IUCRC Program Findings from The Center Structure Database

FY2017
*Data collected from 70 out of 70 total active centers
Trends from Center Structure Database: FY1980-2017

McGowen, L., Leonchuk, O. & Stoica, A.
IUCRC Evaluation Project at
North Carolina State University
Overview

• Fast Facts
  • Slides 3-5

• Data collection methodology and timeframe
  • Slides 6-10

• Number of Centers through 2016-2017
  • Slides 11-13

• Detailed analyses through 2016-2017 (structural, outcomes)
  • Slides 14-45

• CISE and ENG breakdowns
  • Slides 46-53

• Comparison by program Phase (I, II, III)
  • Slides 54-66
FY17 IUCRC Center Structural Fast Facts

- 70 active Centers at 193 University sites
- 1214 Memberships
- 1248 Researchers + 1994 students
- $91.5M in Total Program Funding; $1.3M per center
- NSF invests $16.6M; $238K per Center
- NSF Leveraging ratio 1:4.5

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IUCRC Evaluation Project
FY17 Member Fast Facts

1214 Memberships
190 new and 206 terminated memberships

$53M Provided by Members
58% of total IUCRC program funding

~17 Members per Center

Membership fee leveraging ratio 1:33
IUCRC Student Fast Facts: FY2017

1994 Students Trained
  • 28 students per center

715 Students Graduated
  • 10 graduates per center
  • 1/3 of trainees annually

333 Alumni Hired by Industry
  • 47% of graduates
  • 29% by member organizations

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Methodology

• Collection of 2016-17 structural data from centers and sites completed between November 2017 and January 2018.
  • Centers were asked to report on their most recently completed project year
  • Some variables changed last year (trends adjusted to standardize)
• Data on number of funded centers collected from NSF (through 2018)
• Reporting issues:
  • Issue of how to count centers under NCE (no cost extension) will need to be addressed in the future (e.g., between phase NCE; end-of-funding NCE)
NSF and Center Budgeting Life Cycle

- Structural report includes activities for previous complete project year
- Excludes centers with less 1 year in operation

<table>
<thead>
<tr>
<th>NSF Fiscal Year</th>
<th>NSF Fiscal Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oct FY1</td>
<td>Mar FY1</td>
</tr>
<tr>
<td>Aug FY1</td>
<td>Oct FY2</td>
</tr>
<tr>
<td>Mar FY2</td>
<td>Aug FY2</td>
</tr>
</tbody>
</table>

Center Project Year

First Center Project Year

- Nov – Jan: IUCRC Report Data Collection
- March: Report Complete

Included in report
Not included in report
Understanding Center Counts Through FY2017

70 NSF Funded Centers Operating more than 1 year (completed a project year) + 3 NSF Funded Centers Operating less than 1 year (project year not completed) = 73 Funded Centers

Statistics on Total and Average Activity Slides 10-65
Understanding Center Counts Through FY2018

- 70 NSF Funded Centers Operating more than 1 year (completed a project year)
- 3 NSF Funded Centers Operating less than 1 year (project year not completed)
- 10 Centers Graduated/Closed

70 + 3 - 10 = 63 Funded Centers

6 Phase III Centers Graduated

Slides 11-13
FY2017 Graduated & Closed Centers

• Phase III centers dropped from the FY2017 report
  1. Advanced Processing and Packaging Studies: Ohio State Univ.; NC State Univ.
  2. Intelligence Maintenance Systems: Univ. of Cincinnati; Univ. of Michigan, Ann Arbor; Missouri Univ. of Science & Tech; Univ. of Texas, Austin.
  3. Power Systems Engineering Research Center: Arizona State Univ.; Cornell Univ.; Texas A&M; Washington State Univ.; Univ. of Wisconsin, Madison; Iowa State Univ.; Wichita State Univ.; Univ. of Illinois, Urbana Champaign; Georgia Institute of Tech.; Howard Univ.; Univ. of California, Berkeley.
Center Life Cycle Through FY2018*

IUCRC Evaluation Project
Active Centers and Sites by Year*

*Data Current for FY2018

~2.8 Sites per Center

Plus 6 Int’l Sites
Single & Multi-Site Centers*

*Data Current for FY2017
Total Program Funding^  

*Three highly successful Phase III centers graduated.  
*Dynamic Data Analytics total funding decreased from $13,6M (FY15-16) to $90K (FY16-17).  

^Univ. & Other Cash Excluded
### Average & Median Total Center Funding

<table>
<thead>
<tr>
<th>Year</th>
<th>Average</th>
<th>Median</th>
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<tr>
<td>'07</td>
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<td>$1,500,000</td>
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<tr>
<td>'08</td>
<td>$2,500,000</td>
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<td>'09</td>
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<td>$1,000,000</td>
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<td>'15</td>
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<tr>
<td>'16</td>
<td>$1,750,000</td>
<td>$1,500,000</td>
</tr>
<tr>
<td>'17</td>
<td>$1,500,000</td>
<td>$1,250,000</td>
</tr>
</tbody>
</table>

^Univ. & Other Cash Excluded
NSF Budget by Year

Millions

Total Dollars in Millions

'80 '81 '82 '83 '84 '85 '86 '87 '88 '89 '90 '91 '92 '93 '94 '95 '96 '97 '98 '99 '00 '01 '02 '03 '04 '05 '06 '07 '08 '09 '10 '11 '12 '13 '14 '15 '16 '17

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IUCRC Evaluation Project
NSF Budget by Year

![Budget by Year Diagram](image)

- **'80**: ENG 1.3, CISE 1.5
- **'81**: ENG 3, CISE 3.1
- **'82**: ENG 1.1, CISE 3.6
- **'83**: ENG 4.2, CISE 4.2
- **'84**: ENG 4.2, CISE 4.2
- **'85**: ENG 4.2, CISE 4.2
- **'86**: ENG 8.2, CISE 8.2
- **'87**: ENG 4.2, CISE 4.2
- **'88**: ENG 5, CISE 5.1
- **'89**: ENG 5.2, CISE 5.2
- **'90**: ENG 6, CISE 6
- **'91**: ENG 6, CISE 6
- **'92**: ENG 6, CISE 6
- **'93**: ENG 6, CISE 6
- **'94**: ENG 6, CISE 6
- **'95**: ENG 6, CISE 6
- **'96**: ENG 6, CISE 6
- **'97**: ENG 6, CISE 6
- **'98**: ENG 6, CISE 6
- **'99**: ENG 6, CISE 6
- **'00**: ENG 6, CISE 6
- **'01**: ENG 6, CISE 6
- **'02**: ENG 6, CISE 6
- **'03**: ENG 6, CISE 6
- **'04**: ENG 6, CISE 6
- **'05**: ENG 6, CISE 6
- **'06**: ENG 6, CISE 6
- **'07**: ENG 6, CISE 6
- **'08**: ENG 6, CISE 6
- **'09**: ENG 6, CISE 6
- **'10**: ENG 9.8, CISE 2.3
- **'11**: ENG 1.7, CISE 2.3
- **'12**: ENG 7.7, CISE 4.9
- **'13**: ENG 2.6, CISE 4.6
- **'14**: ENG 8, CISE 8
- **'15**: ENG 10.4, CISE 8
- **'16**: ENG 12.6, CISE 8
- **'17**: ENG 13.3, CISE 8

Other Programs co-fund too!

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NSF : Total Funding Leveraging Ratios

NSF IUCRC Program Budget Leveraging Ratio = Total Funding All Sources / NSF IUCRC Program Budget

NSF Awards Reported Leveraging Ratio = Total Funding All Sources / NSF IUCRC Awards and Supplements Reported

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IUCRC Evaluation Project
NSF : Total Funding (Excluding NSF IUCRC) Leveraging Ratios

0.0  2.0  4.0  6.0  8.0  10.0  12.0  14.0  16.0  18.0
'97  '98  '99  '00  '01  '02  '03  '04  '05  '06  '07  '08  '09  '10  '11  '12  '13  '14  '15  '16  '17

NSF IUCRC Program Budget Leveraging Ratio = Total Funding from all non-NSF-IUCRC Sources / NSF IUCRC Program Budget
NSF Awards Reported Leveraging Ratio = Total Funding from all non-NSF-IUCRC Sources / NSF IUCRC Awards and Supplements Reported

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IUCRC Evaluation Project
Average NSF IUCRC Awards & Supplements per Center*

*The averages do not include centers that were on no-cost extension and received $0 from NSF during the reporting period. The average for FY2017 excludes 3 centers.
Average NSF IUCRC Funding per Site*

*The averages do not include sites that were on no-cost extension and received $0 from NSF during that fiscal year. The average for FY2017 excludes 23 sites that were on no cost extension and received $0 from NSF, and 6 international sites that did not receive NSF IUCRC support.
Total Funding by Source in Dollars^
Total Funding by Source in Percentages^
Industrial Memberships

Total Number of Memberships

Average Number of Memberships

Complex changes:
2011-2014: Massive growth in new centers established (N = 31), decreasing average
2017: Graduation of 3 highly successful Phase III centers, decreasing the average
Average Membership Turn Over

Members Added this FY

Members Left this FY

0 1 2 3 4 5 6

'89 '90 '91 '92 '93 '94 '95 '96 '97 '98 '99 '00 '01 '02 '03 '04 '05 '06 '07 '08 '09 '10 '11 '12 '13 '14 '15 '16 '17

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Membership Turnover Rate

Turnover % = Members terminated in “year X+1” / Total members in “year X”
Average Number of Researchers per Center

Faculty & Post Doc Researchers

'S7 '88 '89 '90 '91 '92 '93 '94 '95 '96 '97 '98 '99 '00 '01 '02 '03 '04 '05 '06 '07 '08 '09 '10 '11 '12 '13 '14 '15 '16 '17

0.0 5.0 10.0 15.0 20.0 25.0

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Average Funding per Researcher

Univ. & Other Cash Excluded
Total Intellectual Property & Commercialization Events


*** Patents Granted Outliers: 2016: BSAC = 6, DDA = 11.
Average Intellectual Property & Commercialization Events


*** Patents Granted Outliers: 2016: BSAC = 6, DDA = 11.
Total Students Trained

PhD (2017 Mean = 14.14)  Masters (2017 Mean = 6.31)  BS (2017 Mean = 8.03)

* Prior to FY2003, the data on PhD and Master’s students were collected together.
Average Students Trained

* Prior to FY2003, the data on PhD and Master’s students were collected together.
Total Students Graduated

- PhD (2017 Mean = 3.56)
- Masters (2017 Mean = 3.84)
- BS (2017 Mean = 2.81)
Average Students Graduated

- PhD
- Masters
- BS

Year: '01 to '17

Graduation Count:
- 0
- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8

IUCRC Evaluation Project

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Total Graduates Hired by Industry & Government Members

- PhD (2017 Mean = .89)
- Masters (2017 Mean = .60)
- BS (2017 Mean = .21)
Average Graduates Hired by Industry & Government Members

- PhD
- Masters
- BS
IUCRC Alumni Career Outcomes: Total FY2017 Graduates Hired

- **Industry**: 236
  - Continuing Edu.: 97
  - Postdoc: 22
  - Faculty: 20
  - Non-Member Org.: 147
  - Member Org.: 103
- **Govt**: 41
- **Academia**: 103
- **Not Reported**: 0

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IUCRC Alumni Career Outcomes: Percent of FY2017 Graduates Hired

- Industry: 46.7% (13.6%), 33.1% (5.8%), 20.6% (6.5%)
- Government: 8.9% (3.1%), 14.5% (2.8%)
- Academia: 23.8% (6.5%)
- Not Reported: 0.0% (5.0%), 10.0% (10.0%), 15.0% (15.0%), 20.0% (20.0%), 25.0% (25.0%), 30.0% (30.0%), 35.0% (35.0%), 40.0% (40.0%), 45.0% (45.0%), 50.0% (50.0%)

3/22/2018 IUCRC Evaluation Project
IUCRC Alumni Career Outcomes: Mean FY2017 Graduates Hired per Center

<table>
<thead>
<tr>
<th>Industry/University</th>
<th>Mean FY2017 Graduates Hired per Center</th>
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</thead>
<tbody>
<tr>
<td>Industry</td>
<td>3.37</td>
</tr>
<tr>
<td>0.31</td>
<td></td>
</tr>
<tr>
<td>1.39</td>
<td></td>
</tr>
<tr>
<td>Govt</td>
<td>0.66</td>
</tr>
<tr>
<td>0.29</td>
<td></td>
</tr>
<tr>
<td>Academia</td>
<td>2.10</td>
</tr>
<tr>
<td>Not Reported</td>
<td>1.00</td>
</tr>
</tbody>
</table>

Industry/University Cooperative Research Centers

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IUCRC Evaluation Project
IUCRC Alumni Career Outcomes: Total Graduates Hired over time
IUCRC Alumni Career Outcomes:
Total FY2017 Graduates Hired by Degree Level

<table>
<thead>
<tr>
<th>Degree Level</th>
<th>Industry Member</th>
<th>Industry Non-Member</th>
<th>Gov't Member</th>
<th>Gov't Non-Member</th>
<th>Faculty</th>
<th>Postdoc</th>
<th>Continuing Education</th>
<th>Not Reported</th>
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</thead>
<tbody>
<tr>
<td>BS</td>
<td>12</td>
<td>60</td>
<td>3</td>
<td>14</td>
<td>NA</td>
<td>NA</td>
<td>55</td>
<td>49</td>
</tr>
<tr>
<td>MS</td>
<td>32</td>
<td>95</td>
<td>9</td>
<td>16</td>
<td>1</td>
<td>NA</td>
<td>48</td>
<td>64</td>
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<tr>
<td>PhD</td>
<td>52</td>
<td>74</td>
<td>10</td>
<td>11</td>
<td>19</td>
<td>46</td>
<td>34</td>
<td>34</td>
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</tbody>
</table>

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IUCRC Evaluation Project
IUCRC Alumni Career Outcomes: Percent of FY2017 Graduates Hired by Degree Level

<table>
<thead>
<tr>
<th>Degree Level</th>
<th>BS</th>
<th>MS</th>
<th>PhD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industry Mem.</td>
<td>6%</td>
<td>12%</td>
<td>22%</td>
</tr>
<tr>
<td>Industry Non-Mem</td>
<td>31%</td>
<td>36%</td>
<td>32%</td>
</tr>
<tr>
<td>Govt Mem</td>
<td>2%</td>
<td>3%</td>
<td>1%</td>
</tr>
<tr>
<td>Govt Non-Mem</td>
<td>7%</td>
<td>6%</td>
<td>4%</td>
</tr>
<tr>
<td>Faculty</td>
<td>NA</td>
<td>0%</td>
<td>11%</td>
</tr>
<tr>
<td>Postdoc</td>
<td>NA</td>
<td>NA</td>
<td>13%</td>
</tr>
<tr>
<td>Cont Edu</td>
<td>28%</td>
<td>18%</td>
<td>NA</td>
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<tr>
<td>Not Reported</td>
<td>25%</td>
<td>24%</td>
<td>17%</td>
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IUCRC Evaluation Project
### IUCRC Alumni Career Outcomes: FY2017 Graduates Hired per Center by Degree Level

<table>
<thead>
<tr>
<th>Industry Mem.</th>
<th>Industry Non-Mem</th>
<th>Govt Mem</th>
<th>Govt Non-Mem</th>
<th>Faculty</th>
<th>Postdoc</th>
<th>Cont Edu</th>
<th>Not Reported</th>
</tr>
</thead>
<tbody>
<tr>
<td>BS</td>
<td>MS</td>
<td>PhD</td>
<td>BS</td>
<td>MS</td>
<td>PhD</td>
<td>BS</td>
<td>MS</td>
</tr>
<tr>
<td>0.17</td>
<td>0.86</td>
<td>0.04</td>
<td>0.20</td>
<td>NA</td>
<td>NA</td>
<td>0.79</td>
<td>0.70</td>
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<tr>
<td></td>
<td>0.46</td>
<td>0.13</td>
<td>0.23</td>
<td>0.01</td>
<td>0.01</td>
<td>0.69</td>
<td>0.91</td>
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<td></td>
<td></td>
<td>1.36</td>
<td>0.17</td>
<td>0.01</td>
<td>NA</td>
<td>0.14</td>
<td>0.49</td>
</tr>
</tbody>
</table>

**IUCRC Evaluation Project**

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CISE & ENG Partnership

Some Comparisons and Recent Trends
Growth in N of CISE & ENG Centers over time
FY2017 CISE & ENG: Funding by Source

Total Dollars

Average Dollars

ENG Average funding is higher than CISE average for the first time
CISE & ENG: Average Students Trained

CISE

ENG

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IUCRC Evaluation Project
CISE & ENG: Average Students Graduated

CISE

ENG

PhD  Masters  BS

'08  '09  '10  '11  '12  '13  '14  '15  '16  '17

0  1  2  3  4  5  6  7  8

'08  '09  '10  '11  '12  '13  '14  '15  '16  '17

0  1  2  3  4  5  6  7  8
CISE & ENG: Average Students Hired by Members

![Graphs showing average students hired by members in CISE and ENG from '08 to '17 for PhD, Masters, and BS degrees.](image)
CISE & ENG: Total Intellectual Property & Commercialization Events


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CISE & ENG: Average Intellectual Property & Commercialization Events

CISE & ENG 2014:
- CISE: CVDI = 40, CITeR = 17, E-Design = 12.
- ENG: BSAC = 20, , BSAC = 32, , BSAC = 25.


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FY2017 Phase-based comparison
N of Centers by Phase

![Graph showing the number of centers by phase from 2012 to 2017 for Phase I, Phase II, and Phase III.](image)

- **Phase I**
- **Phase II**
- **Phase III**

- **Values:** Ranges from 0 to 45

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Total Program Funding

- Phase I (N=29): $27,059,165
- Phase II (N=32): $43,773,980
- Phase III (N=9): $20,673,014

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IUCRC Evaluation Project
Average & Median Total Center Funding

Centers get larger over time

<table>
<thead>
<tr>
<th>Phase</th>
<th>Average</th>
<th>Median</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>$933,074.64</td>
<td>$806,000.00</td>
</tr>
<tr>
<td>II</td>
<td>$1,367,936.87</td>
<td>$1,037,198.50</td>
</tr>
<tr>
<td>III</td>
<td>$2,297,001.54</td>
<td>$1,159,406.00</td>
</tr>
</tbody>
</table>

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Average NSF IUCRC Awards & Supplements

Phase I (N=29) $240,588
Phase II (N=32) $260,631
Phase III (N=9) $147,480
Total Funding by Source in Percentages

- Mem. Fees: 51% (Phase I: 3%, Phase II: 5%, Phase III: 51%)
- Addl Industry: 5% (Phase I: 4%, Phase II: 3%, Phase III: 5%)
- NSF IUCRC: 26% (Phase I: 19%, Phase II: 9%, Phase III: 33%)
- NSF Other: 5% (Phase I: 5%, Phase II: 9%, Phase III: 9%)
- Fed: 5% (Phase I: 6%, Phase II: 3%, Phase III: 3%)
- Non-Fed: 6% (Phase I: 3%, Phase II: 3%, Phase III: 3%)
- State: 3% (Phase I: 6%, Phase II: 6%, Phase III: 1%)

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IUCRC Evaluation Project
Industrial Memberships

**Total Number of Memberships**

<table>
<thead>
<tr>
<th>Phase</th>
<th>Memberships</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase I (N=29)</td>
<td>100</td>
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<tr>
<td>Phase II (N=32)</td>
<td>700</td>
</tr>
<tr>
<td>Phase III (N=9)</td>
<td>300</td>
</tr>
</tbody>
</table>

**Average Number of Memberships**

<table>
<thead>
<tr>
<th>Phase</th>
<th>Average Memberships</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase I (N=29)</td>
<td>5</td>
</tr>
<tr>
<td>Phase II (N=32)</td>
<td>25</td>
</tr>
<tr>
<td>Phase III (N=9)</td>
<td>5.5</td>
</tr>
</tbody>
</table>
Average Membership Turn Over

<table>
<thead>
<tr>
<th>Phase</th>
<th>N</th>
<th>Members Added this FY</th>
<th>Members Left this FY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase I (N=29)</td>
<td>29</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Phase II (N=32)</td>
<td>32</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Phase III (N=9)</td>
<td>9</td>
<td>2</td>
<td>7</td>
</tr>
</tbody>
</table>

*Newly funded Centers’ members are not counted as Members Added
Membership Turnover Rate

Turnover % = Members terminated in “year X+1” / Total members in “year X”
Average Number of Intellectual Property & Commercialization Events

<table>
<thead>
<tr>
<th>Event Type</th>
<th>Phase I (N=29)</th>
<th>Phase II (N=32)</th>
<th>Phase III (N=9)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spinoff Companies Formed</td>
<td>0.10</td>
<td>0.06</td>
<td>0.00</td>
</tr>
<tr>
<td>Royalties Realized</td>
<td>0.00</td>
<td>0.00</td>
<td>1.78</td>
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<tr>
<td>Licensing Agreements</td>
<td>0.03</td>
<td>0.06</td>
<td>2.00</td>
</tr>
<tr>
<td>Software Copyrights</td>
<td>0.07</td>
<td>0.09</td>
<td>0.00</td>
</tr>
<tr>
<td>Patents Granted</td>
<td>0.24</td>
<td>0.41</td>
<td>0.33</td>
</tr>
<tr>
<td>Patent Applications</td>
<td>0.41</td>
<td>0.84</td>
<td>0.00</td>
</tr>
<tr>
<td>Invention Disclosures</td>
<td>0.52</td>
<td>1.75</td>
<td>2.22</td>
</tr>
</tbody>
</table>

BSAC is a Phase 3 Outlier:
Invent. disclosures = 18
Patent applications = 25
Licensing agreements = 18
Royalties Realized = 16
Average Number of Intellectual Property & Commercialization Events*

<table>
<thead>
<tr>
<th>Event Type</th>
<th>Phase I (N=29)</th>
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<td>0.10</td>
<td>0.06</td>
<td>0.00</td>
</tr>
<tr>
<td>Royalties Realized</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Licensing Agreements</td>
<td>0.03</td>
<td>0.06</td>
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<td>Software Copyrights</td>
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<td>Patents Granted</td>
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<td>0.41</td>
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<td>Patent Applications</td>
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<tr>
<td>Invention Disclosures</td>
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<td>1.75</td>
<td>0.25</td>
</tr>
</tbody>
</table>

*Excludes BSAC is a Phase 3 Outlier
Average Students Graduated

Phase I (N=29)
- BS: 1.41
- Masters: 1.41
- PhD: 2.86

Phase II (N=32)
- BS: 3.81
- Masters: 5.84
- PhD: 3.53

Phase III (N=9)
- BS: 3.78
- Masters: 4.56
- PhD: 5.89

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IUCRC Evaluation Project
Average Students Hired by Members

- Phase I (N=29): BS = 0.21, Masters = 0.24, PhD = 0.62
- Phase II (N=32): BS = 0.16, Masters = 0.84, PhD = 1.13
- Phase III (N=9): BS = 0.44, Masters = 0.89, PhD = 0.89

IUCRC Evaluation Project

3/22/2018
Questions?

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