Highlights of Process/Outcome Data
FY 2014-2015
IUCRC Evaluation Project
July 2016

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North Carolina State University
Overview

• Response rate
• Industry Findings
• Faculty Findings
• Industry’s Economic Impact Findings
## Process/Outcome 2014-2015 Response Rates

<table>
<thead>
<tr>
<th>Category</th>
<th>Center Level</th>
<th>Individual Level</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Industry</td>
<td>Faculty</td>
</tr>
<tr>
<td><strong>Response Frequency</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Continuing Population from CD report</td>
<td>73</td>
<td>73</td>
</tr>
<tr>
<td>1st Year Reporting Population from CD report</td>
<td>+0</td>
<td>+0</td>
</tr>
<tr>
<td>Retired/Defunct Centers</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Retired/Defunct Centers Reporting(^{a})</td>
<td>+1</td>
<td>+1</td>
</tr>
<tr>
<td>Phase III Centers Exempt</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Phase III Centers Reporting(^{b})</td>
<td>+3</td>
<td>+2</td>
</tr>
<tr>
<td>Population (^{c})</td>
<td>68</td>
<td>67</td>
</tr>
<tr>
<td>Centers Excused from Evaluation(^{d})</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Centers that did not return data</td>
<td>3</td>
<td>7</td>
</tr>
<tr>
<td>Available Population(^{e})</td>
<td>62</td>
<td>57</td>
</tr>
<tr>
<td>Data Received</td>
<td>62</td>
<td>57</td>
</tr>
</tbody>
</table>

| Received / Population            | 91.18%       | 85.08%          | 39.23%   | 36.65%  |
| Received / Available Population  | 100%         | 100%            | 43.23%   | 40.85%  |
Industry Response Rate

0% 20% 40% 60% 80% 100%

05-06 06-07 07-08 08-09 09-10 10-11 11-12 12-13 13-14 14-15

Center Level Received/Available Population
Center Level Received/Population
Individual Level Received/Available Population
Individual Level Received/Population
Industry Questionnaire

Select Results
Q1a: What percentage of the Center’s currently funded research projects do you consider relevant to your organization’s current or future R&D needs?*

*Previous version of this question asked % of projects in which you take an active interest

Mean = 2.98 or 59.6% of projects

percentage values on y-axis represent midpoint of response range
Q2a: During the past year, how satisfied were you with the capabilities of the researchers and quality of the research program?
Q2b: During the past year, how satisfied were you with the Center’s breadth of research topics covered?

![Graph showing satisfaction ratings from 2005 to 2015. The ratings range from 1 (Not Satisfied) to 5 (Very Satisfied). The values range from 3.86 to 4.04.]

8/1/2016 IUCRC Evaluation Project at NCSU
Q2c: During the past year, how satisfied were you with the Center’s focus of the research?

Very Satisfied

Quite Satisfied

Somewhat Satisfied

Slightly Satisfied

Not Satisfied

05-06 06-07 07-08 08-09 09-10 10-11 11-12 12-12 13-14 14-15

0 1 1.5 2 2.5 3 3.5 4 4.5 5

3.81 3.93 3.8 3.85 3.89 3.88 3.86 3.88 3.91 3.90
Q2d: During the past year, how satisfied were you with relevance of the research to my organizations needs?

*Until 05-06 respondents were asked separately about relevance to short and long term needs. Means reported for those years are the average of the 2.
Q6a: During the past year, to what extent has participation in the Center contributed to the following benefits for your organization?

**Commercialization**

*Question modified to include new technical knowledge and intellectual property resources*

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IUCRC Evaluation Project at NCSU
Q4a: During the past year, to what extent has participation in the Center contributed to the following benefits for your organization?

Professional Networking

*Question changed from “Enhanced via improved ability to recruit students, increased cooperation with other industrial members and scientists outside my organization” (2007-2011) to “Enhanced via ability to network and build scientific capacity via cooperation with industry and university scientists ...” (2012) to “Enhanced cooperation and networking with industry and university scientists ...” (2013).
Q4b. Enhanced ability to identify and recruit well-qualified graduate students.

2015 Mean = 2.42 (0.68)
Q4b. Enhanced ability to identify and recruit well-qualified graduate students.

<table>
<thead>
<tr>
<th>Year</th>
<th>Impact Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>11-12</td>
<td>2.5</td>
</tr>
<tr>
<td>12-13</td>
<td>2.47</td>
</tr>
<tr>
<td>13-14</td>
<td>2.44</td>
</tr>
<tr>
<td>14-15</td>
<td>2.42</td>
</tr>
</tbody>
</table>

Mean low compared to other impacts
Q4c: During the past year, how many students trained in the Center projects were hired by respondent organization?

Average Students Hired by Member Firms
Q8. How can the Center improve its administration and operations? Please mark areas that need improvement.
Q7: During the past year, how satisfied were you with center administrative operations?

![Graph showing satisfaction levels from 2005-2015](image-url)

- Very Satisfied: 4.1 (05-06), 4.13 (06-07), 4.04 (07-08), 3.93 (08-09), 3.97 (09-10), 4.05 (10-11), 4.03 (11-12), 4.09 (12-13), 4.08 (13-14), 4.06 (14-15)
- Quite Satisfied: 4.05 (05-06), 4.03 (06-07), 4.04 (07-08), 3.97 (08-09), 3.97 (09-10), 4.05 (10-11), 4.03 (11-12), 4.09 (12-13), 4.08 (13-14), 4.06 (14-15)
- Somewhat Satisfied: 4.0 (05-06), 4.03 (06-07), 4.04 (07-08), 3.97 (08-09), 3.97 (09-10), 4.05 (10-11), 4.03 (11-12), 4.09 (12-13), 4.08 (13-14), 4.06 (14-15)
- Slightly Satisfied: 4.0 (05-06), 4.03 (06-07), 4.04 (07-08), 3.97 (08-09), 3.97 (09-10), 4.05 (10-11), 4.03 (11-12), 4.09 (12-13), 4.08 (13-14), 4.06 (14-15)
- Not Satisfied: 4.0 (05-06), 4.03 (06-07), 4.04 (07-08), 3.97 (08-09), 3.97 (09-10), 4.05 (10-11), 4.03 (11-12), 4.09 (12-13), 4.08 (13-14), 4.06 (14-15)
Q9: Will your organization renew its membership?*

*Response Categories include: Definitely Not (1), Probably Not (2), Uncertain (3), Probably Yes (4), Definitely Yes (5)
Research Economic Impact Metrics
Defining Research Efficiency Measures

Member Research

- Research Cost Avoidance
  - Project Activity
  - Project Activity
  - Project Activity
- Research Cost Savings
  - Project Activity
  - Project Activity
  - Project Activity
- Stimulated R&D (follow-on funding)
  - Future Project Activity
  - Future Project Activity
  - Future Project Activity
  - New Project Activity

Center Research

- Proposed Project
  - Project Activity
  - Project Results

See calculation formulas in “Extra Slides”

Frequency
Yes = 44%

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Estimating IUCRC-Wide Center-Stimulated Funding

• Program-wide center-stimulated funding reported for 14-15 is $62.02M
• There is a fundamental problem estimating both center and program-wide value of center stimulated projects
  • Response rate is running at ~40% of total population
• Our reported value is a VERY conservative estimate
  • Assumes none of the 50% non-responders invested in center stimulated projects
• Need to find a defensible approach to estimating
  • Non-responders
    • mean
    • 50% of mean
Estimating IUCRC-Wide Follow-on Funding in Millions

- Total Reported (N=438): $62.02
- Total Population Estimated (N=1147) Based on Mean (M=145,930): $167.38
- Total Population Estimated (N=1147) based on 50% Mean (72,965): $83.69

14-15 (in Millions of Dollars)

8/1/2016

IUCRC Evaluation Project at NCSU
IUCRC-Wide Follow-on Funding in Millions over last four completed FYs
## Research Cost Savings

### B. Research & Development Benefits

<table>
<thead>
<tr>
<th>Yes to Either / No to Both</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>%</td>
<td>N</td>
</tr>
<tr>
<td>5a. During the past year, access to Center research findings and outputs has helped accelerate the pace and/or completion of some R&amp;D projects already underway at the organization (N = 382)</td>
<td>239</td>
<td>53.3</td>
</tr>
<tr>
<td>5b. During the past year, access to Center research findings and outputs has helped the organization to decide against initiating a new project we otherwise would have conducted. (N = 384)</td>
<td>243</td>
<td>54.0</td>
</tr>
<tr>
<td>Yes to Either / No to Both</td>
<td>313</td>
<td>69.9</td>
</tr>
</tbody>
</table>
Research Cost Savings

If yes, taking into account personnel, facility and related costs how much would you estimate these accelerated AND/OR avoided project(s) would have cost your organization.
Sample: N of respondents = 450; N of Centers = 64

<table>
<thead>
<tr>
<th></th>
<th>Member Level</th>
<th>Center Level</th>
<th>Program Level</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Member Level Scores</strong></td>
<td>Mean</td>
<td>Median</td>
<td>S.D.</td>
</tr>
<tr>
<td>a. $ value of accelerated/avoided projects (thousands) per respondent org.</td>
<td>139.67</td>
<td>50.00</td>
<td>246.35</td>
</tr>
<tr>
<td><strong>Center Level Scores</strong></td>
<td>Mean</td>
<td>Median</td>
<td>S.D.</td>
</tr>
<tr>
<td>b. $ value of accelerated/avoided projects (thousands) per center</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Program Level Scores</strong></td>
<td>Mean</td>
<td>Median</td>
<td>Total $ value of accelerated/avoided projects supported by respondent orgs.</td>
</tr>
<tr>
<td>c. Total $ value of accelerated/avoided projects supported by respondent orgs.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* It is worth noting that since only 38% of all members completed the questionnaire; this is a very conservative estimate of the value of accelerated/avoided projects supported by members.
Research Cost Savings: Individual Member Level Average (in thousands)

<table>
<thead>
<tr>
<th>Year</th>
<th>Cost Average (in thousands)</th>
</tr>
</thead>
<tbody>
<tr>
<td>11-12</td>
<td>$226.90</td>
</tr>
<tr>
<td>12-13</td>
<td>$127.26</td>
</tr>
<tr>
<td>13-14</td>
<td>$165.60</td>
</tr>
<tr>
<td>14-15</td>
<td>$139.67</td>
</tr>
</tbody>
</table>

First year reporting bias?
Research Cost Savings
Center Level Average (in thousands)

First year reporting bias?

$0.00 $200.00 $400.00 $600.00 $800.00 $1,000.00 $1,200.00 $1,400.00 $1,600.00

11-12 12-13 13-14 14-15

$1,483.59 $916.28 $1,162.45 $997.62

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Research Cost Savings: Program Level Total (in Thousands)

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Cost (in Thousands)</th>
</tr>
</thead>
<tbody>
<tr>
<td>11-12</td>
<td>$57,860</td>
</tr>
<tr>
<td>12-13</td>
<td>$59,285</td>
</tr>
<tr>
<td>13-14</td>
<td>$59,285</td>
</tr>
<tr>
<td>14-15</td>
<td>$62,850</td>
</tr>
</tbody>
</table>

8/1/2016

IUCRC Evaluation Project at NCSU
Research Cost Avoidance

• Definition: Research cost avoidance is savings a firm obtains by having “necessary” research projects performed by a center rather than performing them internally.

• Example: If a firm reports that a particular “necessary” project would cost $100,000 to carry out internally (counterfactual estimate) but that project was actually carried out by a center to which they pay a $50,000 membership fee that firm has avoided $50,000 of R&D costs.
Member Evaluation of the Center Project FY 2014-2015

- Relevant and high priority for a given member
- Relevant to a given member
- Not relevant to a given member

RCA

<table>
<thead>
<tr>
<th>Category</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relevant and high priority</td>
<td>20.30%</td>
</tr>
<tr>
<td>Relevance</td>
<td>40.40%</td>
</tr>
<tr>
<td>Not relevant to a given member</td>
<td>39.30%</td>
</tr>
</tbody>
</table>
# RCA Findings

## Average Research Cost Avoidance (RCA)

<table>
<thead>
<tr>
<th>Member Level Scores</th>
<th>Mean</th>
<th>Median</th>
<th>S.D.</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Average dollar value (in thousands) of avoided projects per respondent organization</td>
<td>631.15</td>
<td>318.54</td>
<td>1173.70*</td>
</tr>
</tbody>
</table>

\[
\text{Av.RCA member} = (N \text{ of projects} \times N \text{ of months} \times \text{Average salary per month}) - \text{Primary Fee}
\]

*Sample: N of respondents = 441, N of centers = 64

<table>
<thead>
<tr>
<th>Center Level Scores</th>
<th>Mean</th>
<th>Median</th>
<th>S.D.</th>
</tr>
</thead>
<tbody>
<tr>
<td>b. Average dollar value (in thousands) of avoided projects per respondent organization</td>
<td>4351.59</td>
<td>3005.91</td>
<td>4707.13</td>
</tr>
</tbody>
</table>

*Sample: N of respondents = 441, N of centers = 64

<table>
<thead>
<tr>
<th>Program Level Scores</th>
<th>Sum</th>
</tr>
</thead>
<tbody>
<tr>
<td>c. Total dollar value of avoided projects by respondent organizations</td>
<td>$278,502,053</td>
</tr>
</tbody>
</table>

\[
\text{RCA program} = \text{Av. RCA member} \times N \text{ of members}
\]

*Sample: N of respondents = 441, N of centers = 64

*70 members (16%) have negative RCA that results in large standard deviation.
RCA: Individual Member Level Average (in thousands)

<table>
<thead>
<tr>
<th>Year</th>
<th>Average (in thousands)</th>
</tr>
</thead>
<tbody>
<tr>
<td>11-12</td>
<td>$487.55</td>
</tr>
<tr>
<td>12-13</td>
<td>$571.17</td>
</tr>
<tr>
<td>13-14</td>
<td>$698.38</td>
</tr>
<tr>
<td>14-15</td>
<td>$631.15</td>
</tr>
</tbody>
</table>

8/1/2016

IUCRC Evaluation Project at NCSU
RCA: Center Level Average (in thousands)

<table>
<thead>
<tr>
<th>Year</th>
<th>Average (in thousands)</th>
</tr>
</thead>
<tbody>
<tr>
<td>11-12</td>
<td>$4,353.40</td>
</tr>
<tr>
<td>12-13</td>
<td>$4,089.61</td>
</tr>
<tr>
<td>13-14</td>
<td>$5,815.88</td>
</tr>
<tr>
<td>14-15</td>
<td>$4,351.59</td>
</tr>
</tbody>
</table>

8/1/2016

IUCRC Evaluation Project at NCSU
RCA: Program Level Total (in thousands)

<table>
<thead>
<tr>
<th>Year</th>
<th>Total (in thousands)</th>
</tr>
</thead>
<tbody>
<tr>
<td>11-12</td>
<td>$153,090.70</td>
</tr>
<tr>
<td>12-13</td>
<td>$219,902.29</td>
</tr>
<tr>
<td>13-14</td>
<td>$237,449.20</td>
</tr>
<tr>
<td>14-15</td>
<td>$278,502.05</td>
</tr>
</tbody>
</table>

Program Level

11-12 (N = 314) $153,090.70
12-13 (N = 385) $219,902.29
13-14 (N = 340) $237,449.20
14-15 (N = 450) $278,502.05
## Summary of R&D Efficiency Impacts

<table>
<thead>
<tr>
<th></th>
<th>Member Level Mean</th>
<th>Center Level Mean</th>
<th>Program Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research Cost Avoidance</td>
<td>$631,150</td>
<td>$4,351,590</td>
<td>$278,502,053</td>
</tr>
<tr>
<td>Research Cost Savings</td>
<td>$139,670</td>
<td>$997,620</td>
<td>$62,850,000</td>
</tr>
<tr>
<td>Stimulated Research Projects</td>
<td>$145,930</td>
<td>$969,090</td>
<td>$62,022,000</td>
</tr>
</tbody>
</table>

**Notes:**
- Since Research Cost Avoidance and Research Cost Savings are “savings” and Stimulated Research Projects involves “costs” indices should not be added.
- Since these data only involve feedback from about 40% of members they almost certainly underestimate impacts at both the Center and Program level.
Industry Summary

• Stability across variables is the dominant pattern with few instances of more positive outcomes.

• Ratings in most domains are relatively flat: research program, impacts, and satisfaction

• Follow up Issues/Concerns
  • Student hires: impact on recruiting relatively low
  • Areas needing improvement
    • Project selection
    • Technology transfer
    • Recruiting/fund raising

• Despite some issues and concerns, members’ satisfaction remains consistently high
Faculty Questionnaire

Select Results
### Faculty Long and Short Forms

<table>
<thead>
<tr>
<th></th>
<th>Long Form</th>
<th>Short Form</th>
</tr>
</thead>
<tbody>
<tr>
<td># of items</td>
<td>13</td>
<td>6</td>
</tr>
<tr>
<td># of questions in common</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td># of unique questions</td>
<td>7</td>
<td>0</td>
</tr>
<tr>
<td># of centers using form</td>
<td>27</td>
<td>16</td>
</tr>
<tr>
<td>Sample size</td>
<td>106</td>
<td>240</td>
</tr>
</tbody>
</table>
Q1: Compared to the research projects you typically conduct, would you describe your Center-funded research as more basic or applied?
During the past year, how satisfied were you with the quality of center-supported research program?

![Graph showing satisfaction levels from 2005-2015]

- Very Satisfied: 5
- Quite Satisfied: 4
- Somewhat Satisfied: 3
- Slightly Satisfied: 2
- Not Satisfied: 1

Satisfaction ratings:
- 05-06: 3.76
- 06-07: 4.13
- 07-08: 4.29
- 08-09: 4.29
- 09-10: 4.27
- 10-11: 4.31
- 11-12: 4.2
- 12-13: 4.21
- 13-14: 4.26
- 14-15: 4.35

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Q2b: During the past year, how satisfied were you with the relevance of the Center’s research program to my professional goals?

![Graph showing satisfaction levels from Very Satisfied to Not Satisfied from 2005-2015]

8/1/2016

IUCRC Evaluation Project at NCSU
Q4a: During the past year, what impact has participation in the Center had for YOU in the following areas?
Q4b: During the past year, what impact has participation in the Center had for YOU in the following areas?

Opportunities for research contracts/grants

- Very High Impact
- High Impact
- Moderate Impact
- Slight Impact
- No Impact

Graph showing impact ratings over time from 2005-2016.
Q4c: During the past year, what impact has participation in the Center had for YOU in the following areas?

Recognition I receive for the work I do

<table>
<thead>
<tr>
<th>Year</th>
<th>Very High Impact</th>
<th>High Impact</th>
<th>Moderate Impact</th>
<th>Slight Impact</th>
<th>No Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>05-06</td>
<td>3.25</td>
<td>3.13</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>06-07</td>
<td>3.49</td>
<td>3.63</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>07-08</td>
<td>3.63</td>
<td>3.64</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>08-09</td>
<td>3.64</td>
<td>3.64</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>09-10</td>
<td>3.64</td>
<td>3.39</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10-11</td>
<td>3.63</td>
<td>3.63</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11-12</td>
<td>3.56</td>
<td>3.59</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

8/1/2016 IUCRC Evaluation Project at NCSU
Q4d: During the past year, what impact has participation in the Center had for YOU in the following areas?

Access to useful equipment

- Very High Impact
- High Impact
- Moderate Impact
- Slight Impact
- No Impact

Impact Scale:
- Very High
- High
- Moderate
- Slight
- No Impact

Yearly Impact Scores:
- 2005-2006: 2.79
- 2006-2007: 2.95
- 2007-2008: 3.03
- 2008-2009: 3.28
- 2009-2010: 3.07
- 2010-2011: 3.15
- 2011-2012: 2.93
- 2012-2013: 3.10
- 2013-2014: 2.73
- 2014-2015: 3.15

Date: 8/1/2016

IUCRC Evaluation Project at NCSU
Q4d: During the past year, what impact has participation in the Center had for YOU in the following areas?

![Chart showing impact levels and years]

- Ability to support graduate students

Impact levels:
- Very High Impact
- High Impact
- Moderate Impact
- Slight Impact
- No Impact

Years:
- 05-06
- 06-07
- 07-08
- 08-09
- 09-10
- 10-11
- 11-12
- 12-13
- 13-14
- 14-15
Q4d: During the past year, what impact has participation in the Center had for YOU in the following areas?

Ability to publish my work in quality proceedings and journals

<table>
<thead>
<tr>
<th>Year</th>
<th>Very High Impact</th>
<th>High Impact</th>
<th>Moderate Impact</th>
<th>Slight Impact</th>
<th>No Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>06-07</td>
<td>3.22</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>07-08</td>
<td>3.17</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>08-09</td>
<td>3.49</td>
<td>3.42</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>09-10</td>
<td>3.52</td>
<td>3.35</td>
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Q5: Which option best expresses your current intentions? - Next year I will submit my best research ideas in a center funded proposal.
Q6: During the past year, how satisfied were you with center administrative operations?
Faculty Summary

• Most indicators are relatively stable
  • Keep using benchmarks: variability between centers is key issue.
How Should These Process/Outcome Results be Used?

• Trends are probably much more interpretable at local center level
  • Director leaves; research direction changes; move from one-on-one to consortial center
• Benchmark center against previous year and national norms
  • By comparing means, medians, and standard deviations, evaluators can see how their centers compare to national “norms”
  • Insert national data into industry software tools for this year/last year comparisons with your center
  • Move current center means to previous year in e-mail software package
• Caution:
  • Deteriorating response rate undermines the validity and usefulness of feedback
    • Need to reinvent our methods
    • Cautiously considered interpretation
Extra Slides
Calculation of Economic Impacts ($)

- Research amplification (Q1a & Q1b)
  - Percent Rel. x N of Center Proj. x Scien. Months x $/Scien. Month (Gray & Steenhuis, 2003)

- Cost Avoidance (Q1a & 1b)

- R&D Cost Savings

- Accelerated R&D savings or Avoided R&D (5c):
  - $ saved by accelerated projects or $ avoided by not starting projects

- Stimulated R&D (5f):
  - $ invested in new or re-directed internal R&D
Research Cost Avoidance (RCA)

• Calculation:
  - \( RCA = \sum C_f - C_c. \)
    - Firm cost \( (C_f) \) is calculated as follows: \( C_f = N_{\text{projects}} \times N_{sm} \times C_{sm}. \)
  - \( N_{\text{projects}} = \) number of center projects a firm considers “high enough priority they would have conducted them internally or by contract” (Q1b)
  - \( N_{sm} = \) how many scientist months those projects would take to complete. (Q1c1)
  - \( C_{sm} = \) the cost of a scientist month (archival)
    - \( (\text{Salary} \ ($88.5k) + \text{Fringe} \ (35\%) + \text{indirect} \ (50\%)) / 12 = $14,939 \)
  - \( C_c = \) average cost of center membership