which yields more accurate results, allows the user to specify the amount of commodity inputs, the proportion of local labor income, and the proportion of local purchases.

**Table 2. IMPLAN Commodities Used in Modeling NRRI Impact**

| <i>IMPLAN Commodity Code</i> | <i>Description</i>  |
|------------------------------|---|
| 3049                         | Electricity transmission and distribution   |
| 3050                         | Natural gas distribution  |
| 3051                         | Water sewage and other systems  |
| 3062                         | Maintenance and repair construction of nonresidential structures                  |
| 3320                         | Analytical laboratory instrument manufacturing                                    |
| 3395                         | Wholesale   |
| 3402                         | Gasoline stores   |
| 3422                         | Software publishers   |
| 3429                         | Satellite, telecommunications resellers, and all other telecommunications         |
| 3440                         | Real estate buying and selling, leasing, managing, and related services           |
| 3447                         | Legal services  |
| 3449                         | Architectural, engineering, and related services                                  |
| 3453                         | Other computer related services   |
| 3454                         | Management consulting services  |
| 3456                         | Scientific research and development services                                      |
| 3460                         | Marketing research and all other professional, scientific, and technical services |
| 3461                         | Management of companies and enterprises   |
| 3499                         | Hotel and motel services  |
| 3501                         | Full-service restaurants  |
| 3502                         | Limited-service restaurants   |
| 3503                         | All other food and beverage stores  |
| 3506                         | Electronic and precision equipment repair and maintenance                         |
| 3515                         | Business and professional associations  |
| 5001                         | Employee compensation   |

*SOURCE: NRRI AND IMPLAN*

Using the Analysis-by-Parts method, all expenditures provided by the organization were re-categorized as IMPLAN commodities to create a customized industry based on an existing budgetary spending pattern.<sup>2</sup> Table 2 shows a list of those commodities used to create the customized industry. The majority of the items shown in Table 2 include expenses by the NRRI for business services, equipment, rent, and supplies. Employee compensation (5001) represents the wages paid to the 130 workers employed by the organization.

<sup>2</sup> IMPLAN, 2016

## Results

This section describes the direct, indirect, and induced economic impacts resulting from the NRRI organization's operations in the Arrowhead Region and the State of Minnesota. Impacts are measured in employment, output, and value added.

### Arrowhead Region

**Table 3. Total Economic Impact of the NRRI Organization on the Arrowhead Region, FY2016**

| <i>Impact Type</i> | <i>Employment</i> | <i>Labor Income</i> | <i>Value Added</i> | <i>Output</i> |
|--------------------|-------------------|---------------------|--------------------|---------------|
| Direct Effect      | 130               | \$11.0              | \$12.3             | \$16.4        |
| Indirect Effect    | 26                | \$1.3               | \$1.8              | \$4.2         |
| Induced Effect     | 62                | \$2.4               | \$4.2              | \$7.8         |
| Total Effect       | 218               | \$14.6              | \$18.2             | \$28.4        |

*SOURCE: IMPLAN*

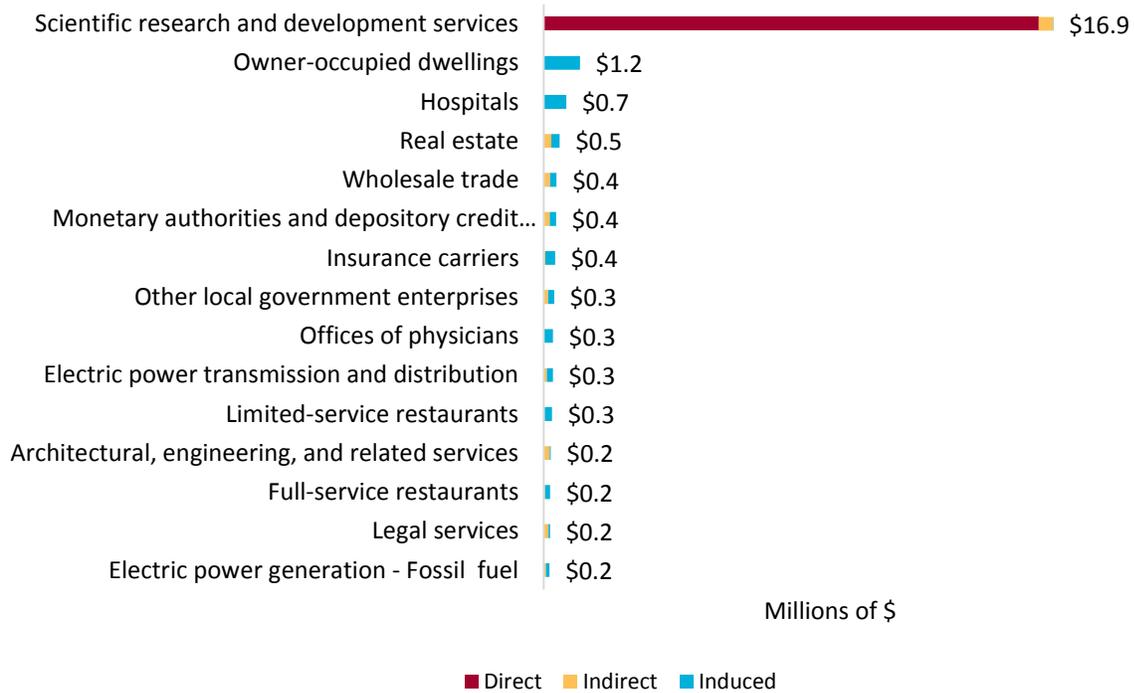
Table 3 depicts the total economic effects of the NRRI operations on the Arrowhead region. The far left column, Employment, is an estimate of the number of new jobs created and supported by the organization's operations. It is important to note that this estimate is in terms of jobs created and does not necessarily represent full-time equivalent employees. These jobs may include full- or part-time, temporary, or short-term positions. From the results produced by this analysis, nearly 220 new jobs in the region can be attributed to spending by the NRRI, with 130 coming from the team's operational spending and an additional 88 jobs resulting from increased inter-industry and household spending.

Labor Income, the column to the right of Employment, is the estimated compensation of all employees, including wages, benefits, and proprietor income. During the 2016 fiscal year, this model estimated that the NRRI contributed roughly \$14.6 million to wages and benefits in the region, of which \$11.0 million was the result of the organization's operational expenditures and the remainder was the result of increased economic activity resulting from industry and household spending.

The next column, labeled Value Added, represents the estimated contribution to the county's gross regional product (GRP) made by an individual producer, industry, or sector. This impact includes additional employee compensation, taxes on production and imports, and gross operating surplus across the local economy due to the organization's spending. In fiscal year 2016, the NRRI contributed roughly \$18 million in Value Added impact to the Arrowhead region's economy, with \$12.3 million coming from the organization's operations and an additional \$6.0 million from indirect and induced effects.

The far right column shows Output, the total value of all local industry production. According to modeling results, it is estimated that the organization increased local output by a total of approximately \$28 million.

**Figure 6. Top 15 Industries Impacted by NRRI Operations in the Arrowhead Region, by Total Output, FY2016**



SOURCE: IMPLAN

Figure 6 shows the top 15 industries impacted by the NRRI’s operations. Scientific research and development services is the industry most impacted, as the organization’s direct expenditures fall into that category. Other impacted industries included owner-occupied dwellings<sup>3</sup>, hospitals, and real estate, and wholesale trade.

## State of Minnesota

**Table 4. Total Economic Impact of the NRRI Organization on State of Minnesota**

| <i>Impact Type</i> | <i>Employment</i> | <i>Labor Income</i> | <i>Value Added</i> | <i>Output</i> |
|--------------------|-------------------|---------------------|--------------------|---------------|
| Direct Effect      | 130               | \$11.0              | \$12.5             | \$16.4        |
| Indirect Effect    | 38                | \$2.4               | \$3.6              | \$6.1         |
| Induced Effect     | 85                | \$4.1               | \$6.9              | \$12.3        |
| Total Effect       | 253               | \$17.5              | \$23.1             | \$34.9        |

SOURCE: IMPLAN

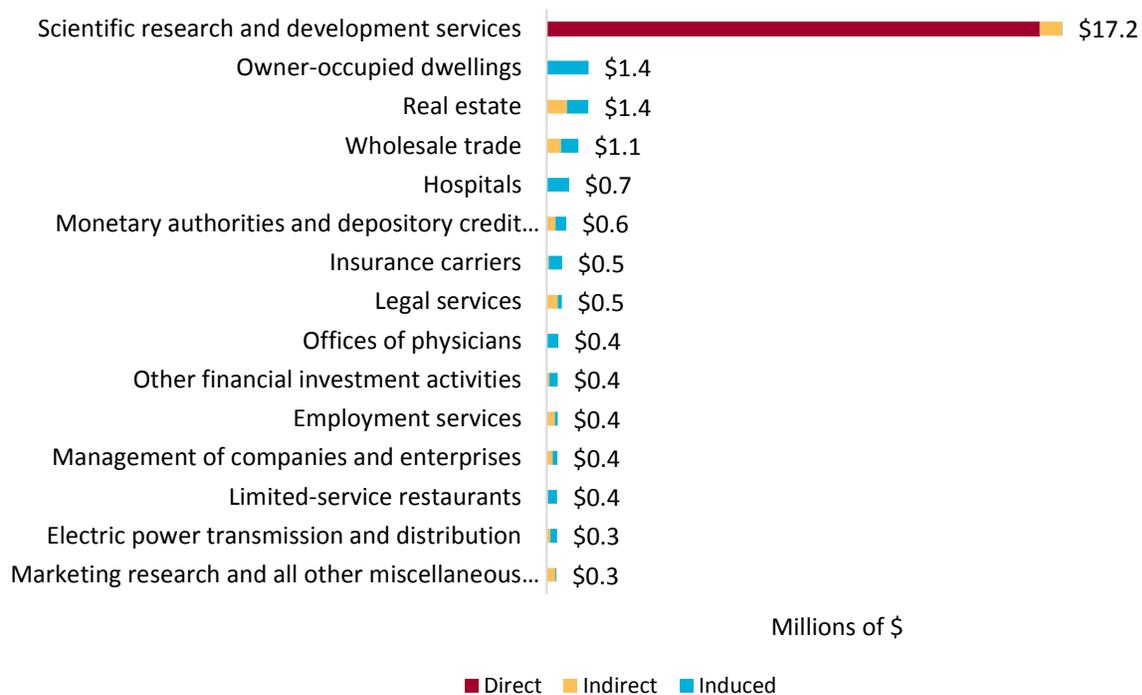
Table 4 shows the economic impacts of the NRRI organization on the state of Minnesota. The inputs provided by the NRRI represent the direct effects and are the basis for quantifying the full economic effects of the project. In this case, the average annual operating budget for the organization in fiscal year 2016, roughly

<sup>3</sup> The owner-occupied dwellings sector estimates what owner/occupants would pay in rent if they rented rather than owned their homes. It is included in the database to ensure consistency in the flow of funds. It captures the expenses of home ownership such as repair and maintenance, closing costs, and upkeep.

\$16.4 million, represents direct Output, as shown above. The 130 NRRRI staff and their wages and payroll taxes (\$11.0 million) are represented as direct employment and labor income.

It is estimated that 253 jobs are supported each year in the state as a result of the organization’s operations. The Indirect Effect (\$6.1 million in industry spending and 38 supported jobs) shows the measurement of increased spending between commercial, government, and service industries as a result of the direct effects. Induced Effect (\$12.3 million in household spending and 85 jobs) measures the amount of increased spending by residential households as a result of the direct effects. These effects are quite large, reflecting the sizable portion of the organization’s budget that goes directly to wages and benefits. Total Effect is the sum of Direct, Indirect, and Induced Effects.

**Figure 7. Top 15 Industries Impacted by NRRRI Operations in Minnesota, by Total Output, FY2016**



SOURCE: IMPLAN

Figure 7 shows the top industries impacted by the NRRRI organization statewide during fiscal year 2016. Most of the industries are similar to those shown previously for the Arrowhead Region. However, legal services, financial investment activities, employment services, and management of companies and enterprises all saw larger impacts statewide than when modeled for the Arrowhead region only.

Overall, economic impacts for the state are larger than the impacts for the Arrowhead region. The reason for this is because more of the organization’s spending is considered “local” when modeling impacts on the state of Minnesota and more of the organization’s impacts ripple throughout the state’s economy than when modeled for the Arrowhead region.

There is one important point to note when interpreting the results for the state of Minnesota. Traditionally, economic impact studies attempt to model impacts resulting only from new investments or spending that is new to a region. In this case, the state dollars that the NRRRI receives (roughly 35% of their annual budget) are

not new because that money would likely be spent elsewhere within the state if the NRRRI did not exist. However, in this situation it is very difficult to isolate only new spending, as the NRRRI leverages state dollars to secure an even larger share from federal and industry sources, which would be considered new spending. Therefore, for the purpose of this analysis, all spending was included, regardless of funding source.

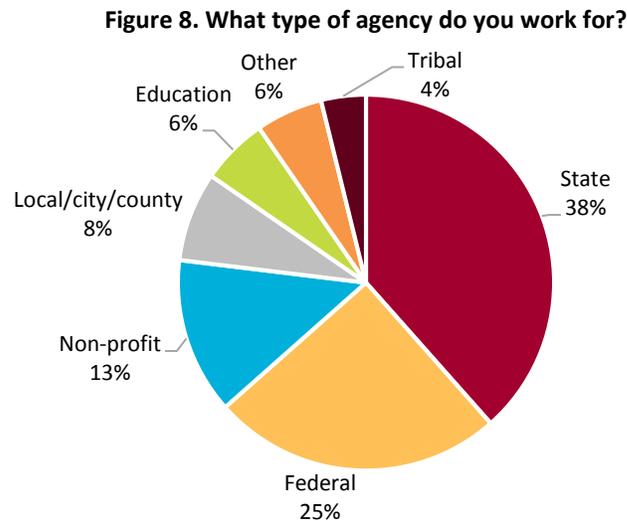
### III. Other Impacts

To complement the results of the economic impact modeling, this chapter presents some of the other impacts that the NRRRI has on the region and the state, using information collected through client surveys and notable research outcomes.

Client survey results include responses from 107 business and agency representatives who completed the NRRRI surveys in September 2016. Two surveys were distributed with questions about the types of services the NRRRI provided, whether projects resulted in additional jobs or cost savings, and general measures of satisfaction. Whenever possible, similar questions were asked of both agency and business representatives to allow for comparison. However, due to the nature of the work done, some agency questions were not appropriate for businesses and vice versa. In total, 52 of 86 agency representatives (60% response rate) and 55 of 122 business representatives (45% response rate) completed the surveys.

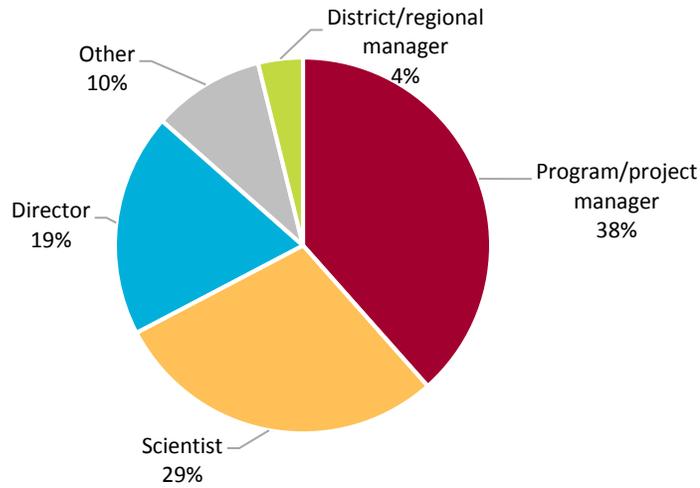
#### Agency Survey Results

NRRRI staff identified 86 agency representatives with whom they had partnered in the past year. Agency partners were first contacted by NRRRI staff familiar with the project to alert them that a survey would be forthcoming. The survey link was distributed in early September, along with several follow-up reminders. In total, 52 respondents provided feedback. Of the 52 respondents, 38% worked for a state agency, 25% for federal, and 13% for a non-profit organization, as shown in Figure 8.



SOURCE: BBER AGENCY SURVEY

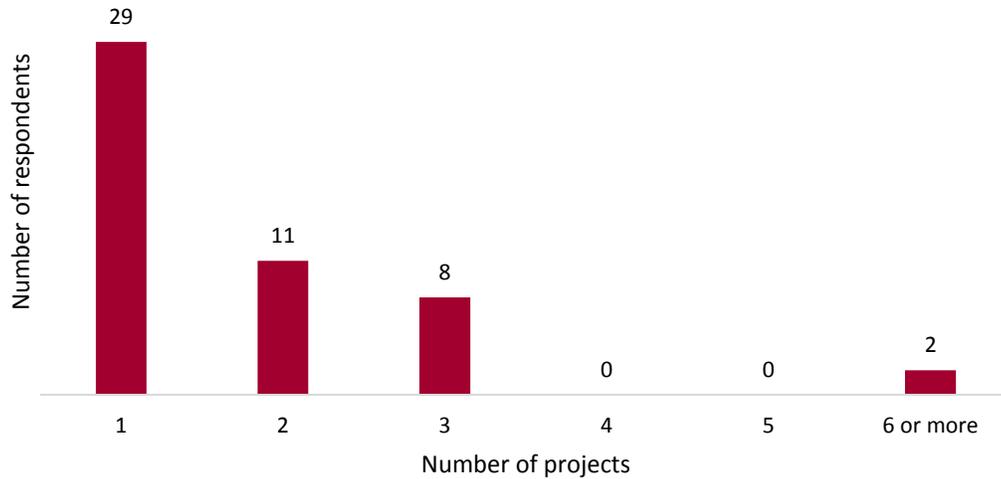
**Figure 9. What is your primary role at this agency?**



SOURCE: BBER AGENCY SURVEY

Respondents were asked to indicate their role within the agency (see Figure 9). Of those that responded, 38% identified as a program or project manager, followed by scientist (29%), and director (19%). About 10% of respondents indicated some other role. Of those, responses included bridge inspector, federal aid coordinator, vice president, and volunteer.

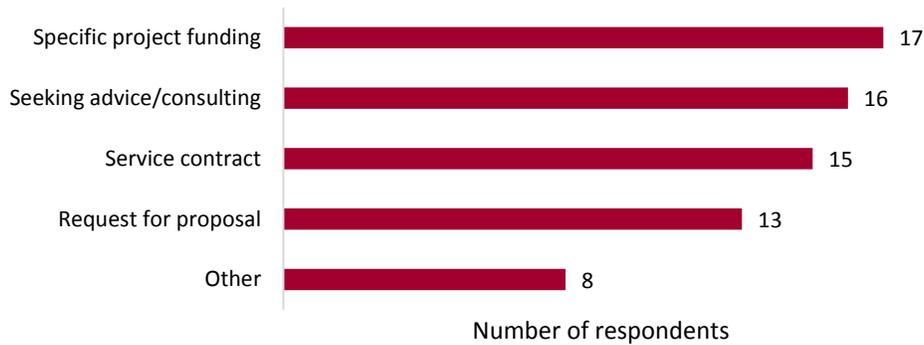
**Figure 10. In the past year, on how many projects have you partnered with the NRRI?**



SOURCE: BBER AGENCY SURVEY

The majority of respondents (n=29) indicated that they had partnered on only one project with the NRRI during fiscal year 2016, as shown in Figure 10. However, if all the responses are combined, it is estimated that the 52 agency partners' responses represent more than 87 projects in total for the twelve-month period.

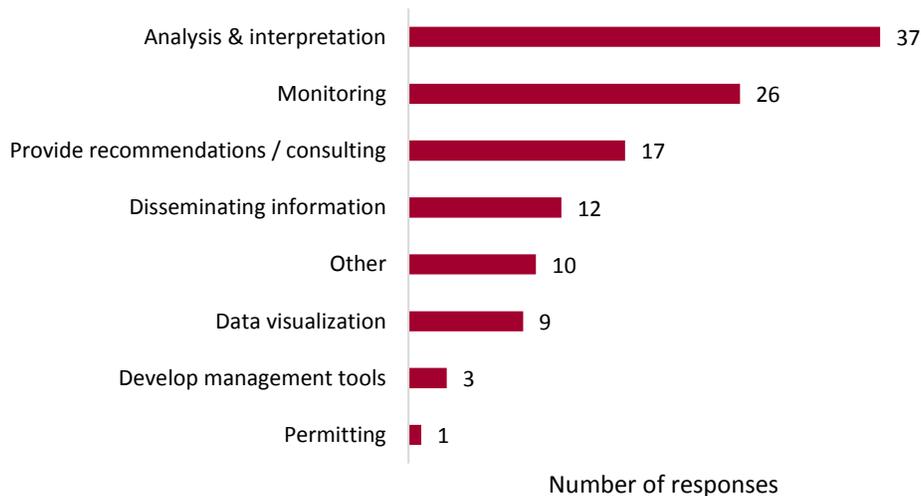
**Figure 11. How did your agency connect with the NRRI?**



SOURCE: BBER AGENCY SURVEY

The survey asked respondents to indicate how they initially connected with the NRRI. Most respondents (n=17) mentioned specific project funding as the way in which they initially connected with the NRRI, as shown in Figure 11. Other common responses included seeking advice and consulting (n=16), a service contract (n=15), and request for proposal (n=13). Eight respondents mentioned some other method. Of those, specific responses included “community collaboration,” “sole source because of expertise and familiarity of the region,” and “working with them for decades.”

**Figure 12. What services did NRRI provide to your agency?**



SOURCE: BBER AGENCY SURVEY

Figure 12 shows agency partner responses to the question, “What services did the NRRI provide to your agency?” Most commonly, agency partners used the NRRI for analysis and interpretation, with 37 respondents indicating that the NRRI had provided that service. Monitoring (n=26) and recommendations/consulting (n=17) were the next most common responses. Of those that indicated some other service, comments mentioned data collection, lab analysis of water samples, population assessment, and project coordination, among other things.

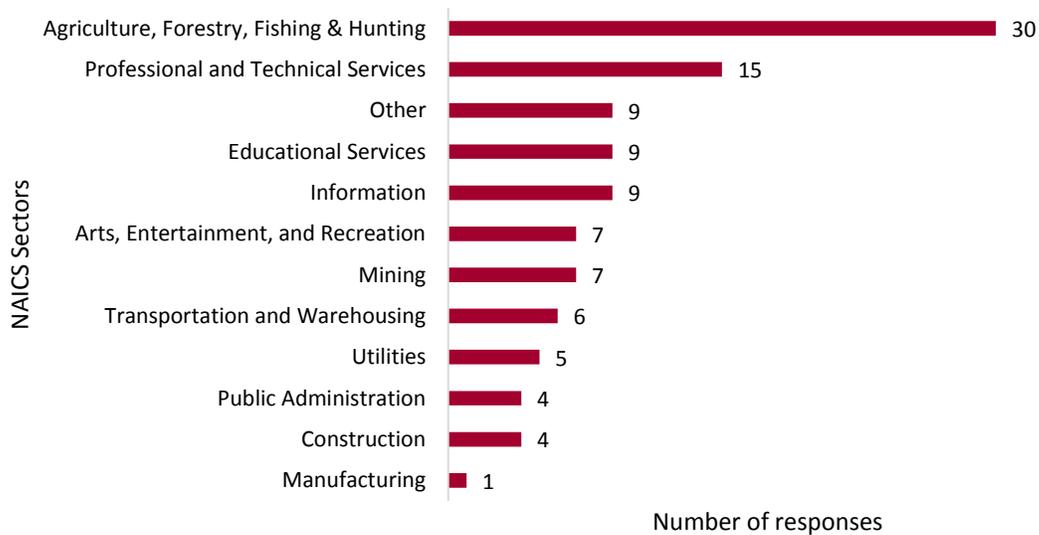
**Table 5. Please rank the following NRRI attributes in order of their importance to you and your agency**

| <i>Attribute</i>                             | <i>% of respondents that ranked attribute in top 3</i> |
|--|--|
| Familiarity with region                      | 81%  |
| Collaborative                                | 69%  |
| Decades of experience                        | 65%  |
| Multi-disciplinary                           | 43%  |
| Cost efficiencies                            | 16%  |
| Timing/availability (need work done quickly) | 16%  |
| Other, please describe                       | 8%   |

SOURCE: BBER AGENCY SURVEY

Respondents were given a selection of NRRI attributes to rank in order of their importance to their agency (see Table 5). The most popular attribute cited was the NRRI’s familiarity with the region. More than 80% of respondents ranked that item in their top three most important NRRI attributes. The NRRI’s collaborative nature (69% ranked that attribute in the top 3) and decades of experience (65%) were also ranked highly among respondents. Of those that mentioned some other attribute, specific/technical expertise was the most common response.

**Figure 13. What industry/business segment(s) benefited from the work NRRI did for your agency?**

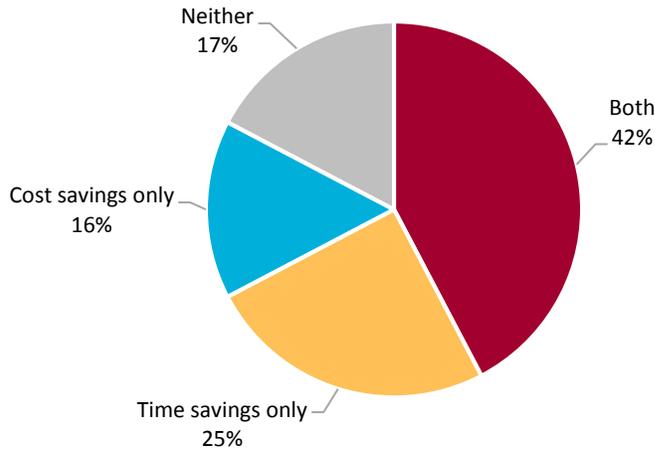


SOURCE: BBER AGENCY SURVEY

All agency partners were asked to indicate which North American Industry Classification System (NAICS) industry or business segment benefited from the work done by the NRRI, as shown in Figure 13. The most common response was Agriculture, Forestry, Fishing & Hunting (n=30), followed by Professional and Technical Services (n=15).<sup>4</sup>

<sup>4</sup> This question proved difficult for some agency representatives to answer. Most surveyed agencies would likely

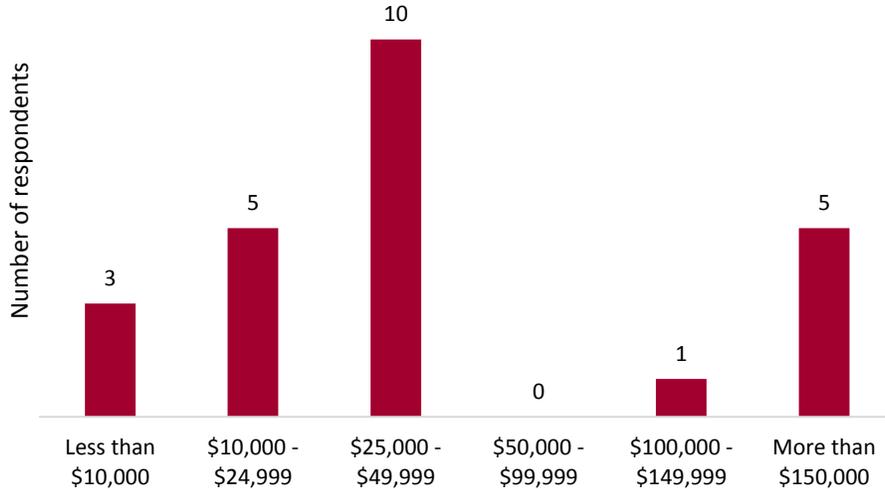
**Figure 14. Generally, can the work done by the NRRI be reflected in time and/or cost savings?**



SOURCE: BBER AGENCY SURVEY

Of the survey respondents, more than 40% felt that the work done by the NRRI could be reflected in both cost and time savings for their agency, as shown in Figure 14. One-quarter of respondents (25%) cited time savings only and 16% cited cost savings only. Roughly one in five respondents (17%) indicated that their partnership with the NRRI could not be quantified in terms of time or cost savings.

**Figure 15. Please estimate the cost savings that can be attributed to your partnership(s) with the NRRI**



SOURCE: BBER AGENCY SURVEY

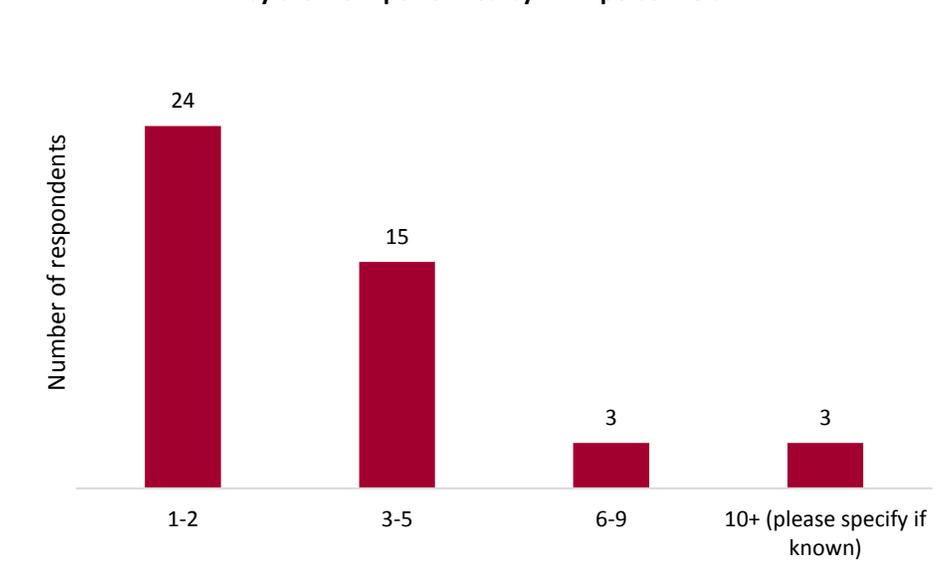
fall within the government sector, which was not included in the list of options. Moreover, many of the agency's projects provide benefits such as water quality and environmental safety, which aren't easily classified in terms of business or industry sectors.

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Agency partners who indicated some amount of cost savings in the previous question (n=30) were then asked to estimate the amount of savings that could be attributed to the partnership with the NRRI (see Figure 15, previous page). Most estimated a savings of between \$25,000 and \$49,999. However, five respondents estimated savings to their agency of more than \$150,000. Using the range given in these responses, it is estimated that the NRRI organization saved agencies between \$1.1 and \$1.5 million over the past year. And this estimate only includes those who responded to the survey, about 60% of the NRRI’s agency partners from fiscal year 2016. The average agency partner is estimated to have saved between roughly \$22,000 and \$30,000 as a result of partnering with the NRRI.<sup>5</sup>

Agency representatives who indicated that their partnership with the NRRI had resulted in time savings were asked to estimate, in months, the amount of savings that could be attributed to the partnership. Specifically, respondents were asked to consider the length of the project completed by the NRRI as compared with the estimated length it would have taken their agency to complete with in-house employees or by hiring additional employees. Those that responded (n=28) estimated an average time savings of 5.6 months. About half (n=15) estimated a savings of fewer than six months and about 40% estimated the time saved at between 6 and 12 months. One respondent noted that the project would have probably taken an additional one to two years had they done it internally.

**Figure 16. Overall, how many agency programs or policies, by your estimate, have been impacted by the work performed by NRRI personnel?**



SOURCE: BBER AGENCY SURVEY

Agency partners were asked to estimate the number of programs or policies that had been impacted by the work of the NRRI (see Figure 16). Most indicated that between one and two programs or policies had been directly impacted by the NRRI’s work. However, a small but significant number estimated that six or more policies or programs had been impacted directly by the work of the NRRI. Using the range of estimates given,

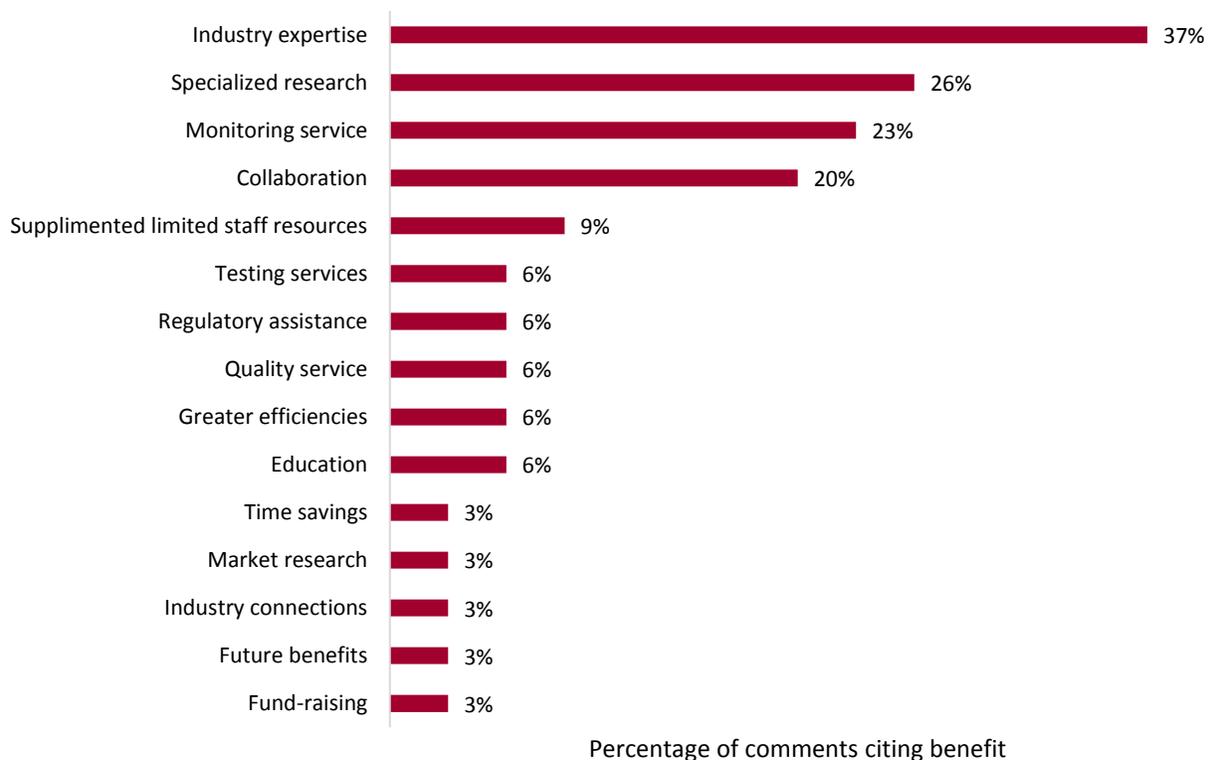
<sup>5</sup> The range of savings was determined by multiplying the number of respondents in each category by the low and high ranges for each response. Average savings was determined by dividing the total by the number of survey respondents (n=52), including those who indicated no savings.

it can be assumed that between 117 and 180 agency programs or policies have been impacted by the work performed by NRRI personnel.

Respondents were asked, “Would you recommend NRRI’s services to colleagues?” Of those that responded, 98% answered yes. Only one respondent indicated that he/she would not recommend the organization, citing concerns about the work quality and some of the scientists' reliability. In response, the NRRI stated, “NRRI is in a transition phase in many areas of research. This feedback is appreciated as new talent is being onboarded, skillsets are expanded and additional training is underway. Facilities are also being upgraded to meet client expectations.”

Finally, surveyed agencies were asked to provide examples of how the NRRI has benefitted their agency. Of the 35 open ended responses, seven included specific results or outcomes from working with the NRRI; these comments can be seen in the “Notable Examples” section on page 25. The remaining comments were categorized according to the nature of their content. The most common types of benefits cited included industry expertise (biomass, environmental, mining, water resource, etc.), specialized research, monitoring service, and collaboration. The full list of benefits and the percentage of comments citing each can be seen in Figure 17. Keep in mind that benefits listed are not mutually exclusive. Several comments cited multiple benefits and all are shown in the figure below.

**Figure 17. Agency Benefits Received by Percentage of Respondents**



SOURCE: BBER AGENCY SURVEY, BBER ANALYSIS

One survey respondent noted, “The scientists at NRRI are respected in the community... their expertise and connections have been very helpful.” Another said, “I look to NRRI to provide high quality, state-of-the-art expertise in various topics areas.” Other representative comments from the question included: “NRRI

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provides us with consistent, high quality laboratory analyses;” “With NRRI's assistance, we are able to collect data we would otherwise not be able to collect;” “Innovative analysis and recommendations;” and “Extensive knowledge and professionalism; consistency.”

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*“NRRI provides a deep and wide reservoir of talented professionals in resource management and research.”*

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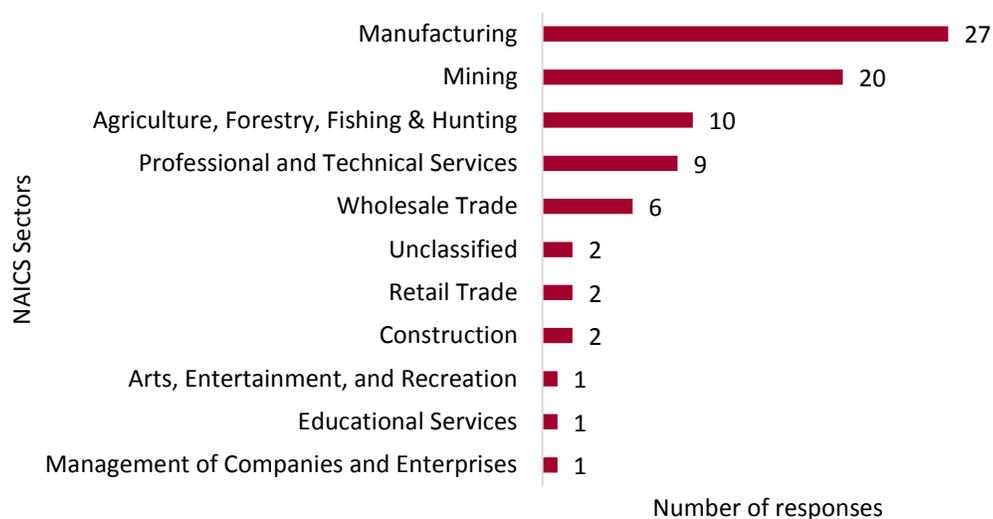
Survey respondent open-ended comment

Clearly, the various agencies the NRRI has worked with in the past have come away with a very positive impression of the NRRI as well as its scientists and staff. In general, respondents’ comments indicated a high level of satisfaction with NRRI’s expertise, local connections, knowledge, analysis, and professionalism.

### **Business Survey Results**

NRRI additionally identified 122 business representatives whom they partnered with in the last year. Similar to the agency survey, business partners were informed in advance by NRRI staff familiar with the project to expect an email survey. The survey link was distributed in early September, along with several follow-up reminders. In all, 56 business partners responded to the survey.

**Figure 18. In which industry segment is your business classified?**

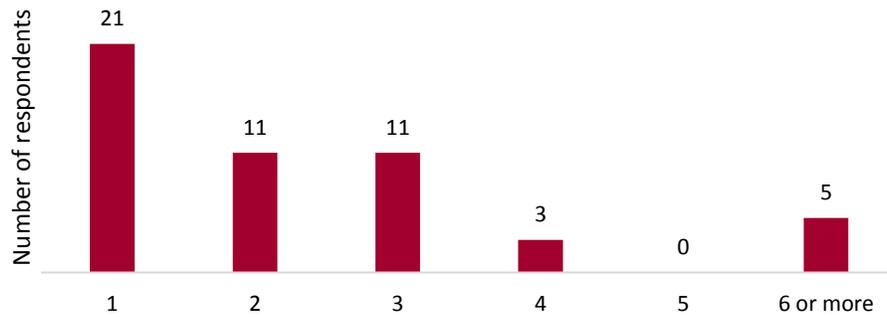


SOURCE: BBER BUSINESS SURVEY

All business partners were asked to indicate in which NAICS industry segment their business was classified. Of the 56 business respondents that provided feedback for the survey, 27 described themselves as operating in the Manufacturing sector, and 20 described themselves as operating in the Mining sector, as shown in Figure 18. These industry classifications were not mutually exclusive, so respondents had the option of selecting multiple industries in which their company operated. The largest industries after mining include Agriculture, Forestry, Fishing & Hunting (n=10), Professional and Technical Services (n=9), and Wholesale Trade (n=6). In addition, the majority of businesses surveyed (64%) indicated that they had more than one location.

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**Figure 19. In the past year, on how many projects have you partnered with the NRRI?**



SOURCE: BBER BUSINESS SURVEY

The majority of respondents (n=21) indicated that they had partnered with the NRRI on only one project in the past year, as shown in Figure 19. However, if all the responses are combined, it is estimated that the 56 business partners’ responses represent more than 118 projects in total.<sup>6</sup>

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*Results suggest that respondents from both surveys represent partnerships from more than 200 projects.*

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**Figure 20. What services did NRRI provide to your business?**



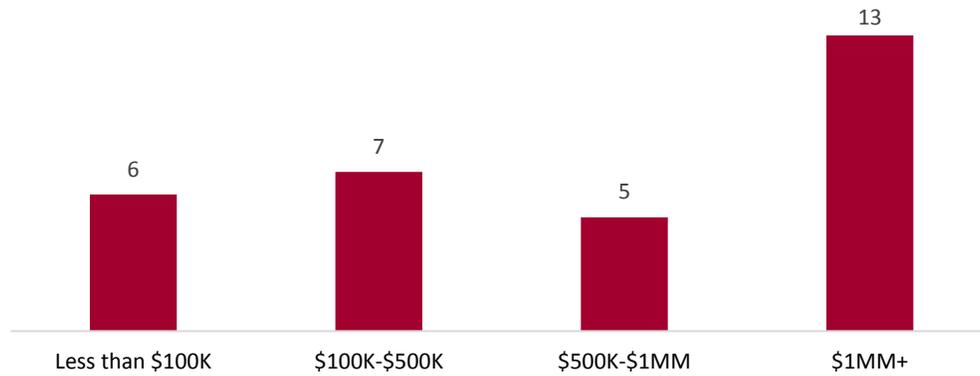
SOURCE: BBER BUSINESS SURVEY

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<sup>6</sup> In fiscal year 2016, the NRRI had 136 active projects/grants and 72 active external sales agreements, for a total of 208 active projects. Based on their combined responses, survey participants indicated partnerships on more than 200 projects in the past year. This would suggest that, despite the survey question asking specifically about project partnerships within the past year, many respondents may have included projects from previous years or may have overestimated the number of project partnerships with the NRRI.

When asked what services the NRRI provided their business, a majority of respondents said product testing or product development (n=43), as shown in Figure 20 (previous page). Other notable services that the NRRI provided businesses in 2015 were byproduct materials consulting (n=12), materials sourcing (n=8), and business consulting (n=4). Some explanations given by respondents who chose some other option (n=9) included 3D printing, material and specimen testing, and minerals research and techniques.

**Figure 21. Please estimate your business's annual revenue**

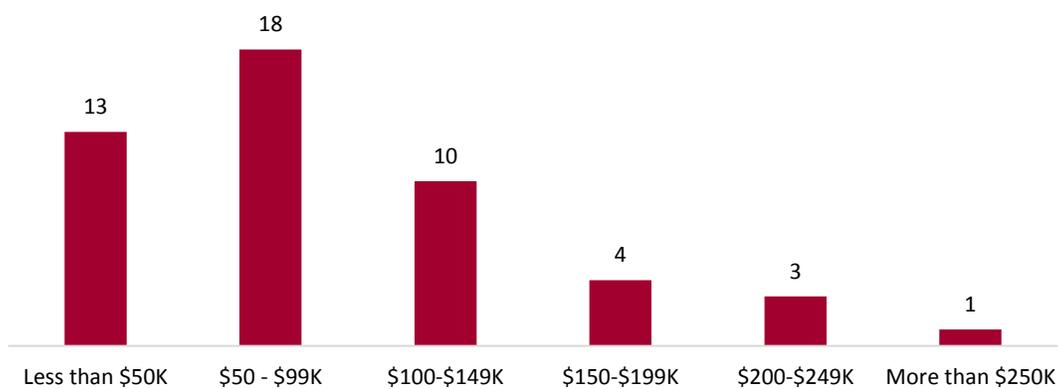


SOURCE: BBER BUSINESS SURVEY

Businesses were asked to estimate their annual revenue, using a range of options (see Figure 21). Of those that chose to respond to the question, the most common answer given was an annual revenue greater than \$1 million (n=13). The remaining business respondents (n=18) claimed their company made \$1 million or less in the past year. If respondents indicated an annual revenue of more than \$1 million, they were then asked to report the actual amount. Responses given ranged from \$2 million to \$10 billion.

A related question asked business representatives to indicate the number of full and part-time employees at their business. Answers ranged from 0 to 500 full-time employees, with a mean response of 42 and 0 to 150 part-time employees, with a mean response of 5. The wide range of responses in both the revenue and employee questions highlight the diversity of companies with which the NRRI partners. The organization works with companies that have only a handful of part-time employees and revenue of less than \$100,000 as well as those with hundreds of employees and billions of dollars in revenue.

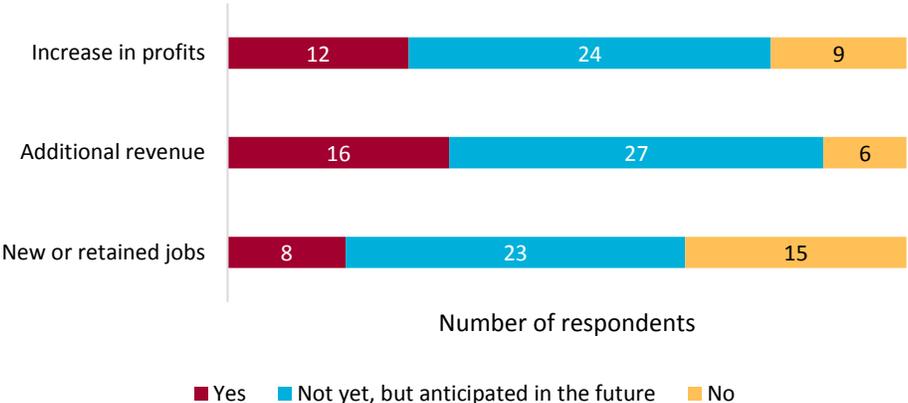
**Figure 22. If you had to hire employees with NRRI's level of expertise to do the work in-house, what might that cost?**



SOURCE: BBER BUSINESS SURVEY

Next, businesses were asked to estimate the amount it might cost their business to hire employees with the NRRI’s level of expertise to work in-house (see Figure 22, previous page). The most common response was between \$50,000 and \$99,999. One respondent estimated that the cost would total more than \$250,000. Using the range given in these responses, it is estimated that, if businesses were to do the same work internally, the combined cost to their organizations would have ranged between \$3.4 and \$5.7 million over the past year. And this estimate only includes those who responded to the survey, about 46% of the NRRI’s business clients from fiscal year 2016. The average business partner is estimated to have saved between \$60,000 and \$100,000 in internal hiring costs as a result of partnering with the NRRI.<sup>7</sup>

**Figure 23. Did the assistance provided by the NRRI result in any of the following?**

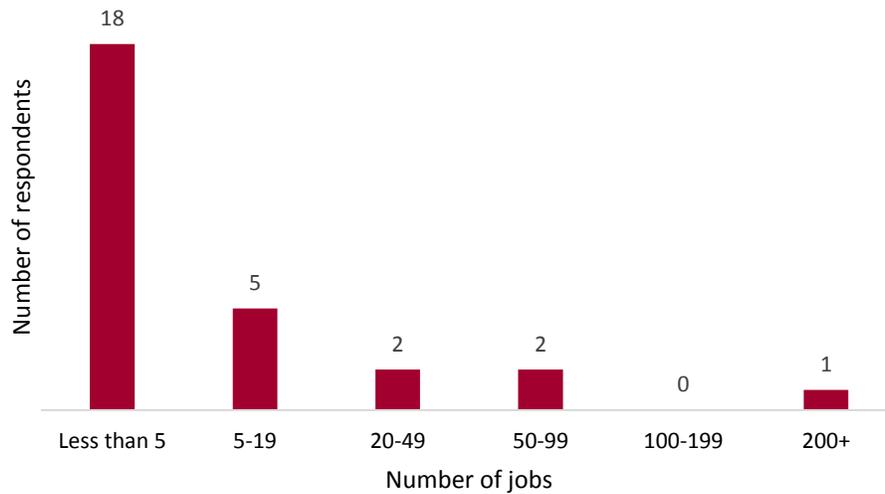


SOURCE: BBER BUSINESS SURVEY

All business respondents were asked if the assistance provided by the NRRI resulted in new or retained jobs, additional revenue, or an increase in profits, as shown in Figure 23. For each of the three questions, the most common response was “not yet,” with more than half of all respondents indicating that they anticipated increased profits, revenue, and jobs in the future but had not yet seen those benefits. However, more businesses had seen an increase in revenue (n=16) than had not (n=6). The same was true for profits. Additionally, only eight businesses indicated that they had added jobs as a result of their partnership with the NRRI, while 15 businesses had not.

<sup>7</sup> The range of savings was determined by multiplying the number of respondents in each category by the low and high ranges for each response. Average savings was determined by dividing the total savings by the number of survey respondents (n=56).

**Figure 24. Please estimate the total number of new or retained jobs**



*SOURCE: BBER BUSINESS SURVEY*

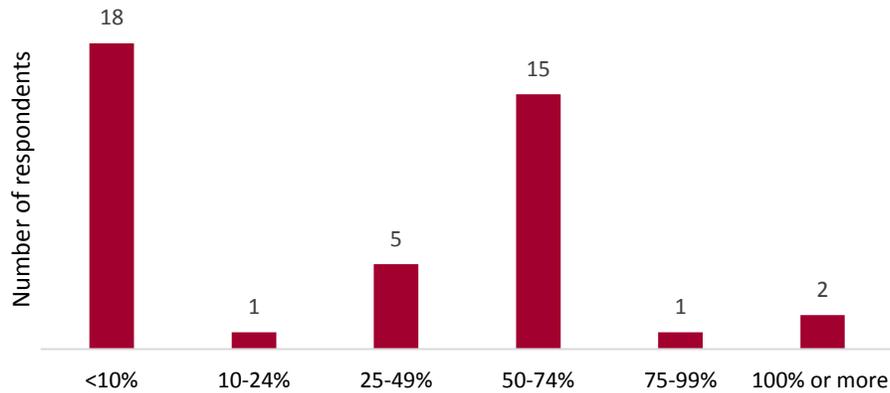
Figure 24 above shows the total number of new or retained jobs that businesses attributed to the assistance of the NRRI. Any business that indicated they had seen new or retained jobs as a result of their partnership with NRRI or anticipated them in the future were given the chance to respond (n=31). Of these, nearly 60% (n=18) indicated that number of new jobs was less than 5. On the other end of the spectrum, one respondent claimed that more than 200 jobs were attributable to the assistance of the NRRI.

Using the range given in these responses, it is estimated that the assistance provided by the NRRI has resulted in at least 365 new or retained jobs among surveyed businesses, and perhaps as many as 650. The average business respondent estimated between 7 and 12 new or retained jobs as a result of his/her partnership with the NRRI.<sup>8</sup>

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<sup>8</sup> The range of jobs was determined by multiplying the number of respondents in each category by the low and high ranges for each response. Average jobs was determined by dividing the total by the number of survey respondents (n=56), including those who indicated no new or retained jobs.

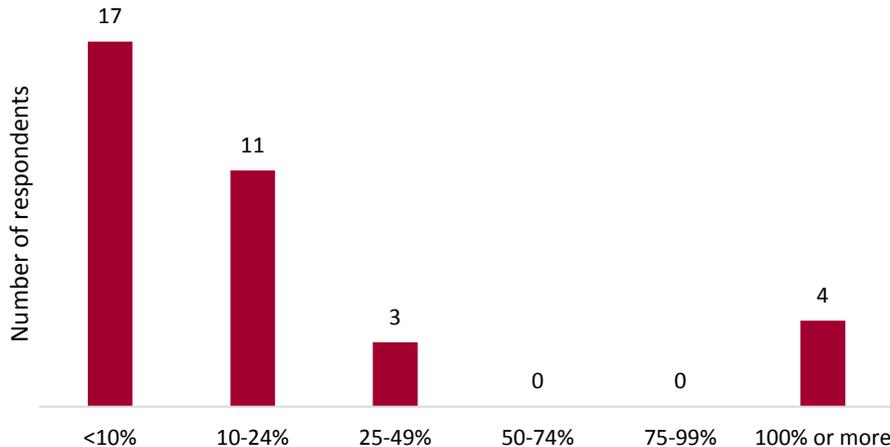
**Figure 25. Please estimate the percentage increase in revenue**



SOURCE: BBER BUSINESS SURVEY

Figure 25 shows the estimated percentage increase in revenue that companies attributed to the assistance of the NRRI. In total, 42 companies said that the NRRI helped increase revenue or that they expected an increase in revenue in the future. Of that number, almost 44% (n=18) indicated that the percentage of the increase in revenue was less than 10%. The next most frequent response was that the NRRI increased annual revenue by 50-74% (n=15). Two respondents estimated that the NRRI increased business revenue by 100% or more.

**Figure 26. Please estimate the percentage increase in profit**



SOURCE: BBER BUSINESS SURVEY

Figure 26 shows the estimated percentage increase in profit that companies attributed to the assistance of the NRRI. About half (n=17) of the 35 respondents that indicated the NRRI helped raise profits reported that the increase was less than 10%. The next highly reported increase was of 10-24% (n=11). Four respondents said that the NRRI increased business profits by 100% or more.

**Table 6. Please rank the following NRRI attributes in order of their importance to you and your business**

| <i>Attribute</i>                             | <i>% of respondents that ranked attribute in top 3</i> |
|--|--|
| Collaborative                                | 75%  |
| Decades of experience                        | 54%  |
| Timing/availability (Need work done quickly) | 50%  |
| Familiarity with region                      | 44%  |
| Cost efficiencies                            | 42%  |
| Multi-disciplinary                           | 29%  |
| Other, please describe                       | 6%   |

*SOURCE: BBER BUSINESS SURVEY*

Respondents were given a selection of NRRI attributes to rank in order of their importance to their business (see Table 6). The most popular attribute cited was the NRRI’s collaborative nature, with 75% of respondents ranking that item in their top three most important NRRI attributes. The NRRI’s experience (54% ranked attribute in top 3) and availability (50%) were also ranked highly among respondents. Of those that mentioned some other attribute, good facilities, specialized capabilities, and strong product knowledge were the most common responses.

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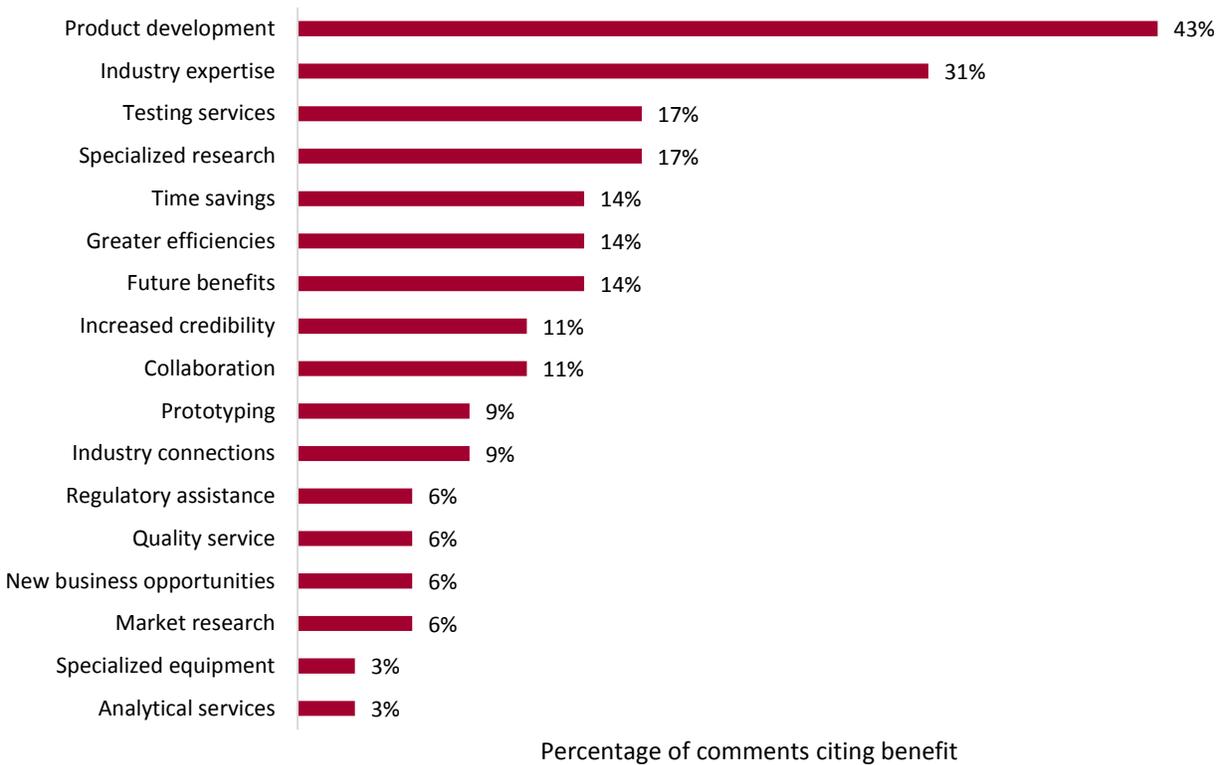
*Businesses are more likely to value the NRRI’s experience and timing/availability, while agency partners are more likely to work with the NRRI because of its familiarity with the region and multi-disciplinary team. Both groups rated the NRRI’s collaborative nature among their top three attributes.*

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According to survey results, the overwhelming majority of business respondents said that they would use the NRRI again in future projects. Only one of the 53 business respondents said that he/she would rather not use the NRRI again, stating that the NRRI has lost its expertise over time. Clearly, the NRRI is viewed as valued asset by most business partners. In response, the NRRI stated, “NRRI needs to proactively evolve with market needs in mind, anticipating skillsets ahead of the curve. The institute will continue to upgrade personnel and training in response to client needs, and based on project activity.”

Surveyed businesses were also asked to provide examples of how the NRRI has benefitted their business. Of the 35 open ended responses to the business survey, six included specific results or outcomes from working with the NRRI; these comments can be seen in the “Notable Examples” section on page 25. The remaining comments were categorized according to the nature of their content. The most common type of benefit cited by business representatives was product development, with 43% of business comments mentioning this as a benefit of their partnership with the NRRI. Other cited benefits included various kinds of industry expertise (mining, minerals, natural resource, wood, etc.), testing services, and specialized research. The complete list of categories can be seen in Figure 27 below. As previously mentioned, benefits listed are not mutually exclusive. Several comments cited multiple benefits and all are shown in the figure below.

**Figure 27. Business Benefits Received by Percentage of Respondents**



SOURCE: BBER BUSINESS SURVEY, BBER ANALYSIS

*Benefits cited by businesses were more practical and applied in nature than those cited by agencies. Most notably, this difference can be seen in the product development category, with 43% of business respondents' comments indicating this benefit type compared to none among the agencies. Testing services, time savings, and greater efficiencies were also more often cited as benefits received by the businesses while agencies were more likely to mention monitoring service and collaboration. However, there is significant overlap between the two groups, specifically in industry expertise and specialized research with a high incidence among both business and agency comments.*

One business respondent noted, "NRRI has a wealth of experience that they are willing to share. They also have industry connections that can be most helpful. They are good to work with and want to help." Another said, "NRRI is helping us to develop new technologies and improve existing processes." Other representative comments from the question included: "Their expertise is a very valuable tool for any business in northeastern Minnesota;" "They have been pivotal in supplying deep insight through their extensive experience;" "Working with the NRRI team has helped us to get quick market insights to specific product development concepts and introduction to potential partners and customers;" and "(NRRI) has been very helpful and attentive to our needs."

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This survey commentary suggests the various businesses the NRRI has worked with in the past have really felt a benefit from the NRRI and value the experience of working with them. In general, respondents' comments indicated a high level of satisfaction with NRRI's extensive research, innovation, product development and prototyping, and consulting.

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*“Staff are very knowledgeable, have many valuable contacts,  
and provide valuable research.”*

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Survey respondent open-ended comment

In both surveys, respondents were asked to add any additional comments that might assist the NRRI in providing quality service. Many of those comments were positive and reinforced the positive feedback that had already been provided. However, some respondents did have constructive criticism for the organization. All comments were aggregated and shared with the NRRI for the purpose of improving the NRRI's interactions with business and agency partners.

### ***Notable Examples***

Finally, some notable examples from the surveys are included here to highlight the impacts that the NRRI has made beyond the standard economic impacts, jobs created, and dollars saved. Survey respondents were asked to provide specific examples of benefits to their organizations as a result of their partnership with the NRRI. The following are just a sample of the responses received:

“As a leader in sound science and a strong reputation for finding solutions, NRRI has helped to save millions of dollars from being spent for things that are not necessary for success in the St. Louis River Area of Concern (AOC). They have helped other organizations spend funds and research efforts to meet the goals of Beneficial Use Impairment removals and delisting the AOC in the year 2025.”

“We are not able to hire enough staff to fulfill our work requirements. We are however, able to contract with institutes such as NRRI. With NRRI's assistance, we are able to collect data we would otherwise not be able to collect.”

“The scientists at NRRI are respected in the community. So, their expertise and connections have been very helpful in trying to protect and restore streams in urban Duluth.”

“Projects led to the use of scientific data to help make targets and design goals for habitat restoration. Projects led to providing shared information about a state program with many partners available to the public in a collaborative website.”

“The specific testing that was performed freed up our customer from doing the testing [and] saved us time in completing the testing phase of a new material/species approval process. We are expecting additional business for the start of 2017.”

“We were able to conduct lab testing to qualify our products for a prospective customer and provide a formal lab report helping us with a more professional proposal, leading to new business.”

“Working with [the] NRRI team has helped us to get quick market insights to specific product development concepts and introduction to potential partners and customers. [The] NRRI team is also a good sounding board for ideas, and they have been able to perform quick and very hands-on trials, which is what is needed in early stage development. The team also has a strong contact base and long experience in N. America, which is valuable to save time and reduce risk of going over old things.”

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“We have a long-term water quality monitoring program. NRRI provides us with consistent, high quality laboratory analyses. We use the data sets to inform management. These data are also used to assess effects of rules governing dam operation and are used by partner agencies to assess lakes for nutrient impairment.”

“Quick turn around on rapid prototyping tools helped speed up our manufacturing team.”

“I look to NRRI to provide high quality, state-of-the-art expertise, in various topics areas related to water resource protection and management. There are times when the state agency I work for needs to provide the best science available to determine where to set a regulatory standard, how to design an effective policy initiative, or if environmental conditions are changing. In those types of situations, NRRI has often been able to provide the high quality scientific expertise required.”

“They have been pivotal in supplying deep insight through their extensive experience in the minerals division. Whenever we have an issue, they can work quickly to get to the bottom of the scientific problem in question.”

“[The NRRI] allows our Great Lakes wetland monitoring program to operate efficiently at a basin-wide scale. NRRI scientists are the experts in their region, and we rely on that expertise as well as the logistical efficiencies of having NRRI located on western Lake Superior.”

“These projects involve 3D printing and new product development that we would not have been able to afford otherwise and that we did not have the expertise to execute.”

“[The NRRI] provided critical data and analysis to inform our water quality monitoring and assessment program and led to development and validation of water quality criteria.”

NOTE - Readers are also encouraged to remember the UMD Labovitz School’s BBER was asked to supply an economic impact analysis only. Any subsequent policy recommendations should be based on the “big picture” of total impact.

## **Appendix A: Definitions Used in this Report**

**Direct Effect:** Initial new spending in the study area resulting from the project.

**Employment:** Estimates (from U.S. Department of Commerce secondary data) are in terms of jobs, not in terms of full-time equivalent employees. Therefore, these jobs may be temporary, part-time, or short-term.

**Gross Output:** The value of local production required to sustain activities.

**Indirect Effect:** The additional inter-industry spending from the direct impact.

**Induced Effect:** The impact of additional household expenditures resulting from the direct and indirect impact.

**Labor Income:** All forms of employment income, including employee compensation (wages and benefits) and proprietor income.

**Value Added:** A measure of the impacting industry's contribution to the local community; it includes wages, rents, interest, and profits.

*SOURCE: IMPLAN*

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## APPENDIX B: IMPLAN Assumptions

The following are suggested assumptions for accepting the impact model:<sup>9</sup>

**Backward-Linkages:** IMPLAN is a backward-linkage model, meaning that it measures the increased demand on industries that produce intermediate inputs as a result of increases in production. However, if an industry increases production, there will also be an increased supply of output for other industries to use in their production. Models that measure this type of relationship are called forward-linkage models. To highlight this concept, consider the example of a new sawmill beginning its operations in a state. The increased production as a result of the sawmill's operations will increase the demand for lumber, creating an increase in activity in the logging industry, as well as other supporting industries such as electric transmission and distribution. IMPLAN's results will include those impacts, but will exclude effects on any wood product manufacturers located nearby that might be impacted by the newly available supply of lumber.

**Fixed Production Patterns:** Input-output (I-O) models assume inputs are used in fixed proportion, without any substitution of inputs, across a wide range of production levels. This assumption assumes that an industry must double its inputs (including both purchases and employment) to double its output. In many instances, an industry will increase output by offering overtime, improving productivity, or improvements in technology.

**Industry Homogeneity:** I-O models typically assume that all firms within an industry have similar production processes. Any industries that fall outside the typical spending pattern for an industry should be adjusted using IMPLAN's Analysis-by-Parts technique.

**Fixed Prices and No Supply Constraints:** IMPLAN is a fixed-price model. This means that the modeling software assumes no price adjustment in response to supply constraints or other factors. In other words, the model assumes that firms can increase their production as needed and are not limited by availability of labor or inputs and that firms in the local economy are not operating at full capacity.

**Employment:** IMPLAN input-output is a production-based model, and employment numbers (from U.S. Department of Commerce secondary data) treat both full- and part-time individuals as being employed.

**Leakages:** A small area can have a high level of leakage. Leakages are any payments made to imports or value added sectors, which do not in turn re-spend the dollars within the region. What's more, a study area that is actually part of a larger functional economic region will likely miss some important linkages. For example, workers who live and spend outside the study area may actually hold local jobs.

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<sup>9</sup> Bureau of Economic Analysis [https://www.bea.gov/papers/pdf/WP\\_IOMIA\\_RIMSII\\_020612.pdf](https://www.bea.gov/papers/pdf/WP_IOMIA_RIMSII_020612.pdf)

## APPENDIX C: Detailed Inputs

The following charts and tables provide additional detail on the inputs used in modeling the NRRI's economic impact.

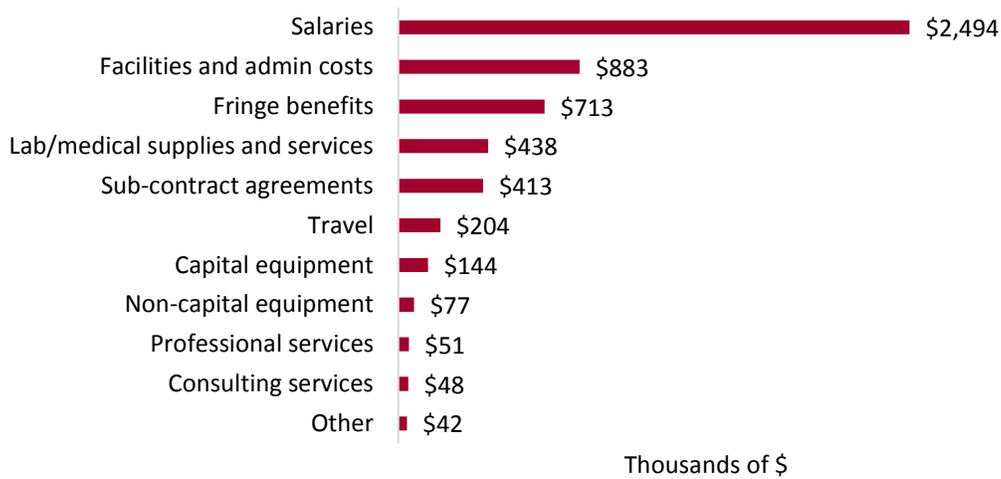
**Table 7. Breakdown of NRRI Non-Sponsored Expenditures, FY2014-2016**

|  | <i>Actuals 2014</i> | <i>Actuals 2015</i> | <i>Year To Date Actuals 2016</i> |
|--|---------------------|---------------------|----------------------------------|
| Salaries                                 | \$5,621,968         | \$6,005,866         | \$5,926,048                      |
| Fringe Benefits                          | \$1,878,400         | \$1,816,127         | \$1,829,832                      |
| Student Aid                              | \$0                 | \$500               | \$1,000                          |
| Consultant/Purchased Person              | \$118,740           | \$117,200           | \$128,481                        |
| Supplies, Serv. & Misc. Exp.             | \$1,712,477         | \$2,014,023         | \$1,791,180                      |
| Materials for Resale                     | \$0                 | \$0                 | \$0                              |
| Capital Equipment (FY14 forward)         | \$841,667           | \$566,971           | \$392,411                        |
| Equip (thru FY13) & Other Capital Assets | \$29,286            | \$29,154            | \$32,660                         |
| Non-Capital Equipment < \$5,000 (FY14 +) | \$113,095           | \$116,280           | \$151,717                        |
| Rents & Leases                           | \$159,217           | \$99,789            | \$218,549                        |
| Repairs, Maintenance & Supplies          | \$151,721           | \$341,251           | \$155,293                        |
| Utilities                                | \$271,347           | \$220,674           | \$207,608                        |
| ICR/Subcontracts & Participants          | \$0                 | \$0                 | \$0                              |
| Enterprise Assessment                    | \$70,927            | \$80,010            | \$80,463                         |
| Budgeted Reserves                        | \$0                 | \$0                 | \$0                              |
| Recurring FY Compact Allocation          | \$0                 | \$0                 | \$0                              |
| <b>Total Operating Expenditures</b>      | <b>\$10,968,845</b> | <b>\$11,407,845</b> | <b>\$10,915,242</b>              |

SOURCE: UMN FINANCE DEPARTMENT

Table 7 shows the breakdown of the NRRI's non-sponsored expenditures for the fiscal years 2014 through 2016. The year-to-date actuals for the year 2016 (highlighted in the table) were used in modeling the organization's economic impact.

**Figure 28. Breakdown of NRR I Sponsored Expenses, FY2016**



*SOURCE: NRR I*

Figure 28 above shows a breakdown of the NRR I’s sponsored expenses. Salaries represent the bulk of these expenses at over \$2.4 million, doubling the next highest expense, facilities and admin costs (\$883,000). This does not come as a surprise being that salaries for most organizations or companies comprise the greatest share of expenses. In fact, three of the largest expenses are payments made to either employees, sub-contractors, or student researchers (salaries, fringe benefits, and sub-contract agreements). Other significant sponsored expenditures include facilities and admin costs (\$883,000), Lab/medical supplies and services (\$438,000), Travel (\$204,000),<sup>10</sup> and capital equipment (\$144,000).

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<sup>10</sup> Travel expenses were allocated to the appropriate sectors using the General Services Administration’s standard per diem rates. Of the total, 64% was modeled in lodging, 33% in restaurants, and 3% in gasoline and convenience.