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# Highlights of Survey Data FY2019

## IUCRC Evaluation Project

December, 2020

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North Carolina State University



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# Overview

- Response rate
  - Slides 3-4
- Industry Findings
  - Pulse Survey: Slides 5-12
  - Benefits Inventory: Slides 13-36
- Faculty Findings
  - Slides 37-42
- Student Findings
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# FY2019 Response Rates

	Center Level				Individual Level			
	Pulse	Benefits	Faculty	Student	Pulse	Benefits	Faculty	Student
Continuing Population from CD report	72	72	72	68	1212	1212	1053	1908
1st Year Reporting Population from CD report	+1	+1	+0	+0	+6	+1	+0	+0
NCE/Retired/Defunct Centers	15	15	15	15	236	236	179	332
NCE/Retired/Defunct Centers Reporting <sup>[1]</sup>	+1	+2	+0	+2	+32	+28	+0	+10
COVID-19 Impacted Centers <sup>[2]</sup>	4	7	5	14	64	207	75	267
Population <sup>[3]</sup>	55	53	52	43	950	798	799	1319
Centers That Did Not Return Data <sup>[4]</sup>	8	12	16	19	113	163	212	457
Available Population <sup>[5]</sup>	47	41	36	26	837	635	587	862
Data Received	47	41	36	26	281	289	192	251
Received / Population	85.65%	77.35%	70.59%	60.46%	29.58%	36.22%	26.03%	19.02%
Received / Available Population	100%	100%	100%	100%	33.57%	45.51%	32.71%	29.11%

[1] Retired/defunct Centers and Centers on no-cost extension (NCE) are not required to submit data, but some do. If so, those data were included in the analysis.

[2] COVID-19 Impacted Centers include centers that reported inability to collect information due to rescheduled meetings, virtual formats, or center leadership decisions to postpone collection until less stressful times.

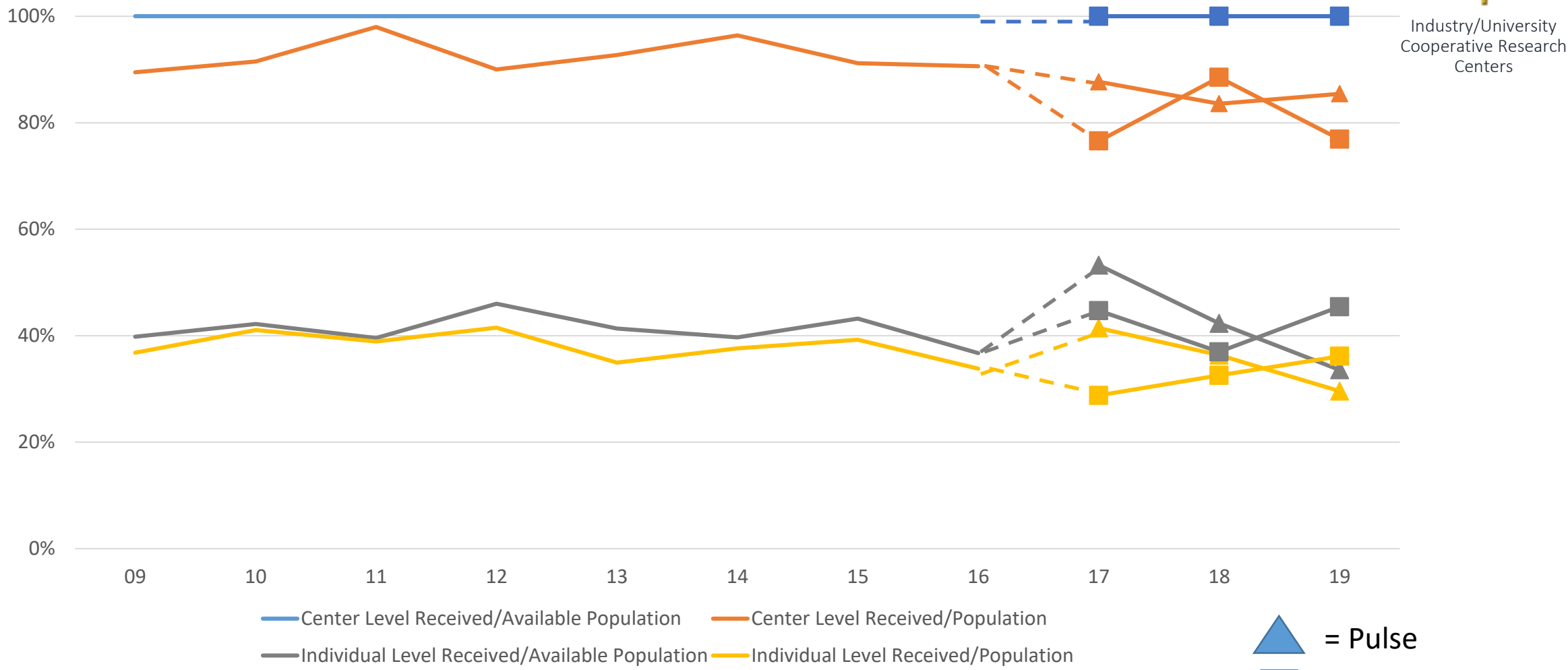
[3] Population was defined as centers that were at least 1 year old, did not report COVID-19 impacts, and/or were not classified as NCE, graduated, or retired.

[4] Centers were excused for reasons such as being in the midst of center restructuring, high respondent turnover, and respondent failure to complete surveys.

[5] Numbers based on population minus excused and not returned counts.



# Industry Response Rate Over Time



▲ = Pulse  
■ = Benefits



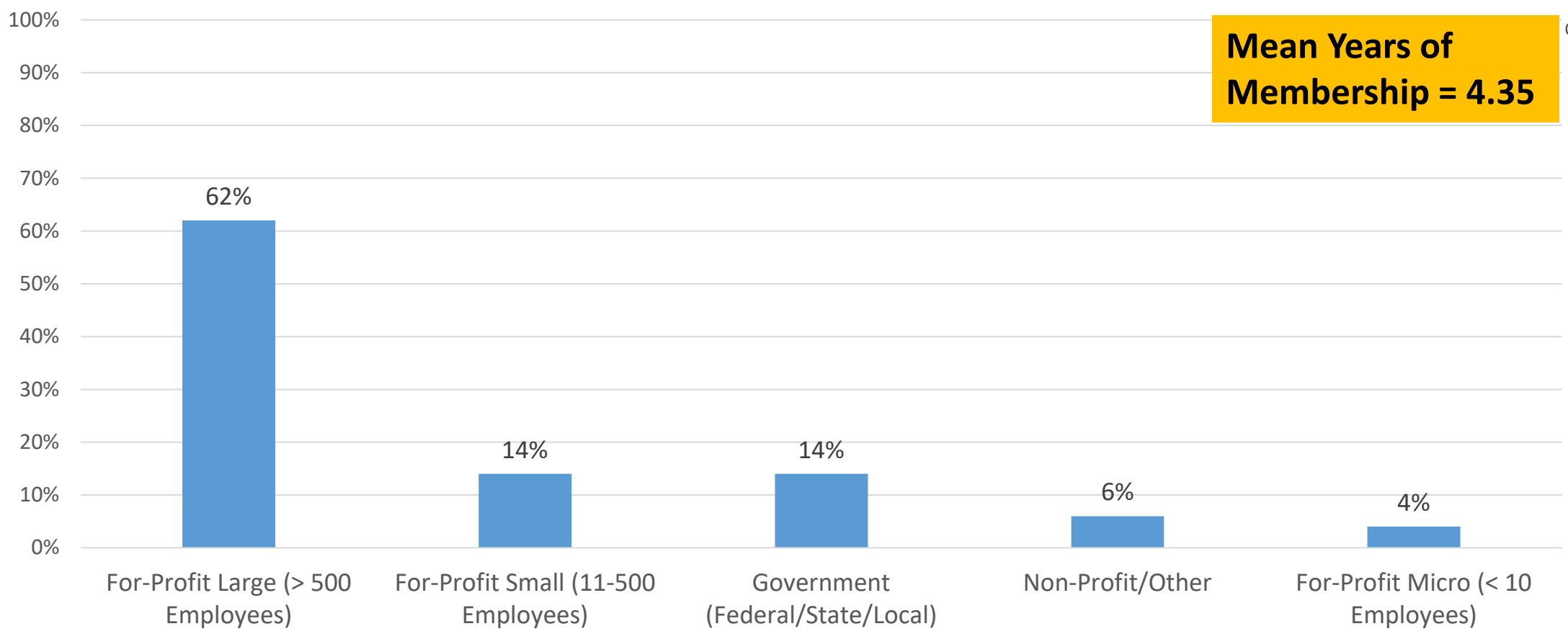
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# Industry Pulse Survey



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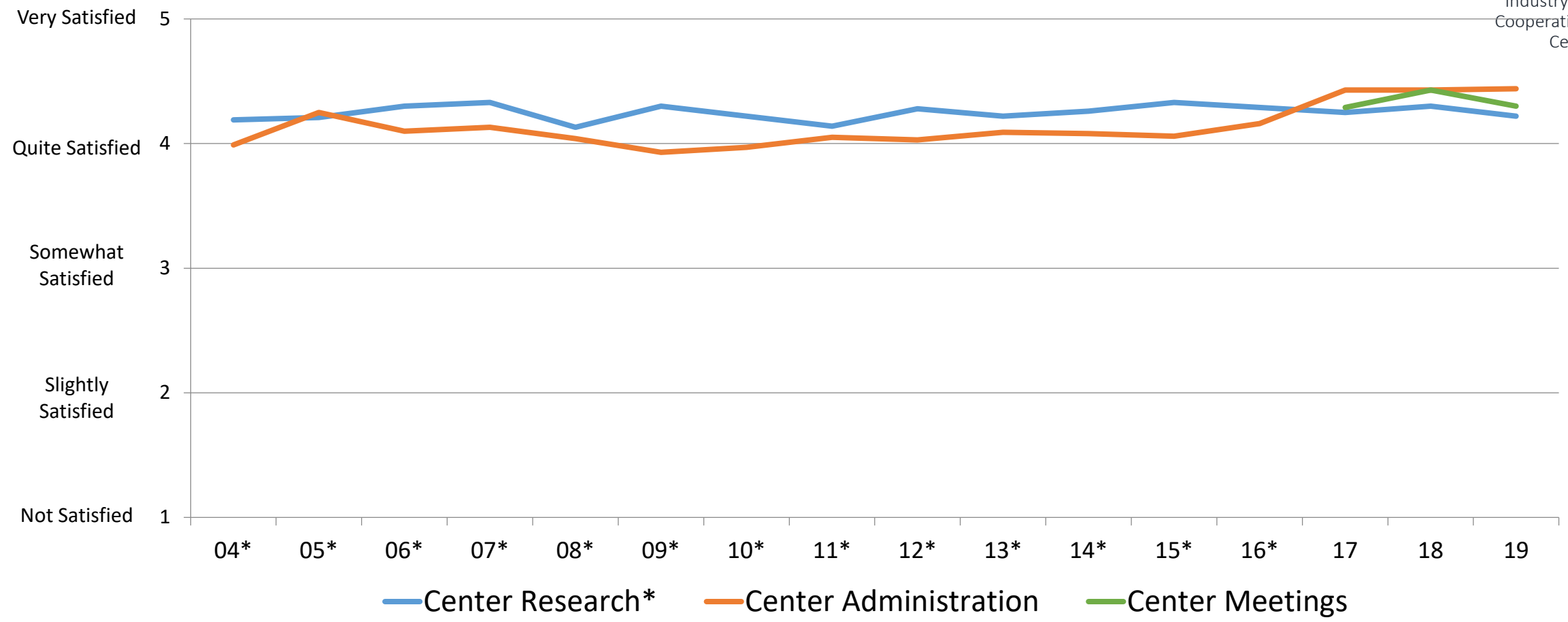
# FY2019 Organization Type/Size





# IAB Member Satisfaction Over Time

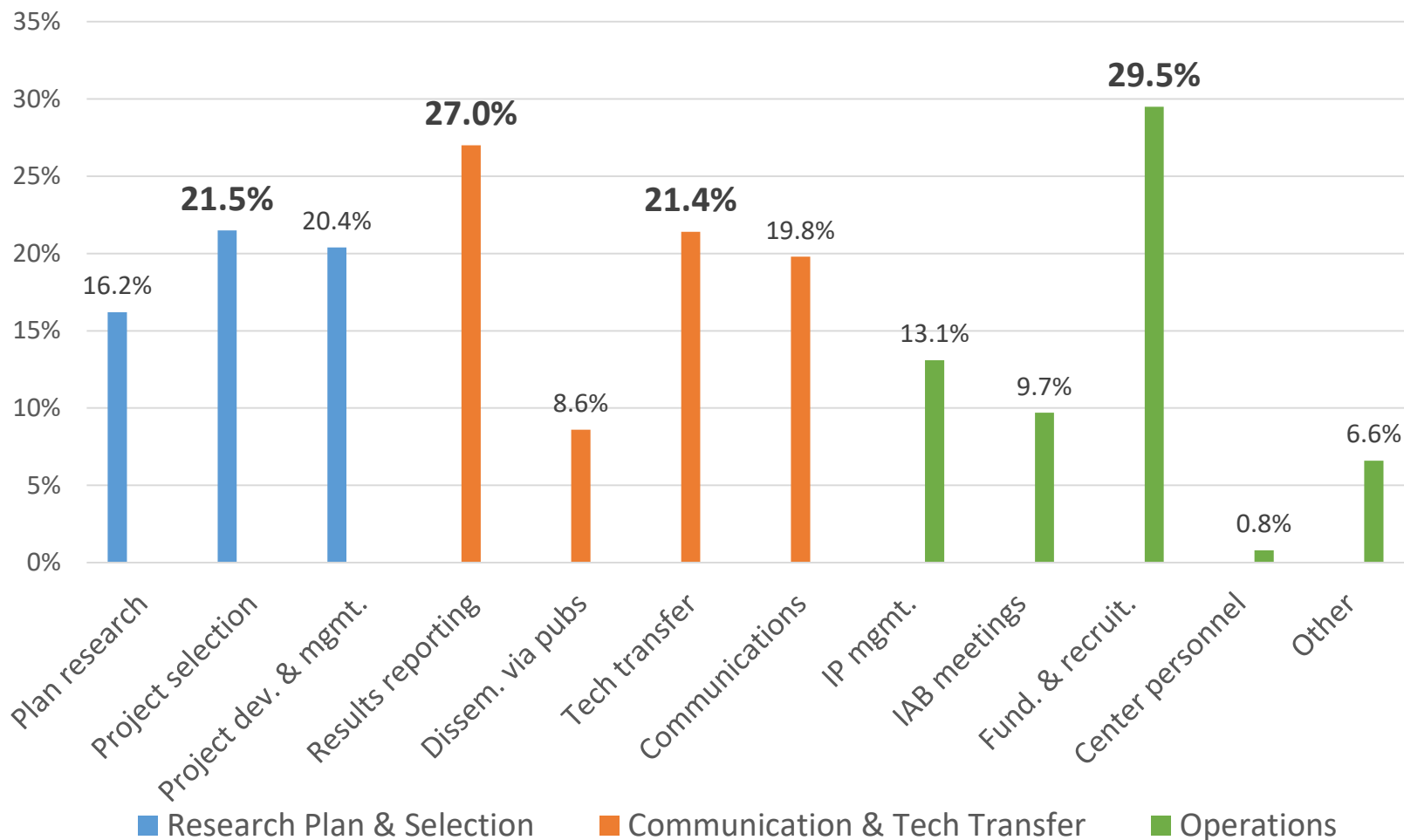
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\* Previous version of the survey asked for ratings of research quality



# FY2019 IAB Identified Areas for Improvement



*“Regular reports from the individual projects would be appreciated, so that its not just an update twice a year. Monthly progress reports would be very helpful and help identify areas of interest or where feedback could be useful before we are 50 to 100% through the project.”*

*“It would be worthwhile for new project ideas to be sent out to the IAB earlier to allow for more time to review within their respective companies. Sometimes the projects go a little off track relative to the initial proposal, and it feels that the IAB sponsors are left out of that decision making process.”*

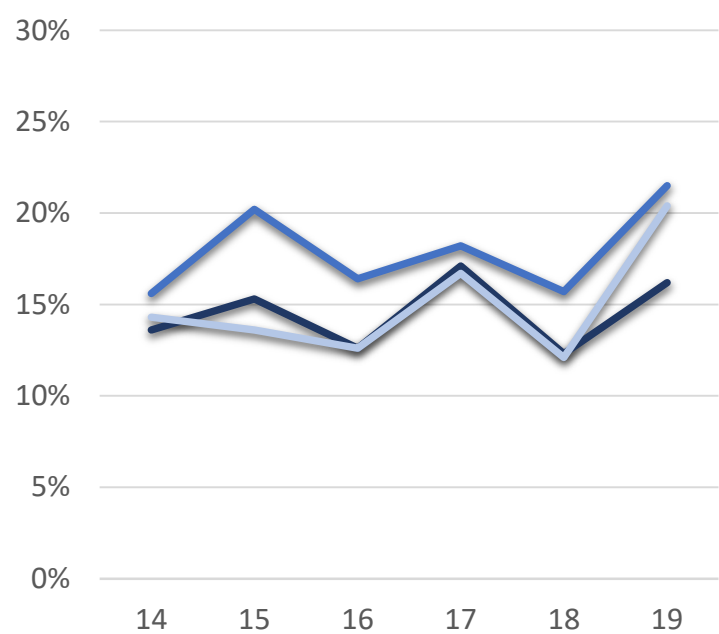




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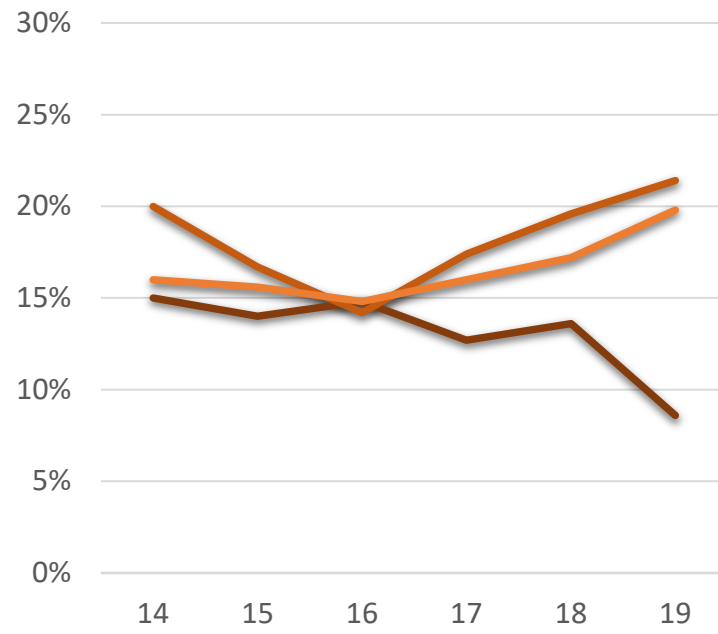
# IAB Identified Areas of Improvement Over Time

### Research Planning & Selection



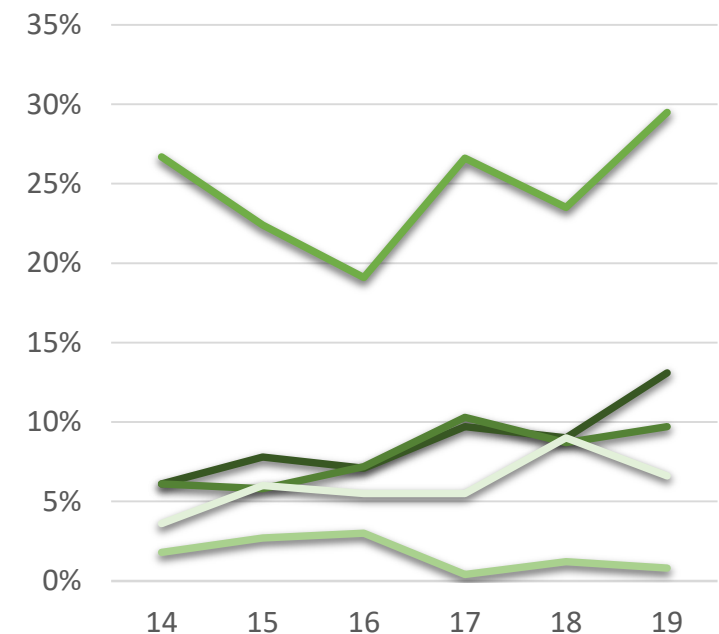
- Plan research
- Project selection
- Proj. devel. and mgmt.

### Communication & Tech. Transfer



- Dissem. via pubs
- Tech transfer
- Communications

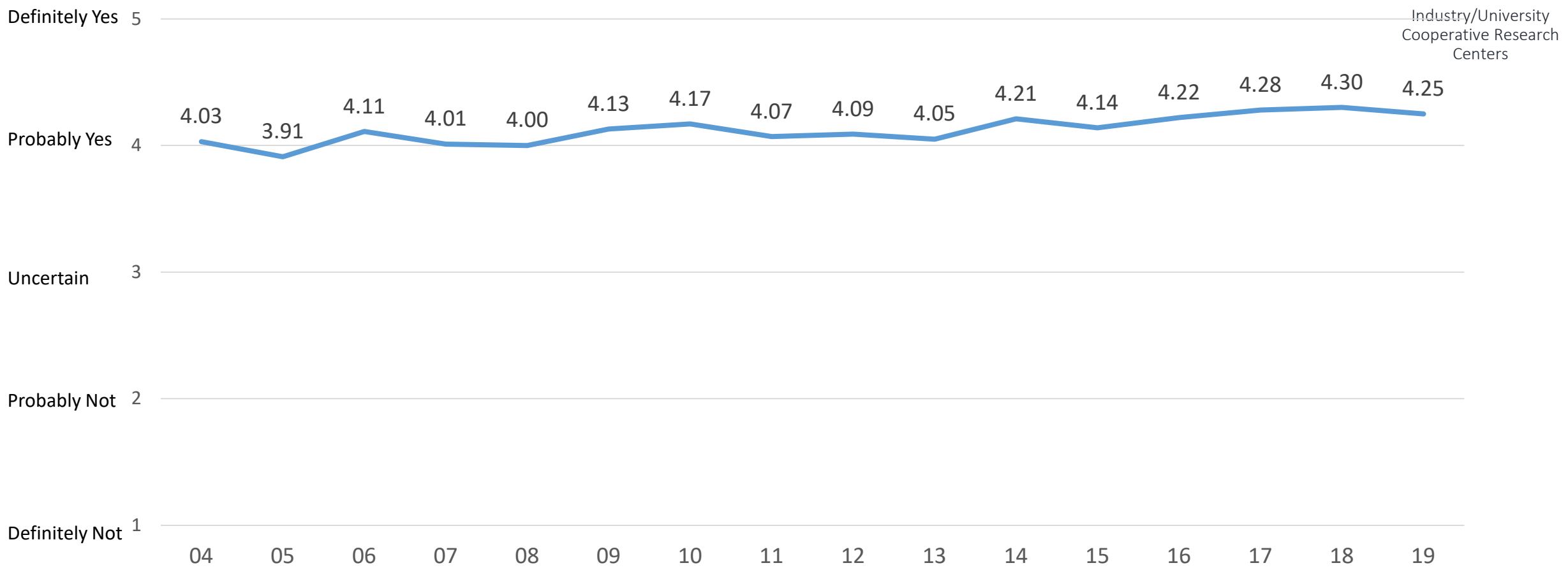
### Operations



- IP mgmt.
- IAB meetings
- Fund. & recruit.
- Center personnel
- Other



# IAB Renewal Intentions Over Time



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# FY2019 Predicting Renewal Intentions: Regression

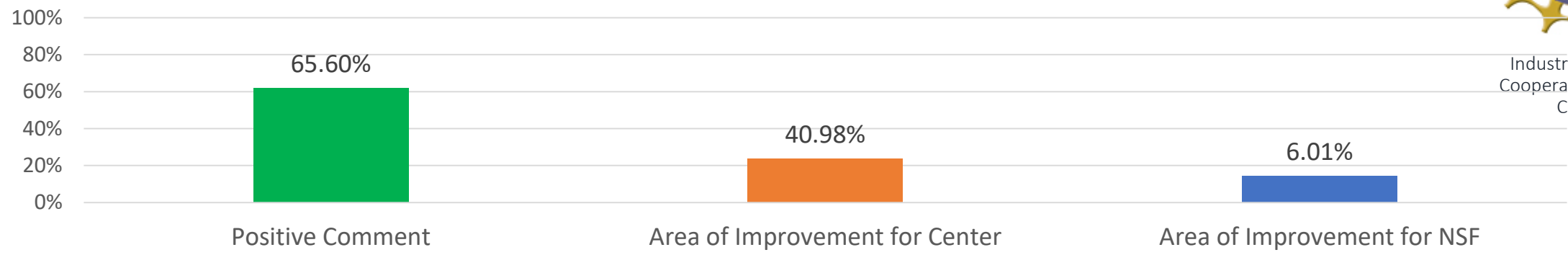
- Wanted to determine what member perceptions were predictive of renewal intentions.
- 1<sup>st</sup> looked at bivariate correlations to identify satisfaction and improvement metrics that were significantly correlated with renewal intentions.
- Variables that were significant at the bivariate level were included in the multiple regression.
- 11% of renewal intentions were predicted by satisfaction with center research, meetings, and administration, as well as project selection and intellectual property management  $F(5, 240) = 5.842, p < .001, R^2 = .111$
- Members who are more satisfied with center research had significantly greater intentions to renew their membership.

Renewal Intentions	B	SE	$\beta$	<i>t</i>	<i>p</i>
Satisfaction: Center Research	.228	.074	.244	3.097	.002**
Satisfaction: Center Meetings	-.056	.082	-.056	-.675	.500
Satisfaction: Center Administration	.108	.076	.113	1.415	.158
Areas for Improvement: Project Selection	-.094	.109	-.056	-.863	.389
Areas for Improvement: IP Management	-.225	.128	-.109	-1.755	.081



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# FY2019 IAB Comments for NSF



- *“The value of networking among IAB members and faculty have resulted in meaningful exchange of ideas and further work and product improvement.”*
- *“The research has helped us during bring-up and test to get through issues much faster than re-inventing the wheel ourselves.”*
- *“Student interns from [Center] have been excellent and have contributed to our projects.”*

- *“Still concerned with efforts to grow membership and diversify the kinds of end market industries involved in the Center.”*
- *“Some of the faculty could be more vested in the program (industry and university together) rather than projects only.”*

- *“Requirement for a new university to bring 5 new industry members seems heavy. Perhaps a requirement that allows the natural growth of the center to a particular size would allow a new university to join (with perhaps 1 or 2 new companies).”*



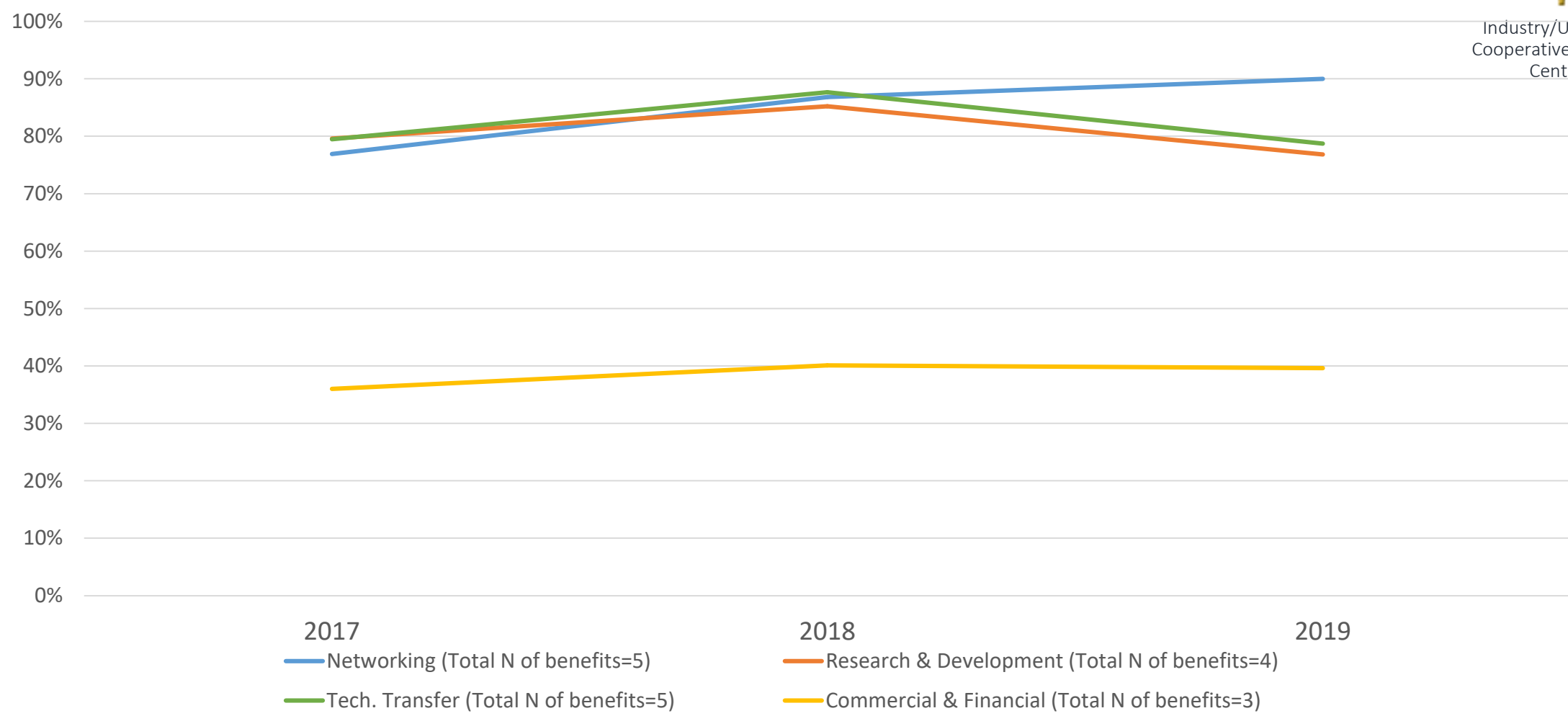
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# Industry Benefits Inventory



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# FY2019 Percent of IAB Members Reporting Any Benefit: by Category

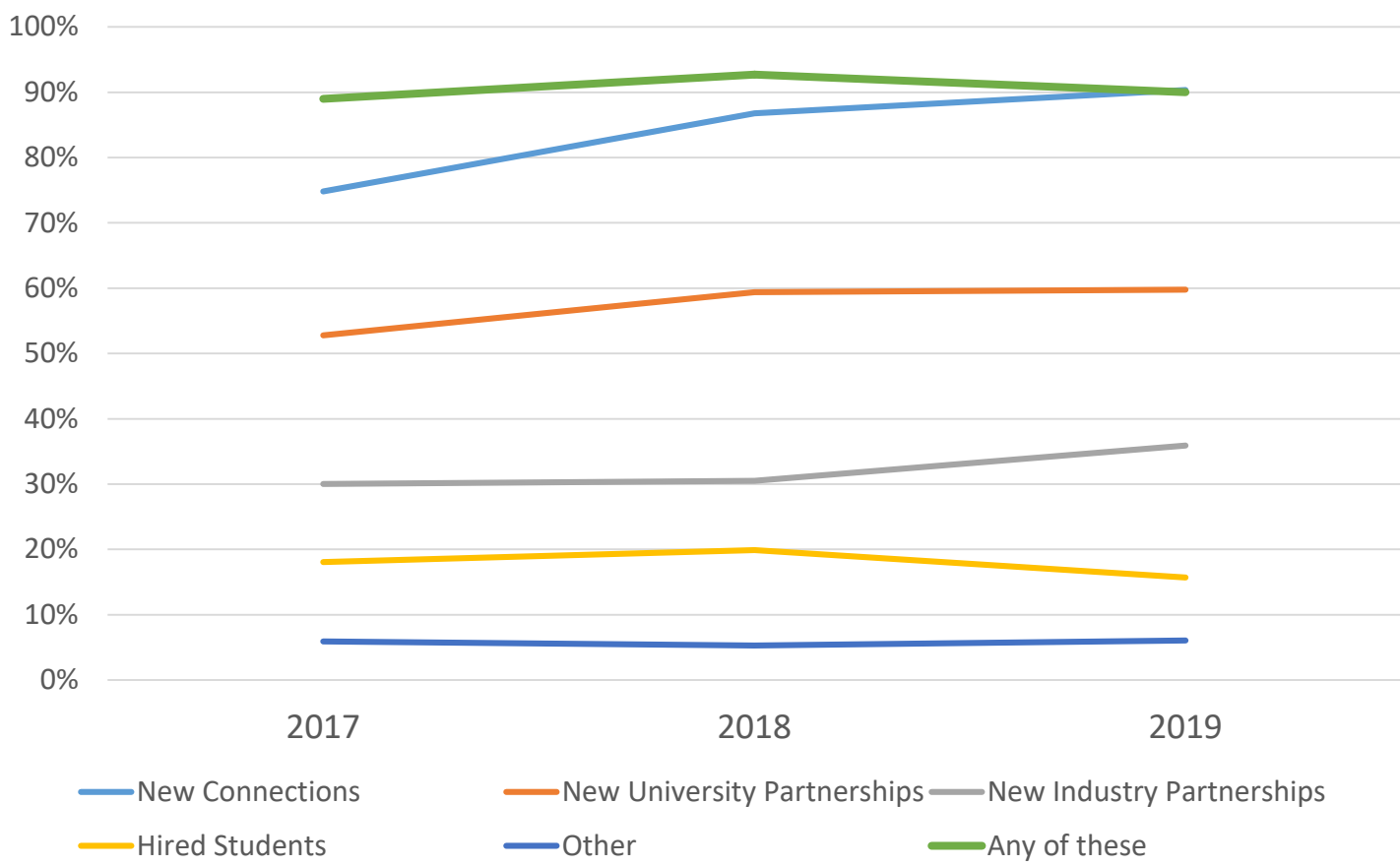




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# Networking Benefits Summary: Over Time

% of Members Reporting Networking Benefits



*“The connections with universities and professors have been great for hiring students that are prepared for work in industry. The research has potential for influence in industry, but nothing has yet directly made it into our industry work.”*

*“We have been able to enter completely new areas through connections with other industrial members and with students through the universities.”*

*“New partnership created which is resulting in the sale of one of our assets to the another IAB member.”*

*“Allowed more cross-collaboration between companies and to work on mechanistic models that address industry concerns using the consortium. High value add!”*

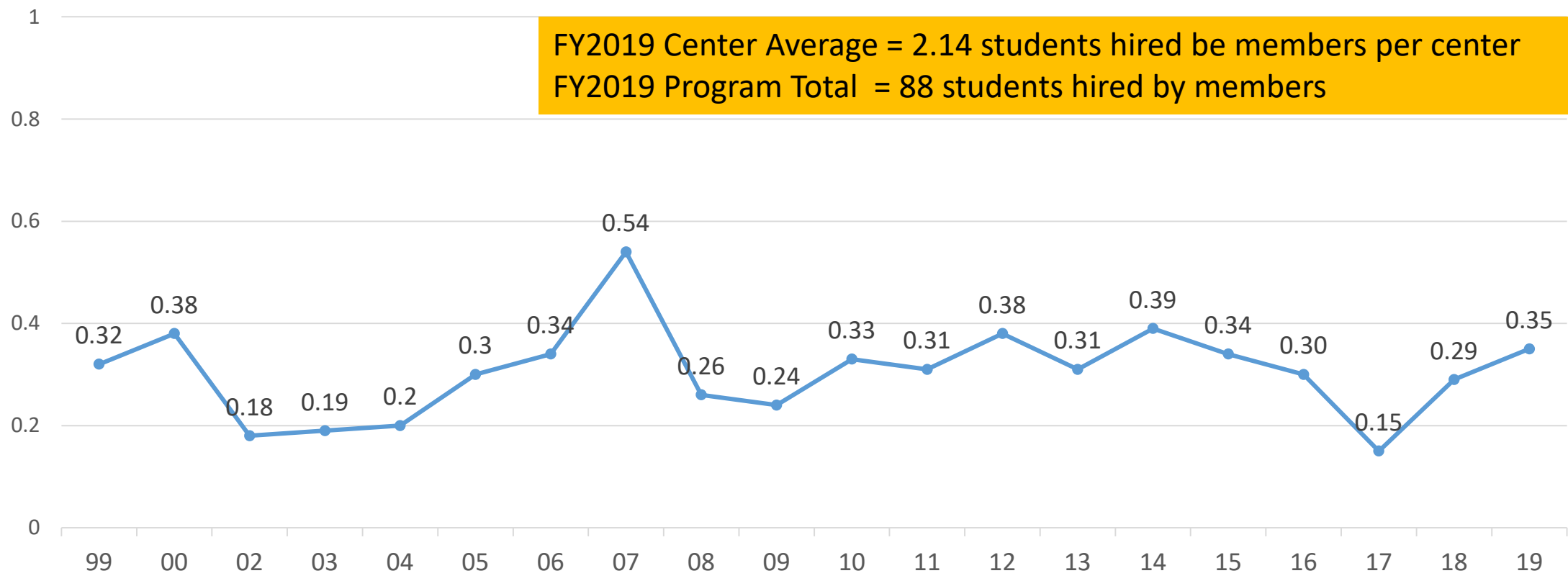


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# Networking Benefits: Students Hired by IAB Members Over Time

Average Students Hired per Member Firm

FY2019 Center Average = 2.14 students hired be members per center  
FY2019 Program Total = 88 students hired by members



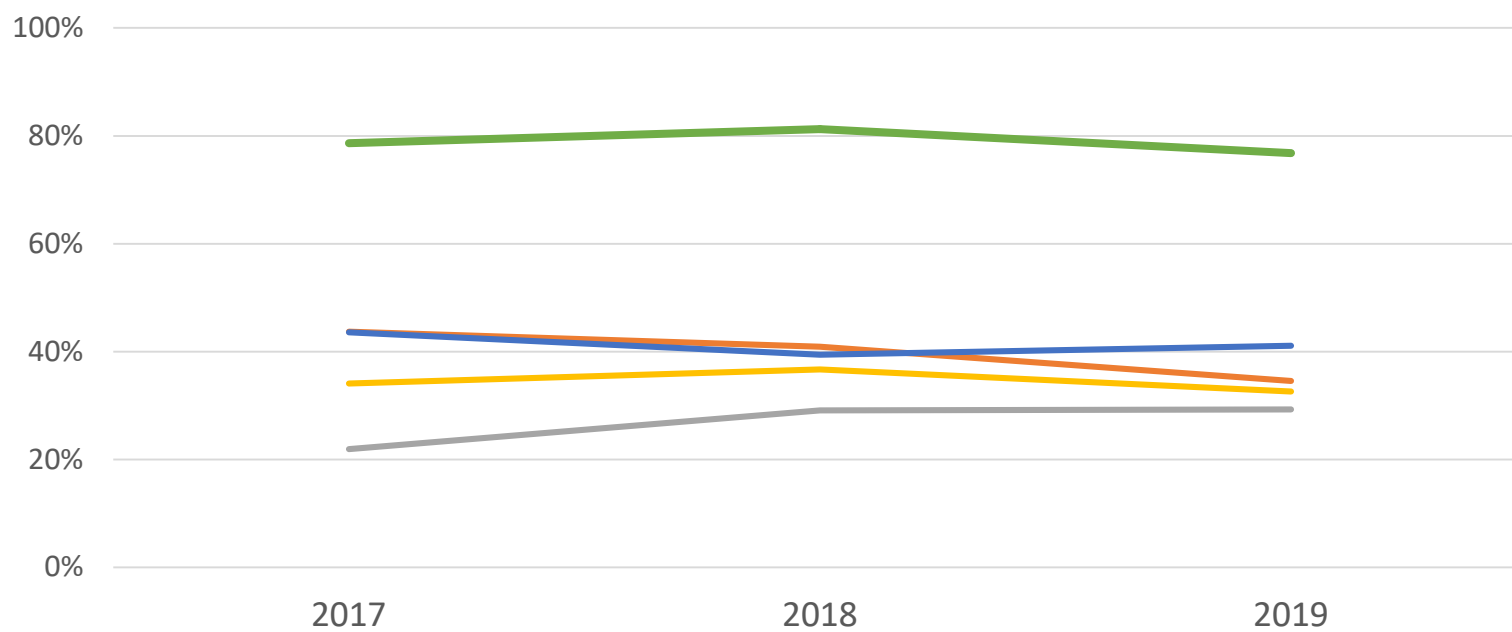




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# R&D Benefits Summary: Over Time

% of Members Reporting R&D Benefits



- Helped accelerate pace or completion of some R&D projects at your org.
- Helped org. decide against starting 1+ new R&D projects that otherwise would not have been initiated
- Triggered dev. of new R&D projects or significantly redirected pending projects within org.
- Helped advance the TRL of tech. being developed within your org.
- Any of These

*“[The Center] enables us to peer 'behind the curtain' of academic research and the research interests of our customers. **This is immeasurable in most ways, though could be considered in cost terms to save us \$100-200k per year of projects we did not have to run that would be dead-ends, or staff we didn't need to hire**”*

*“Developing experienced students, grad students, and professors as potential resources, future hires, or research partners - \$500K”*

*“Primary benefit has been access to and collaboration with experts in our domain. **We expect this to result in a new product line to be offered for sale in 2021 by our company.**”*

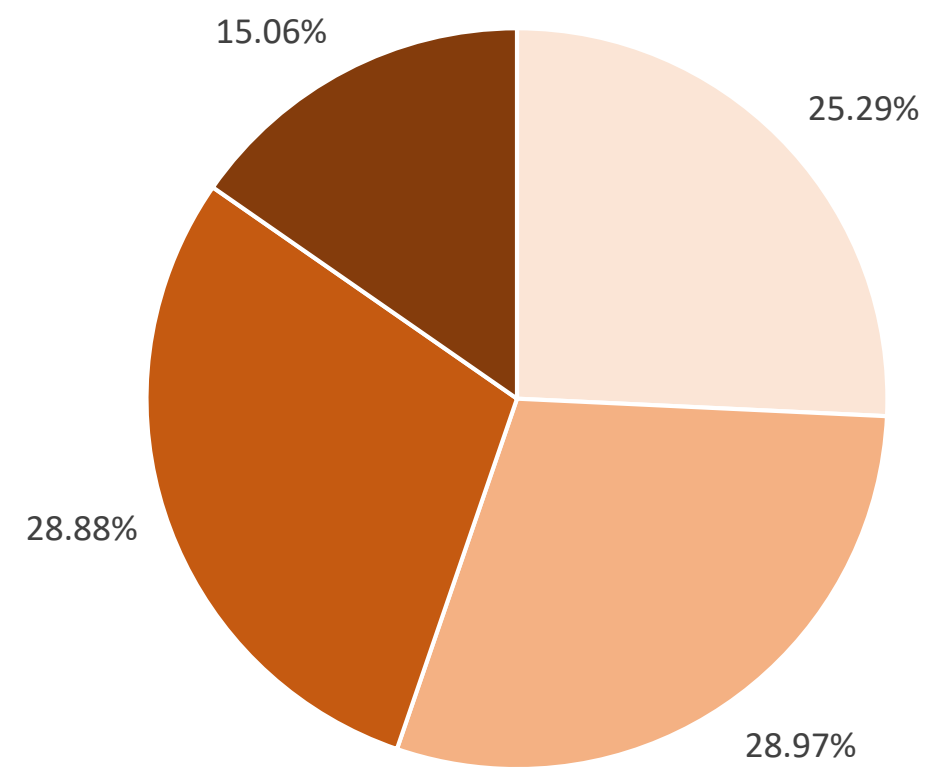
*“**The time and capital equipment saved through this project has been significant. Time saved: 2 weeks. Capital equipment savings - too large to quantify.**”*



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# FY2019 R&D Benefits: Research Relevance for the Average Member

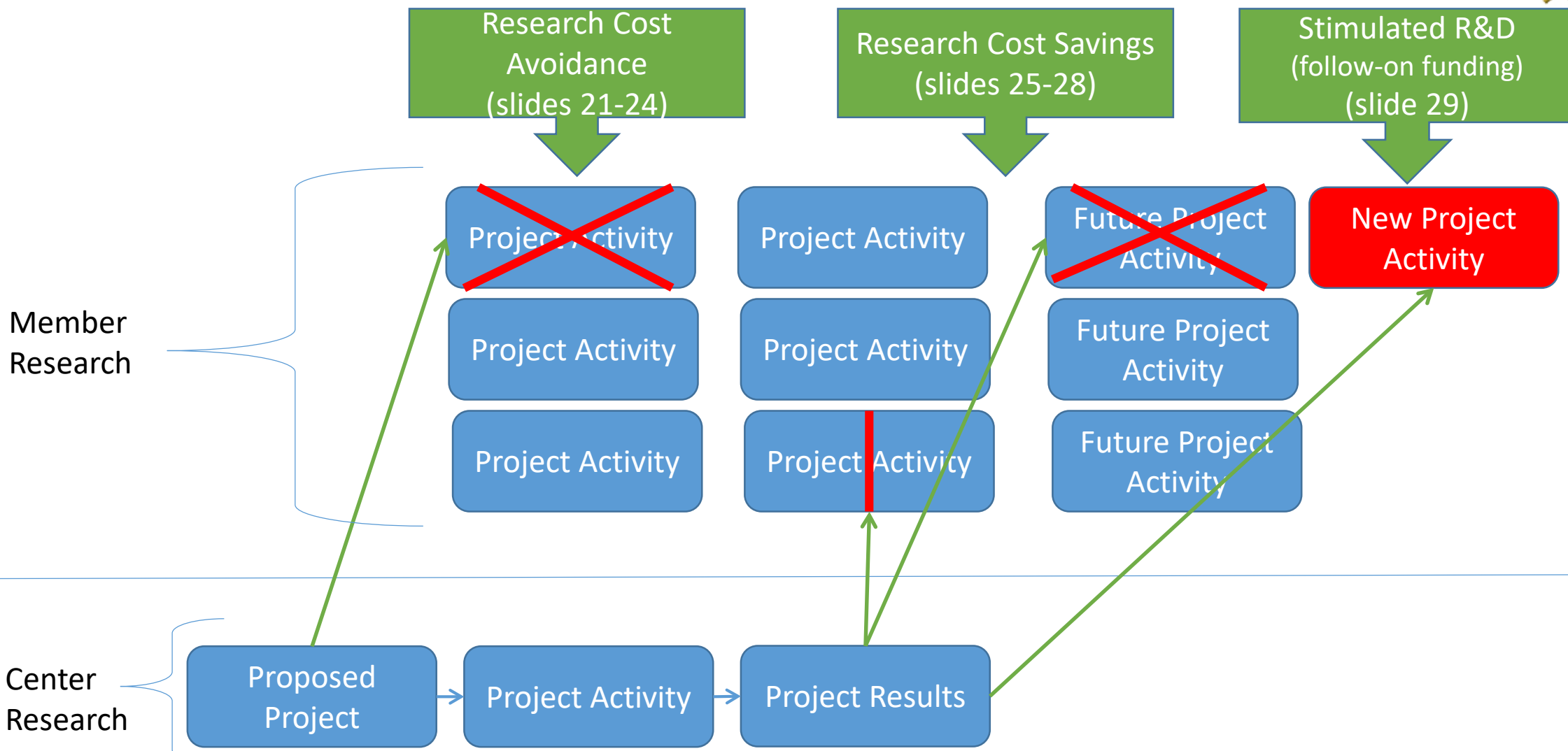
For an Average Member, 73% of Center research projects are relevant.



- Not Relevant Research: % projects that are probably not relevant to your organization's current or future needs
- Adjacent Research: % projects potentially relevant to your org's current or future needs, but in area outside your org's current focus
- Core Research: % projects so relevant to your org's needs that your org. would almost certainly have conducted/contracted out similar project within next couple years
- Transformational Research: % projects potentially relevant to your org's current or future needs, but too risky/blue sky for internal investment



# Defining Research Efficiency Measures





# Research Cost Avoidance (RCA)

- 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.
- $RCA = N \text{ of Proj. Avoid} \times \text{Scien. Months} \times \$/\text{Scien. Months}$  (Gray & Steenhuis, 2003)
  - N of Proj. Avoid = N of Center projects (CD report) X % Core projects (Benefits Inventory)
  - N Scientist months = 5 year median



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# R&D Benefits: Research Cost Avoidance (in thousands)

- Sample: N of respondents = 357, N of centers = 54

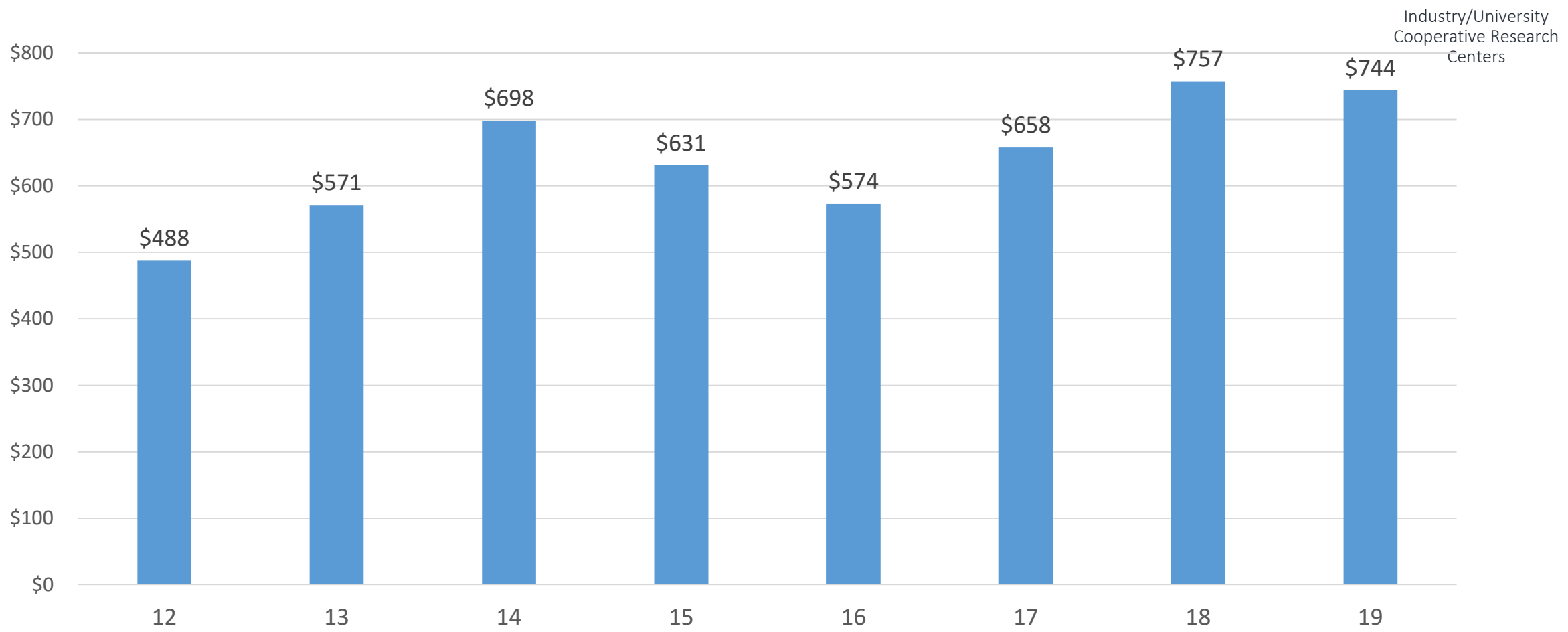
Calculation: (N of Core Projects \* 12 months \* Average cost per scientist month) – Primary Membership Fee

Member Level Scores	Mean	Median	S.D.
a. Average dollar value of avoided projects per respondent organization	\$744.13	\$554.52	777.77*
Center Level Scores	Mean	Median	S.D.
b. Average dollar value of avoided projects per respondent organization	\$5,357.76	\$3,085.75	\$6,703.55
Program Level Scores	Sum		
c. Total dollar value of avoided projects by respondent organizations RCA program = Sum of member level RCA	\$214,310,563		

\*31 members (11%) have negative RCA that results in large standard deviation.



# RCA Over Time: Member Level Average (in thousands)

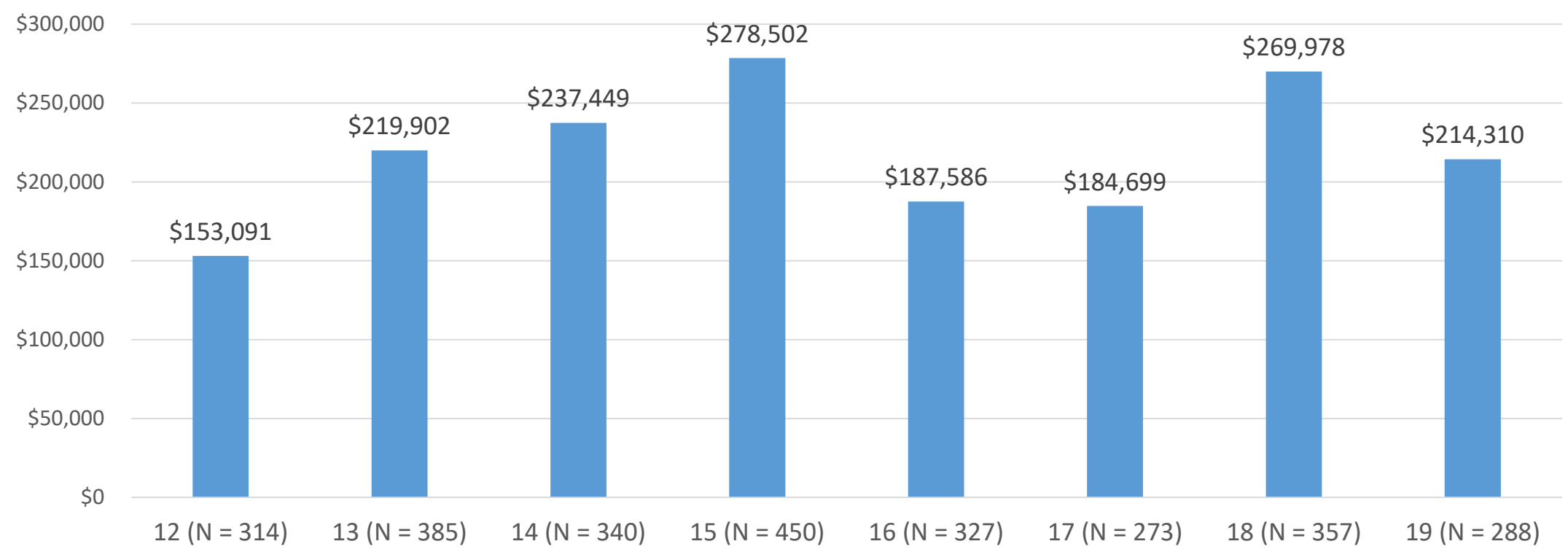


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# RCA Over Time: Program Level Total (in thousands)





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# R&D Benefits: Research Cost Savings

Research Cost Savings – estimated dollar value of research dollars saved

- Taking into account personnel, facility and related costs, how much would you estimate your organization saved by shortening project completion-time, reducing costs and/or by choosing not to start new research?

Level of Analysis	Dollar Value
Member Level Average	\$102,980
Center Level Average	\$509,470
Program Total Reported	\$19,360,000



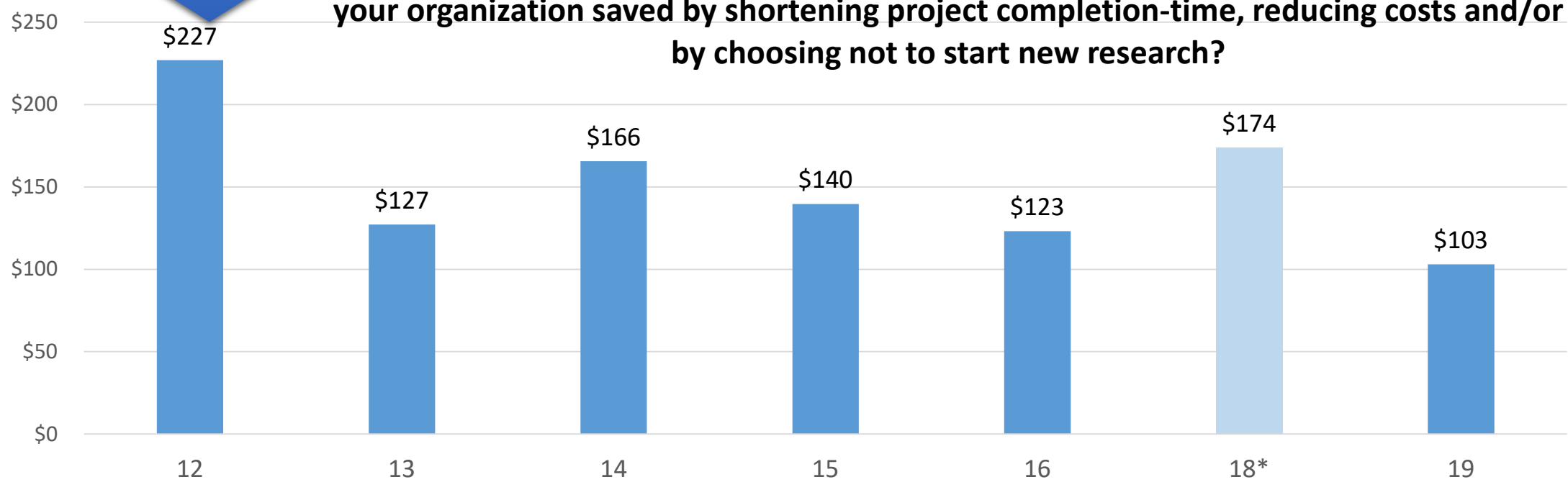


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# Research Cost Savings Over Time: Member Level Average (in thousands)

First year  
reporting  
bias?

**Taking into account personnel, facility and related costs how much would you estimate your organization saved by shortening project completion-time, reducing costs and/or by choosing not to start new research?**



\*For FY2018, the dollar value questions were administered to only a *sample* of 12 centers as part of the experiment to test their effect on the Benefits Inventory's response rate. Metric not collected in FY2017.

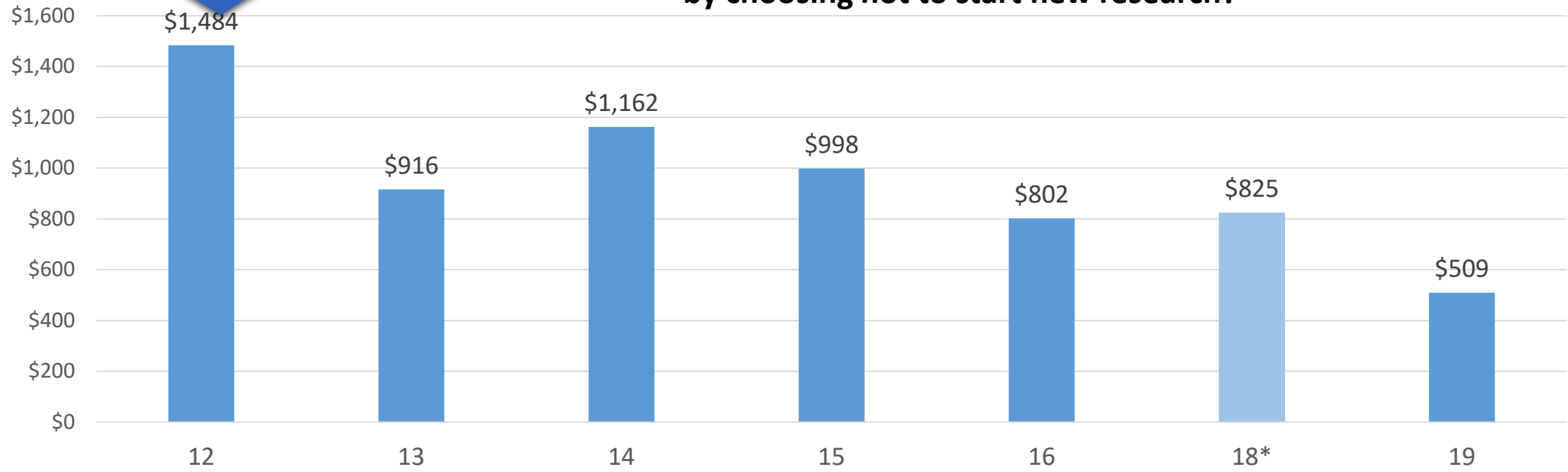


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# Research Cost Savings Over Time: Center Level Average (in thousands)

First year  
reporting  
bias?

**Taking into account personnel, facility and related costs how much would you estimate your organization saved by shortening project completion-time, reducing costs and/or by choosing not to start new research?**



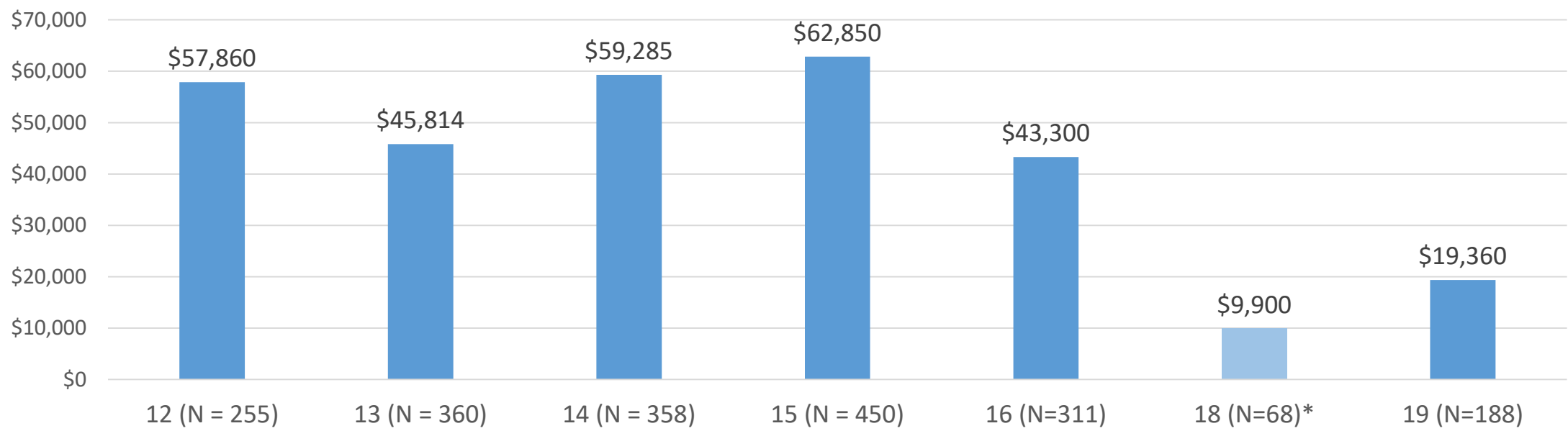
\*For FY2018, the dollar value questions were administered to only a *sample* of 12 centers as part of the experiment to test their effect on the Benefits survey's response rate. Metric not collected in FY2017.



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# Research Cost Savings Over Time: Program Level Total (in thousands)

**Taking into account personnel, facility and related costs how much would you estimate your organization saved by shortening project completion-time, reducing costs and/or by choosing not to start new research?**



\*For FY2018, the dollar value questions were administered to only a *sample* of 12 centers as part of the experiment to test their effect on the Benefits survey's response rate. Metric not collected for FY2017.



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# Follow-on Funding Over Time: Program Total (in thousands)

Dollar value of new R&D projects, or significantly redirected pending projects within  
your organization

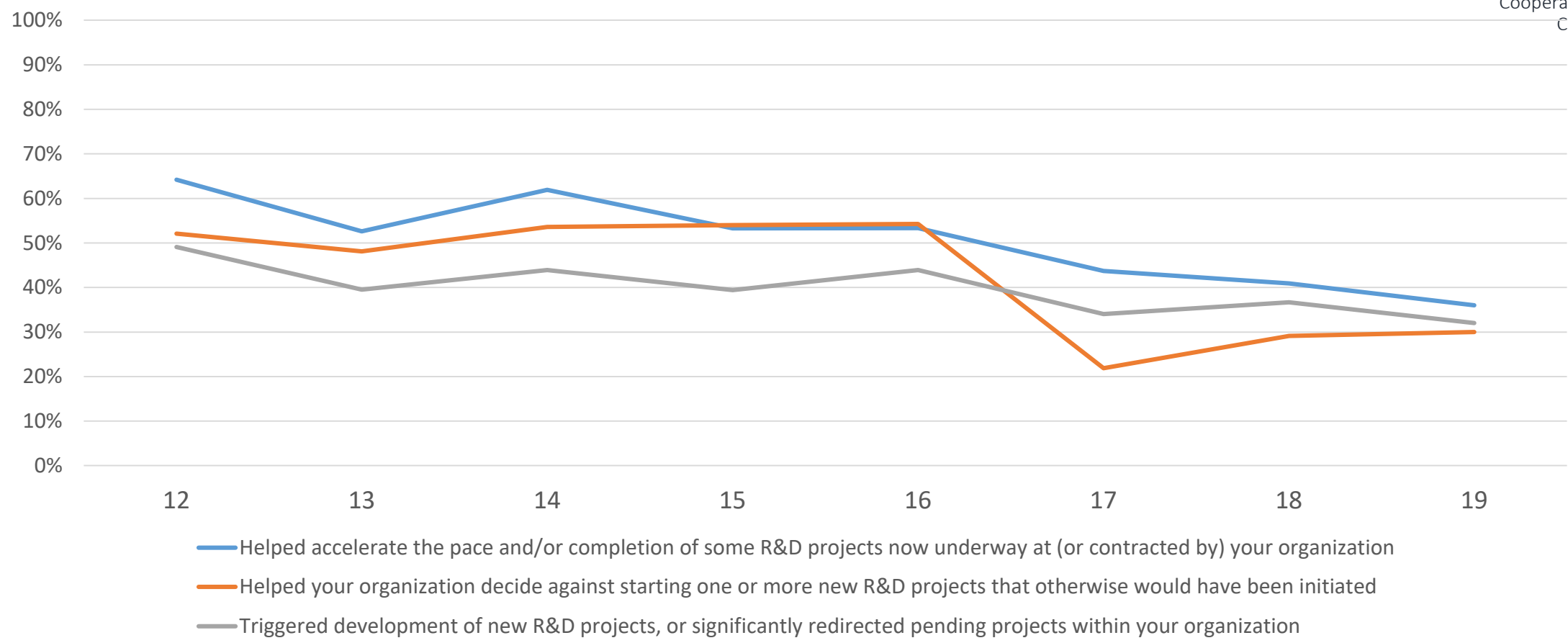


\*For FY2018, the dollar value questions were administered to only a *sample* of 12 centers as part of an experiment to test their effect on the Benefits survey's response rate. Metric not collected for FY2017.



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# R&D Impacts: Trend Over Time

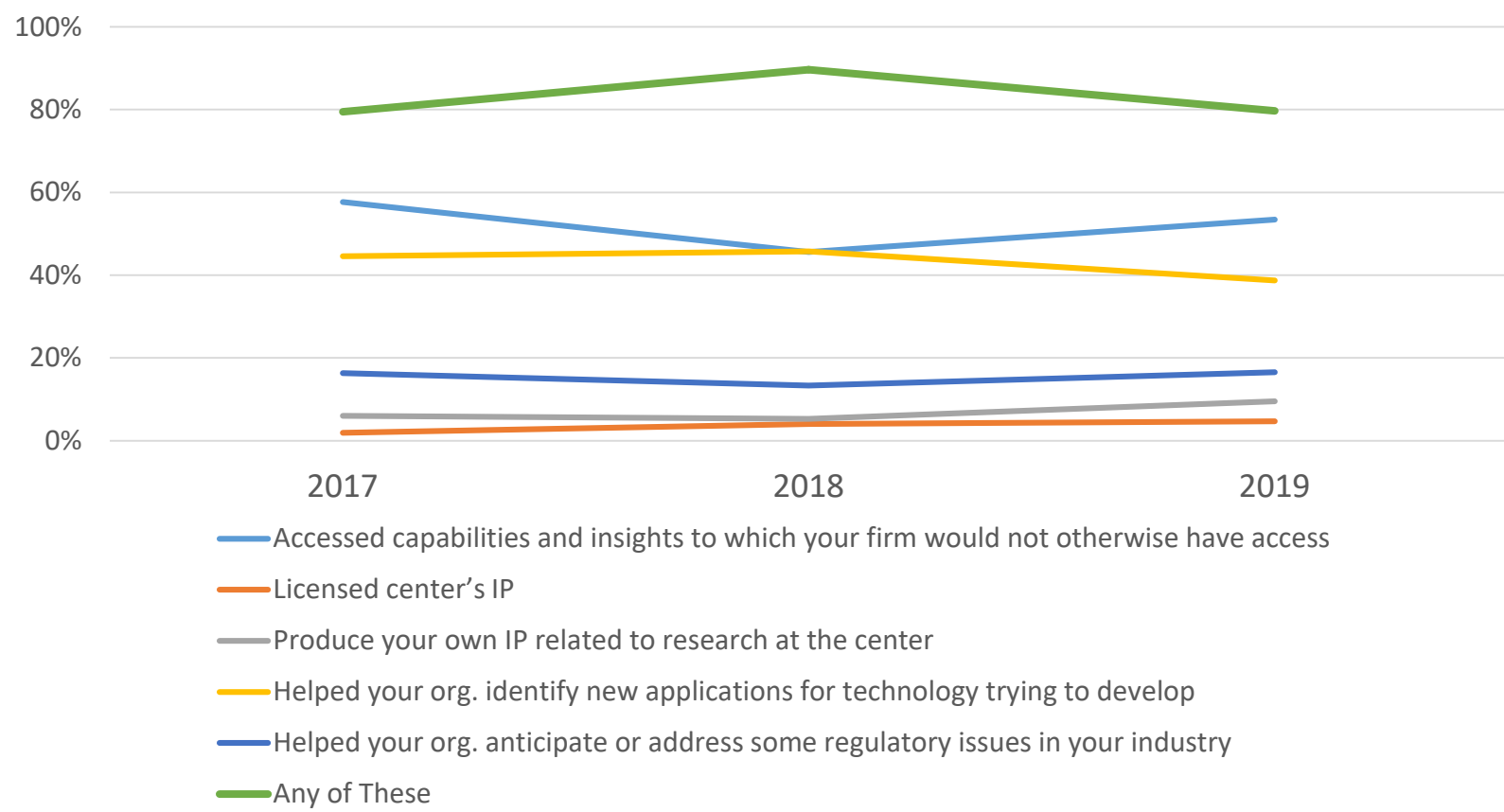




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# Technology Translation Benefits Summary: Over Time

% of Members Reporting Technology Translation Benefits



*“A reduction in the unknowns and a **better understanding of the challenges** associated with the approach being researched. Economic value is in terms of a reduction in the time until the approach might be commercially realizable.”*

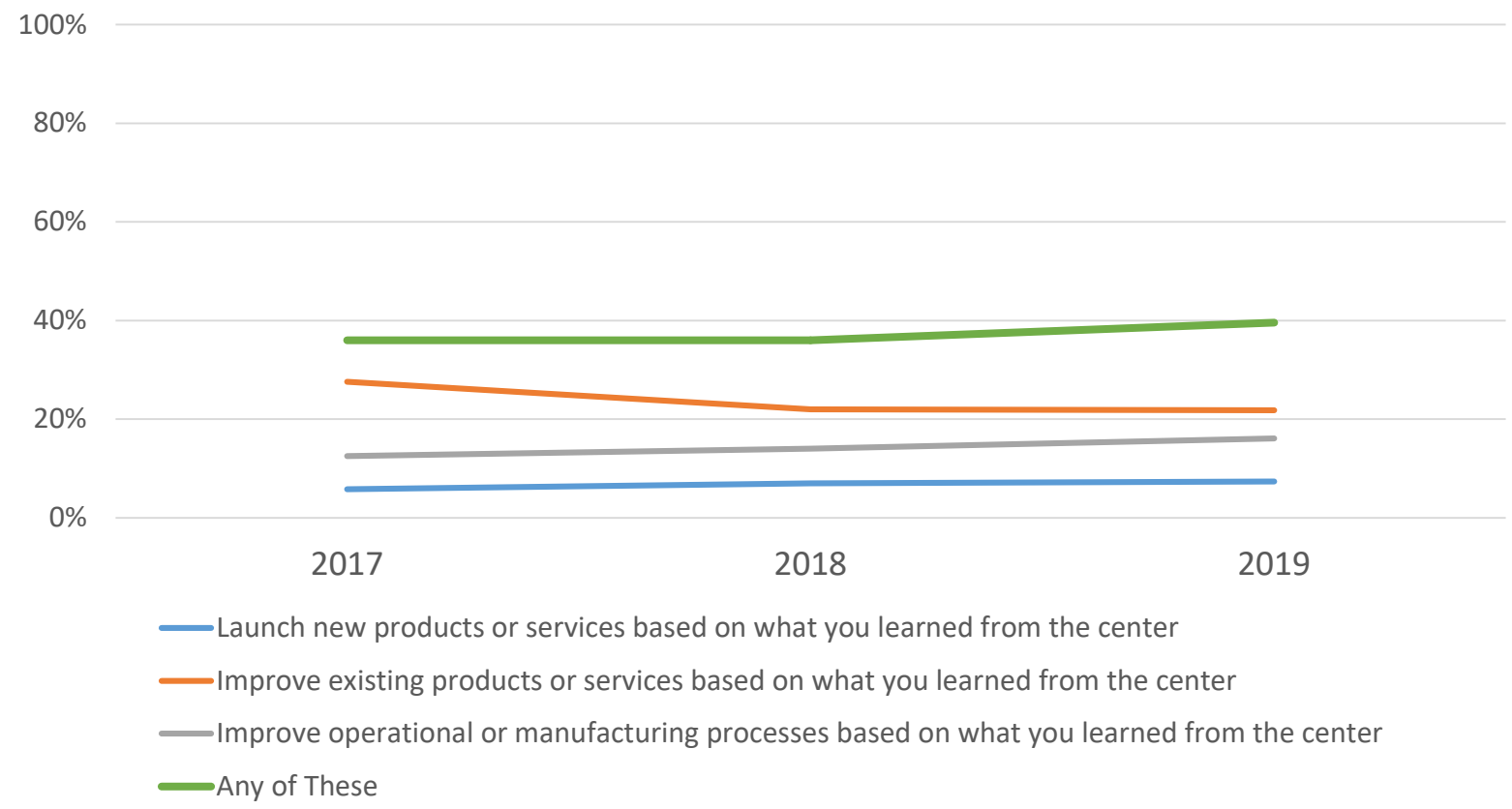
*“From the technology we've adopted from [Center] research, it has given us **140x faster time to a solution with higher accuracy.**”*



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# Commercial & Financial Benefits Summary: Over Time

% of Members Reporting Commercial Benefits



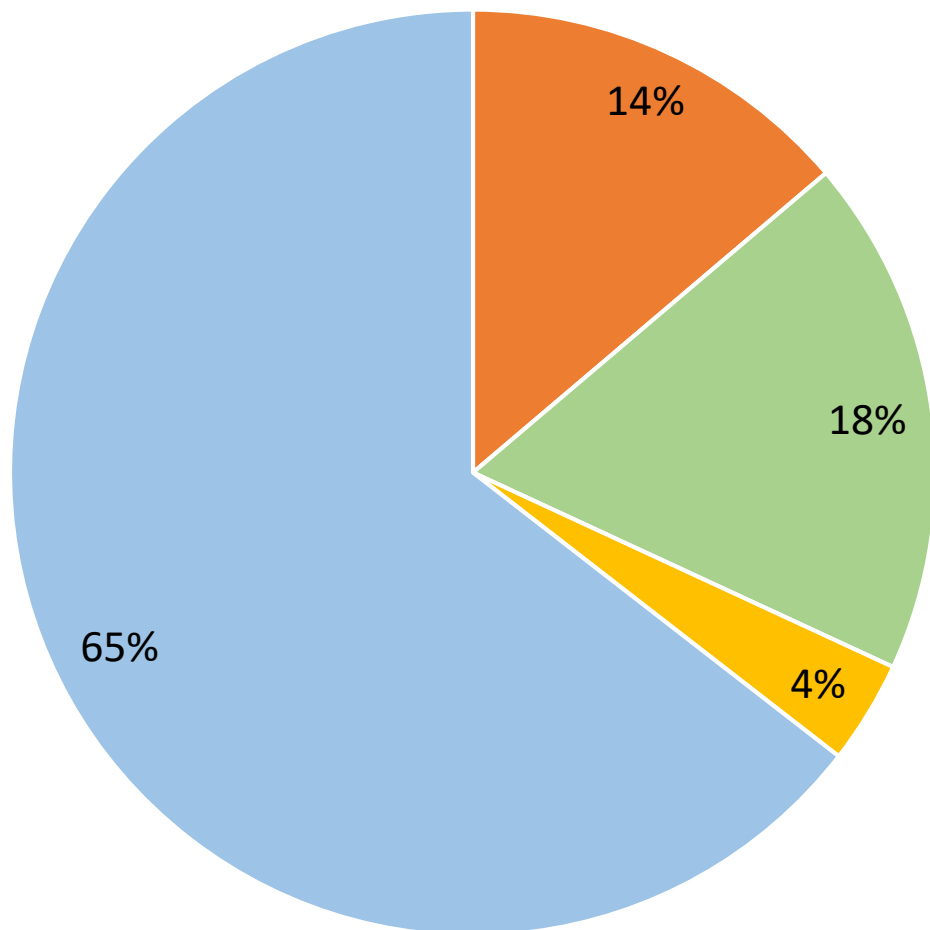
*“We learn how our tools are/can be used in different and new applications - we also benefit by transferring knowledge and training the students to use our software. The next generation of students graduate knowing the benefit of our tools, and that can translate to sales for us down the road, and the use of our tools for R&D in other organizations helps them save time and money.”*



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# FY2019 Center Contribution to Commercial Outcomes

Would these commercial or financial benefits have been realized in the absence of the center?



- No, the center played a critical role in realizing these benefits
- Yes, but the benefits would have been delayed without the center's involvement
- Yes, the center had only limited influence on our ability to realize these benefits
- Not applicable





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# FY2019 Effect of Member Years on Benefits Realized

- Wanted to know if there is any relationship between time as a member and the types of benefits realized.
- Ran a bivariate correlation to identify benefits that were correlated with years as a member. Benefits that were significantly correlated at the bivariate level were included in a multiple regression.
- Members years significantly predicted number of Technology Translation benefits  $F(2, 259) = 4.565, p = .011$ . Members with more years of participation reported realizing a higher number of technology translation benefits during the reporting period.
- Specifically, members with more years of membership were more likely to report that they licensed Center’s IP (technology translation benefit) during the reporting period,  $F(1, 259) = 11.646, p = .001$

Member Years	B	SE	$\beta$	t	p
N of Technology Translation Benefits	.043	.014	.185	3.021	.003**
Tech. Transfer: Licensed Center’s IP	.011	.003	.208	3.413	.001**



# FY2019 Examining Benefits by Organization Type

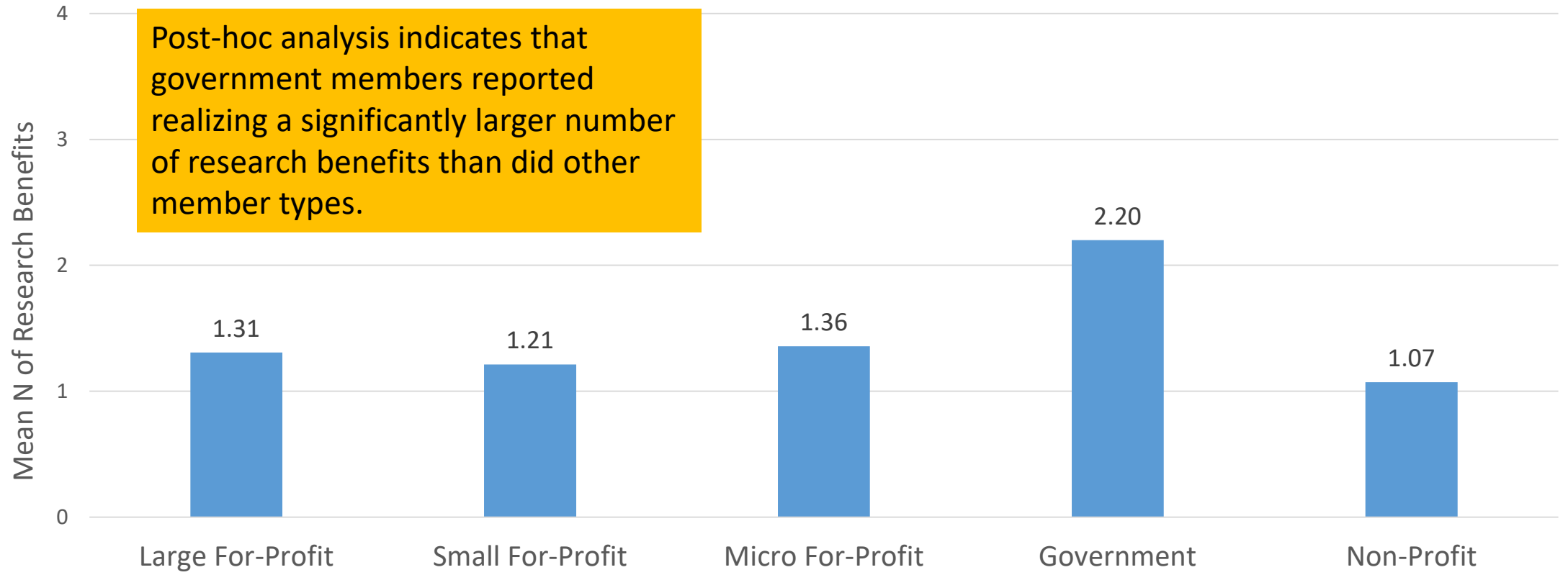
- Wanted to know if there are differences in benefits experienced by members based on organization type. Computed a sum of benefits score for each benefits category.
- Ran a bivariate correlation to identify clusters of benefits that were correlated with organizational type. The number of Research Benefits was significantly correlated at the bivariate level and were included in an ANOVA (due to the categorical nature of the organization type)
- There is a significant difference in the average number of research benefits realized by members from different organizational types,  $F(4, 265) = 5.956, p = .000$ .



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# FY2019 Examining Benefits by Organization Type

Mean N of Research Benefits by Organization Type



Post-hoc analysis indicates that government members reported realizing a significantly larger number of research benefits than did other member types.



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# FY2019 Understanding Government Research Benefits

- We wanted to know which research benefits specifically showed a significant difference for Government members compared to other member types.
- Ran a multivariate analysis of variance (MANOVA) to identify which specific research benefits differed across member organization types. Results from this analysis revealed a significant main effect of organizational type for research benefits,  $F(4, 261) = 1.836, p < .05$ . Follow-up univariate ANOVA's revealed a significant difference in the reported benefit "Helped accelerate the pace and/or completion of some R&D projects now underway at (or contracted by) your organization"; called research cost savings.
- Specifically, post-hoc analyses showed that Government members reported research cost savings significantly more than Large For-Profit Members and Micro For-Profit members.
- Notably, Government members demonstrated an observed average higher than each organization type for each research benefit item, despite not reaching significant levels.



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# Faculty Questionnaire

Select Results



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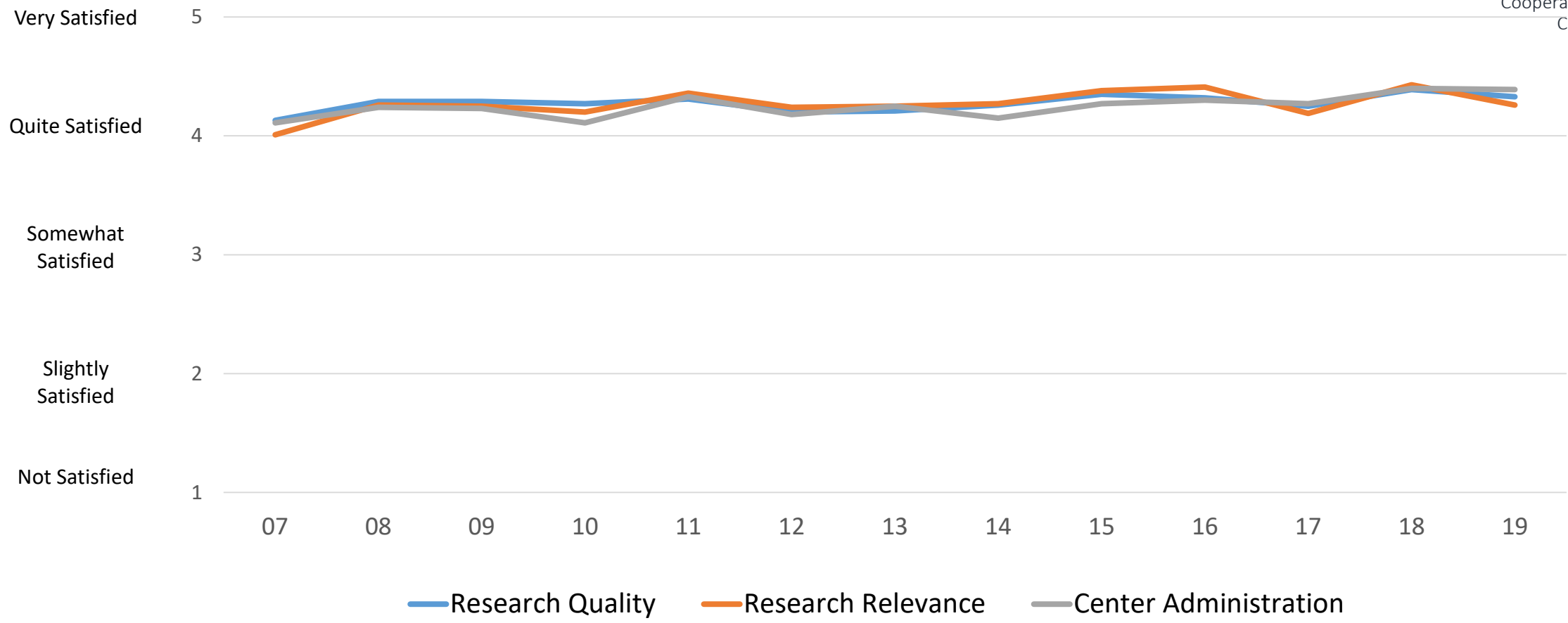
# FY2019 Faculty Long and Short Forms

	Long Form	Short Form
# of items	13	6
# of questions in common	6	6
# of unique questions	7	0
# of centers using form	20	17
Sample size	113	79



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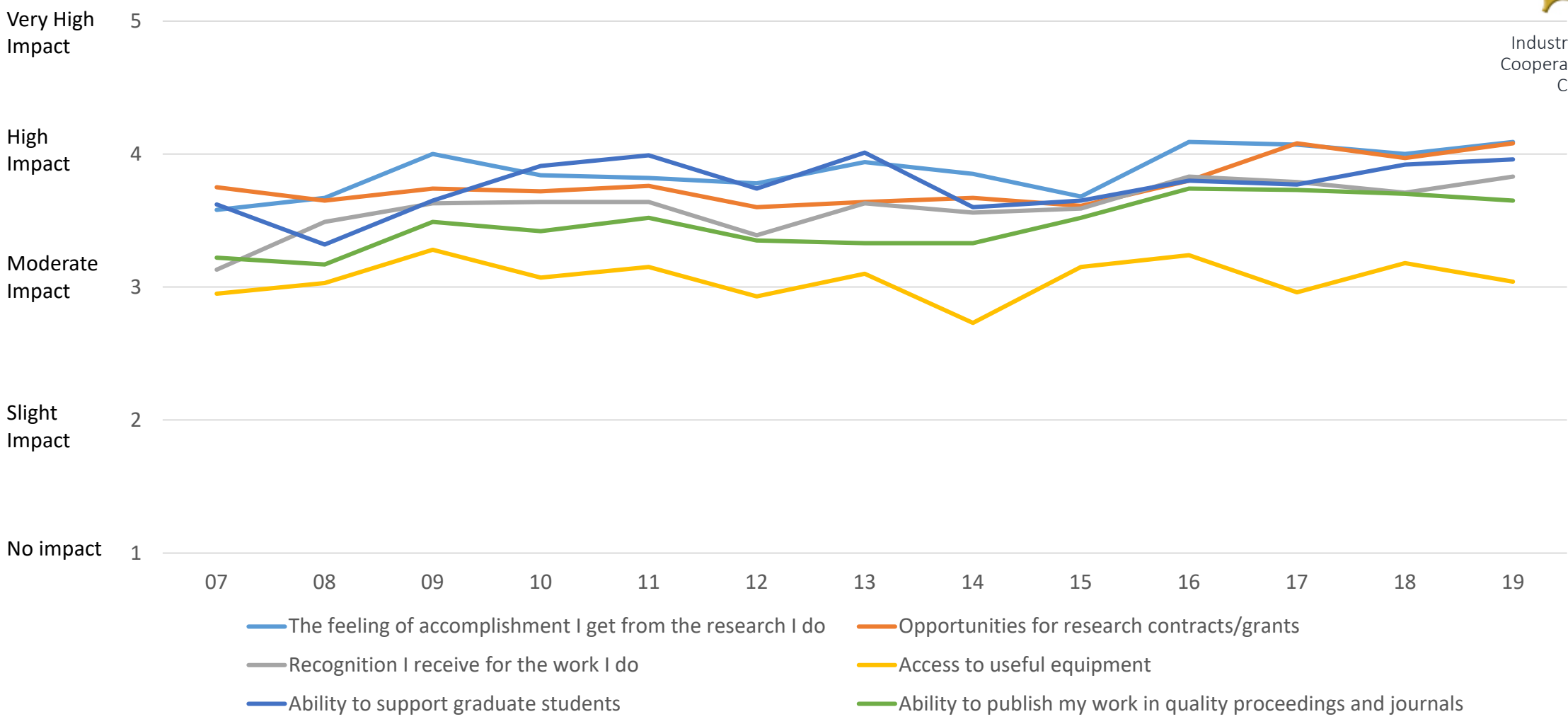
# Faculty Satisfaction Over Time





# Faculty Benefits Over Time (Long version only)

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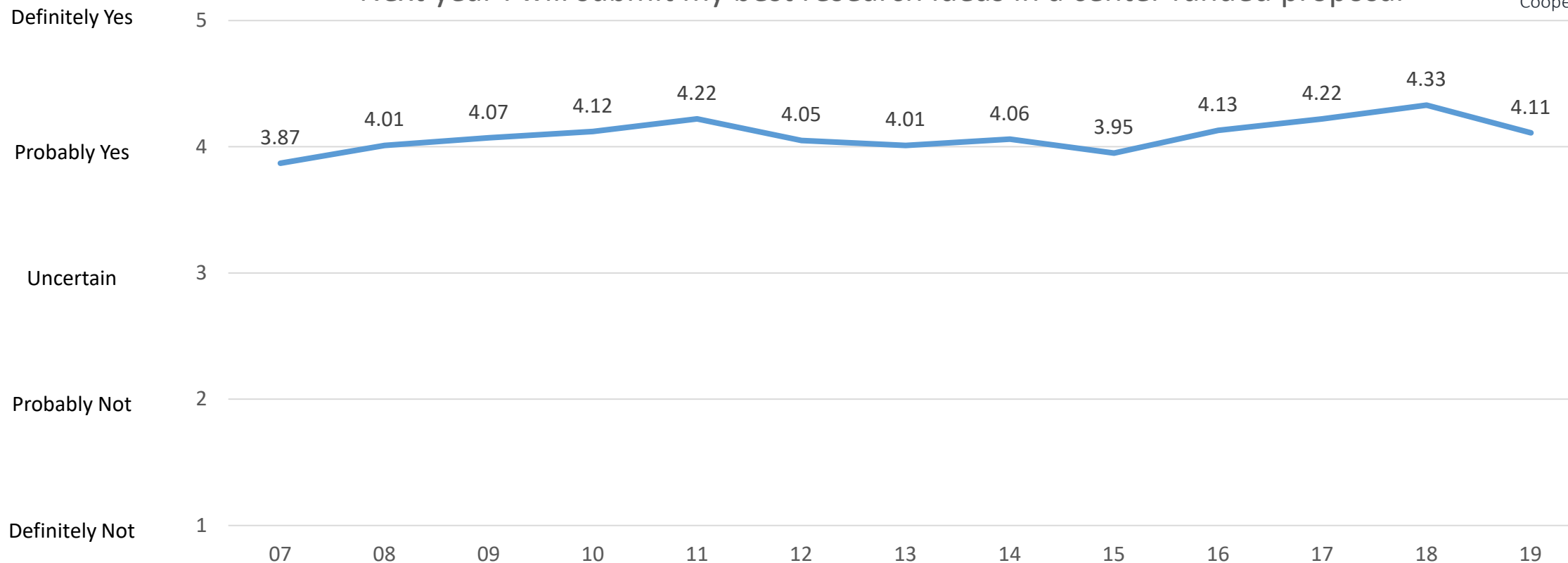




# Faculty Commitment Over Time

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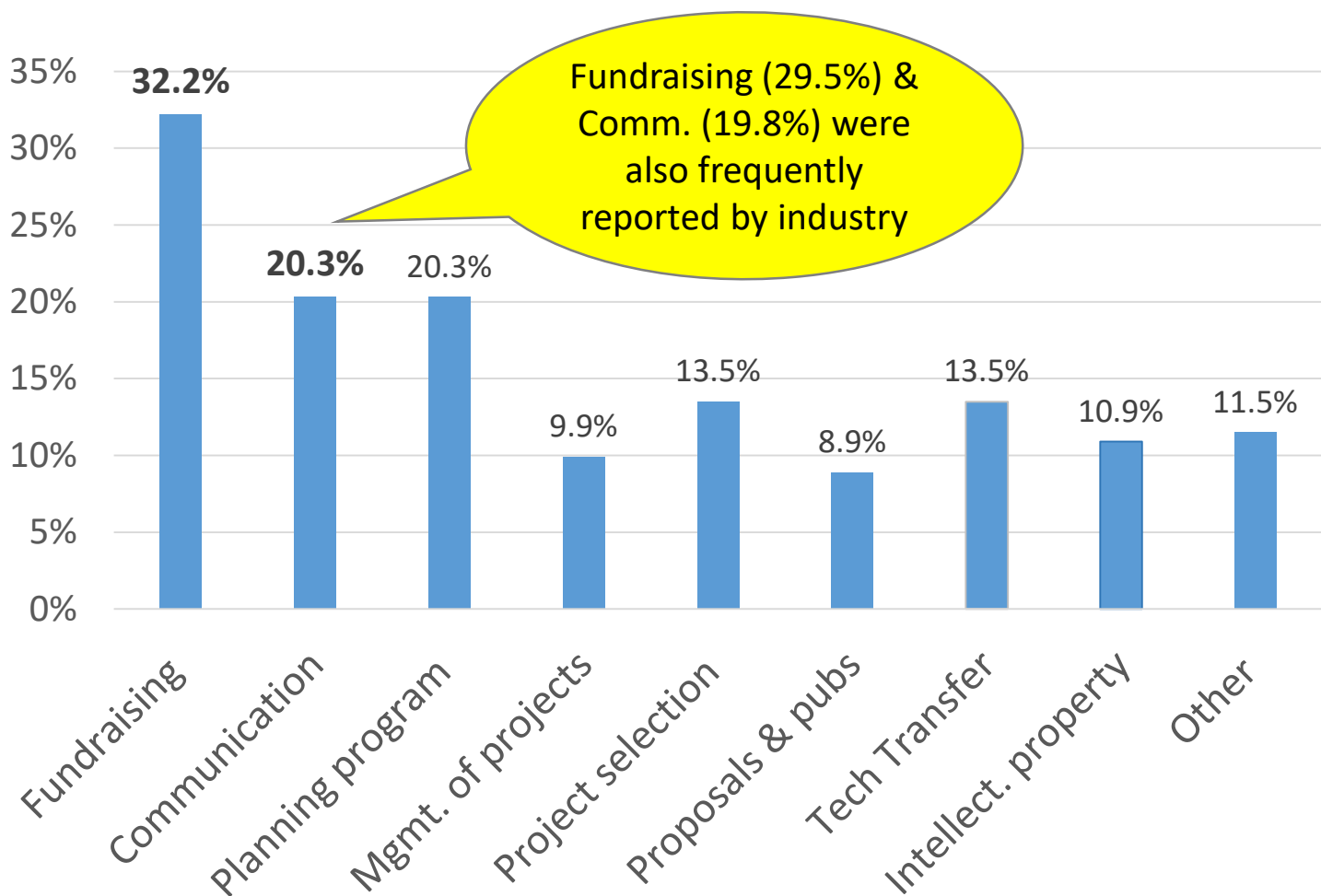
Next year I will submit my best research ideas in a center funded proposal





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# FY2019 Faculty Areas for Improvement



*“More collaboration across sites. Selection of focus areas. More collaboration would allow for pooling of limited funds and a have greater overall impact.”*

*“We can do a better job of cajoling our industry partners in the development of new proposals. We can meet more frequently for group project meetings between the Project Updates to the IAB.”*

*“The interaction between students and industry partners is absolutely critical to the graduate experience and understanding real world problems.”*



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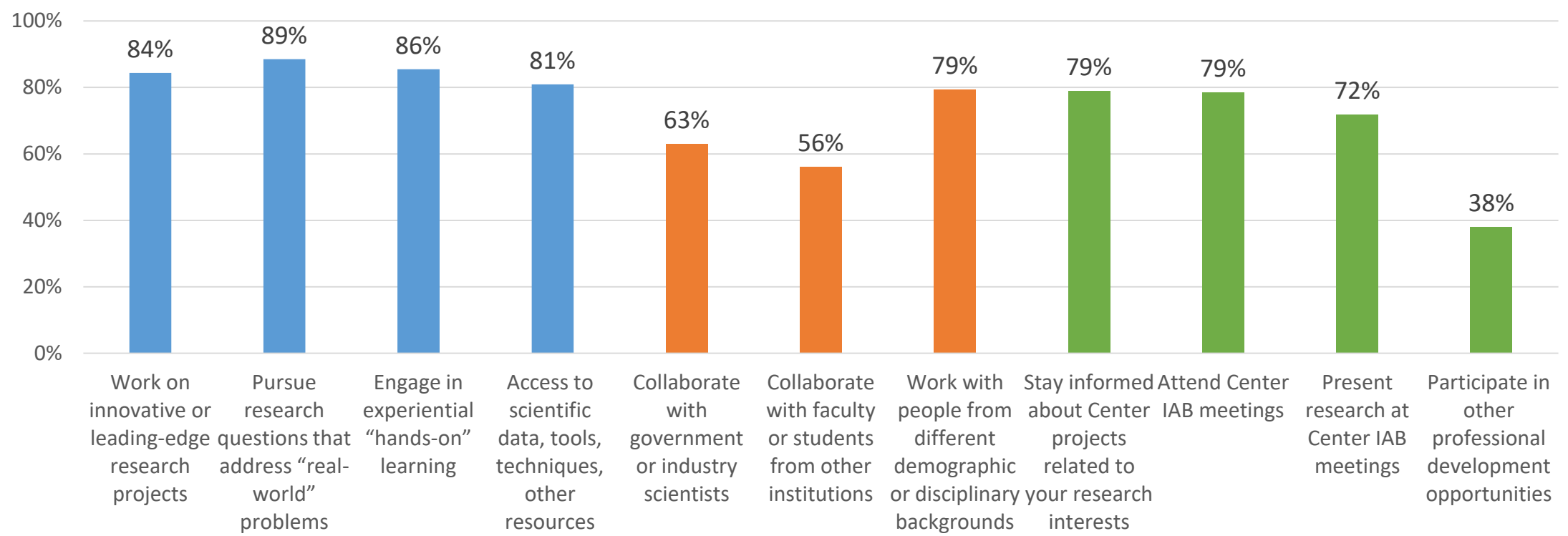
# Student Questionnaire



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# FY2019 Training Opportunities: Indicate whether your Center experience has included the following opportunities

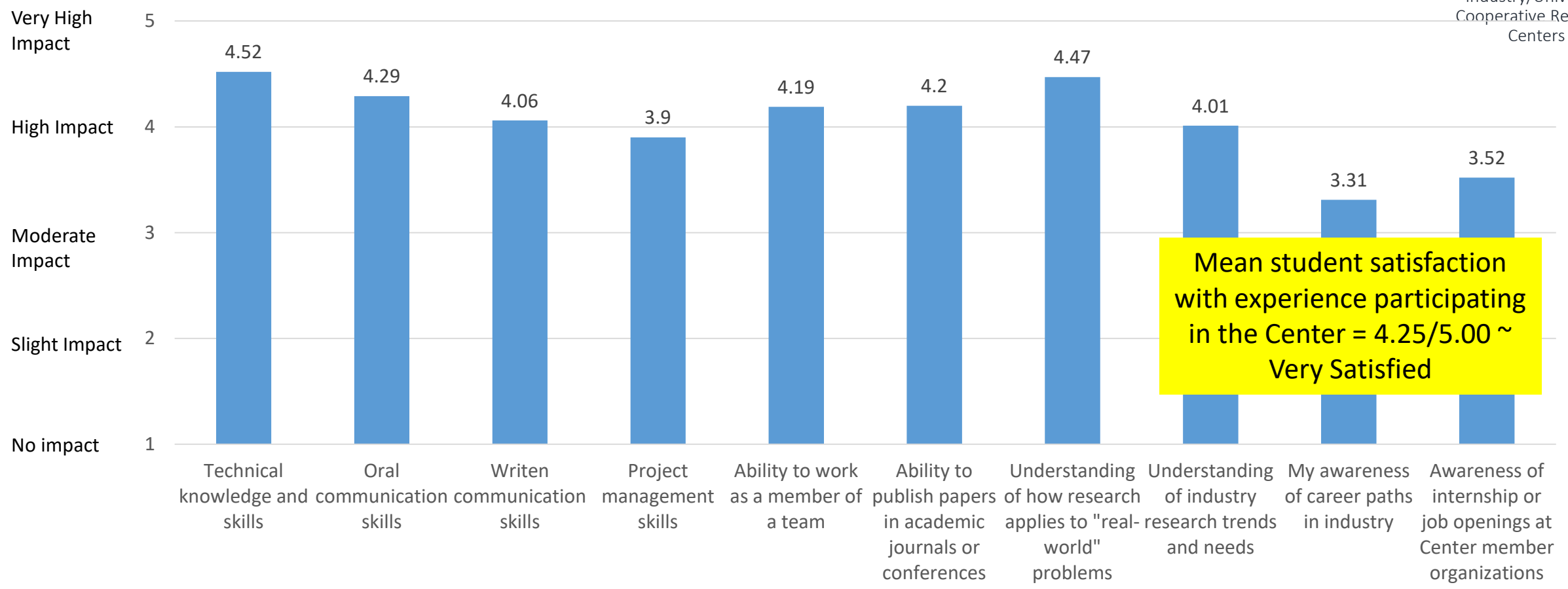
Please indicate whether your Center experience has included the following opportunities: Available and did participate





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# FY2019 Impact on Trainee Knowledge and Skills

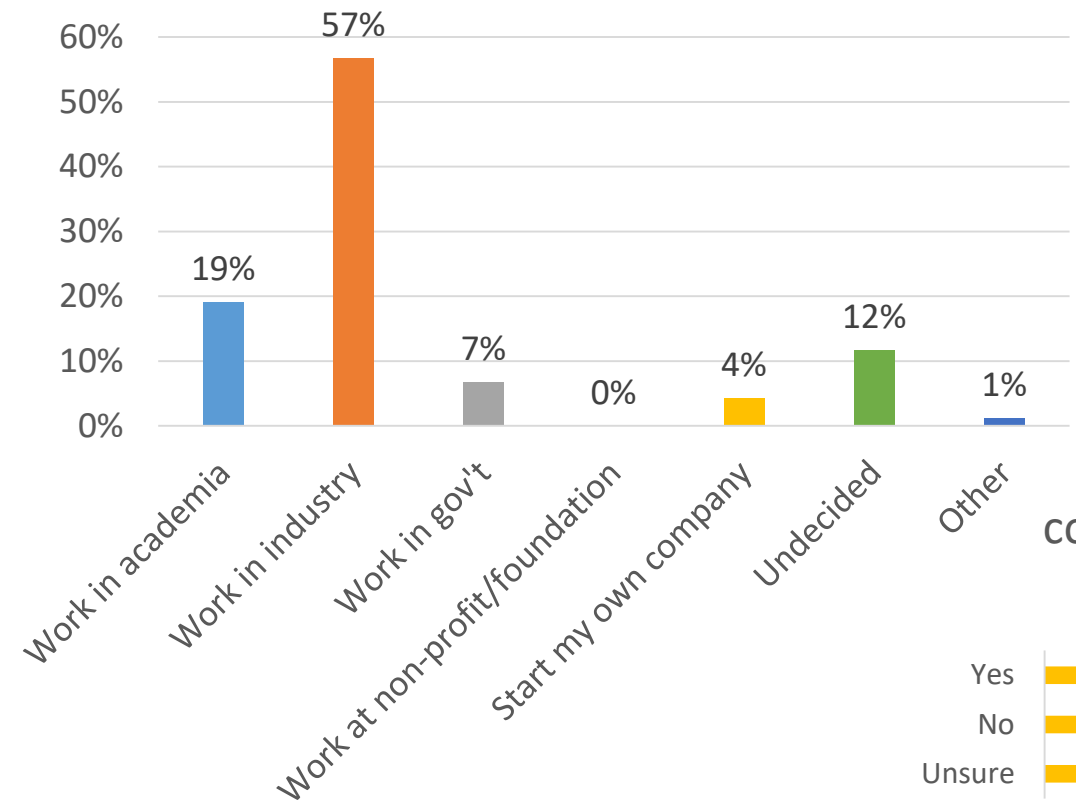




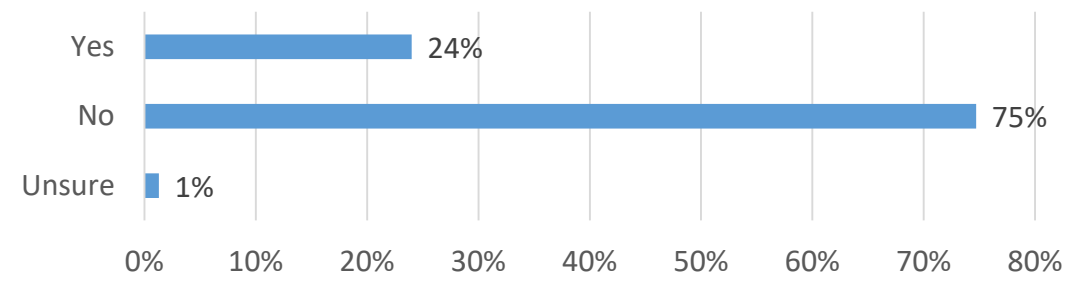
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# FY2019 Career Outcomes

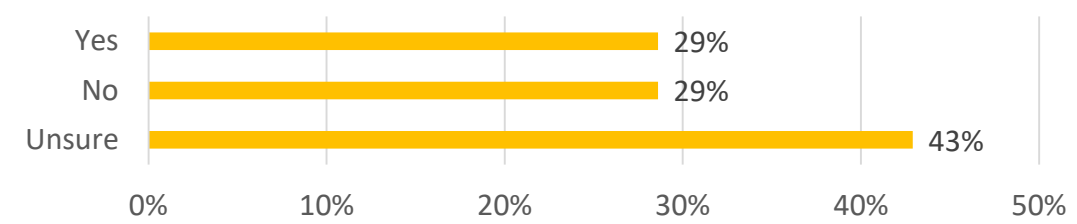
### Career Goals



### Has your career goal changed as a result of your Center participation?



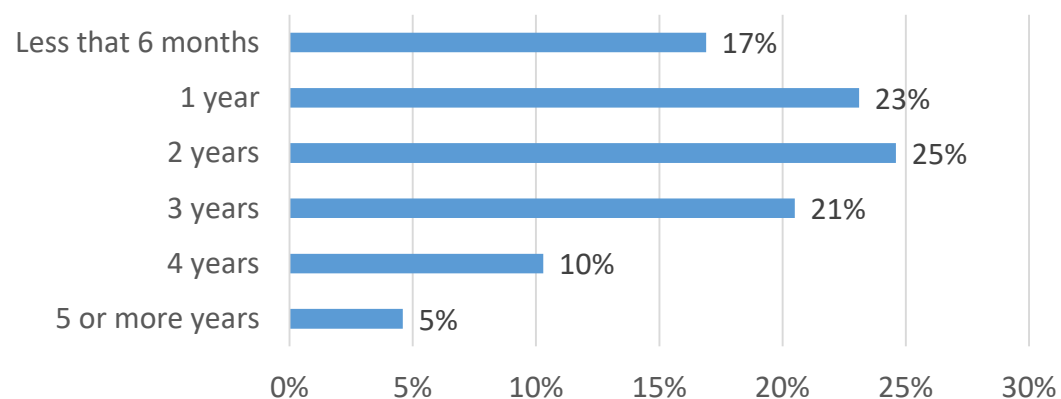
### [If starting own company] Will your company be based on an idea from your Center research?





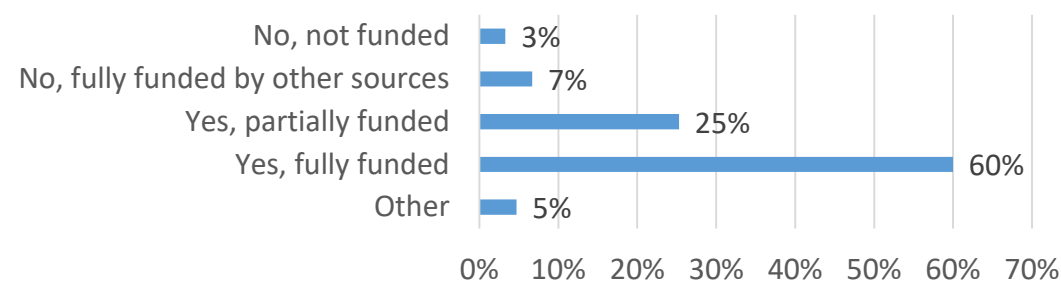
# FY2019 Trainee Characteristics

### How long have you been involved with the Center?

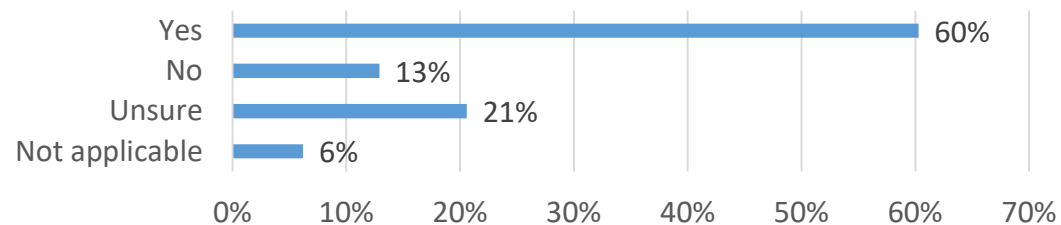


### Have you been funded by the Center with which you are affiliated?

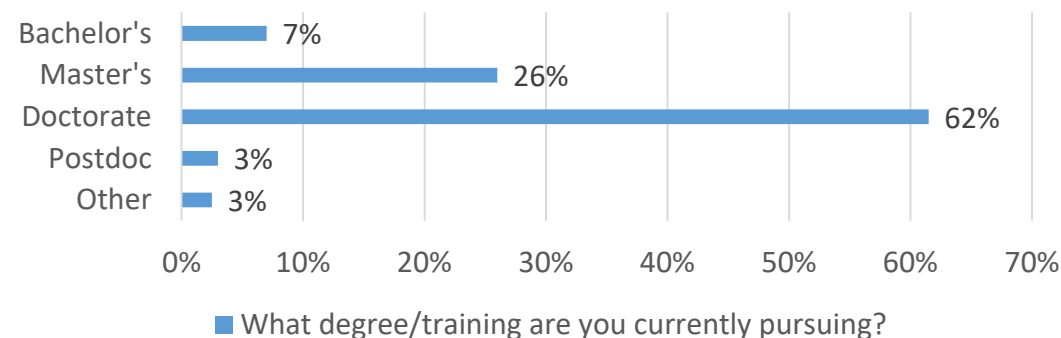
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### Will your thesis, dissertation, or postdoc research be based on a Center project?



### What degree/training are you currently pursuing?

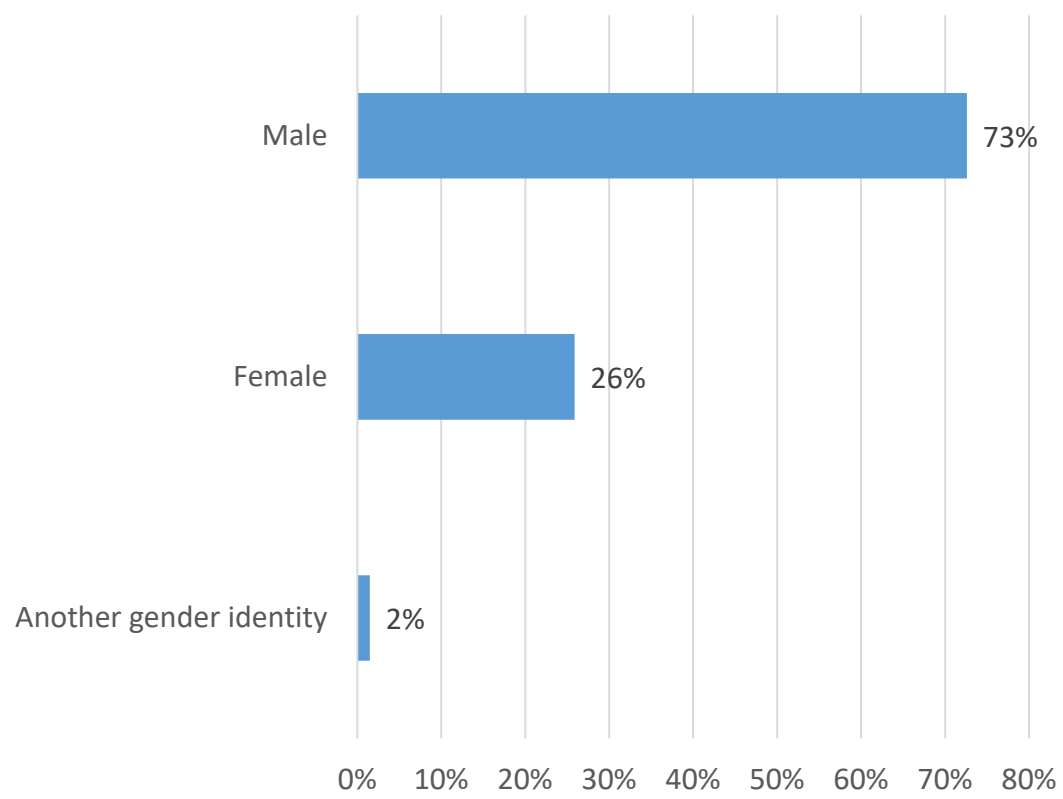




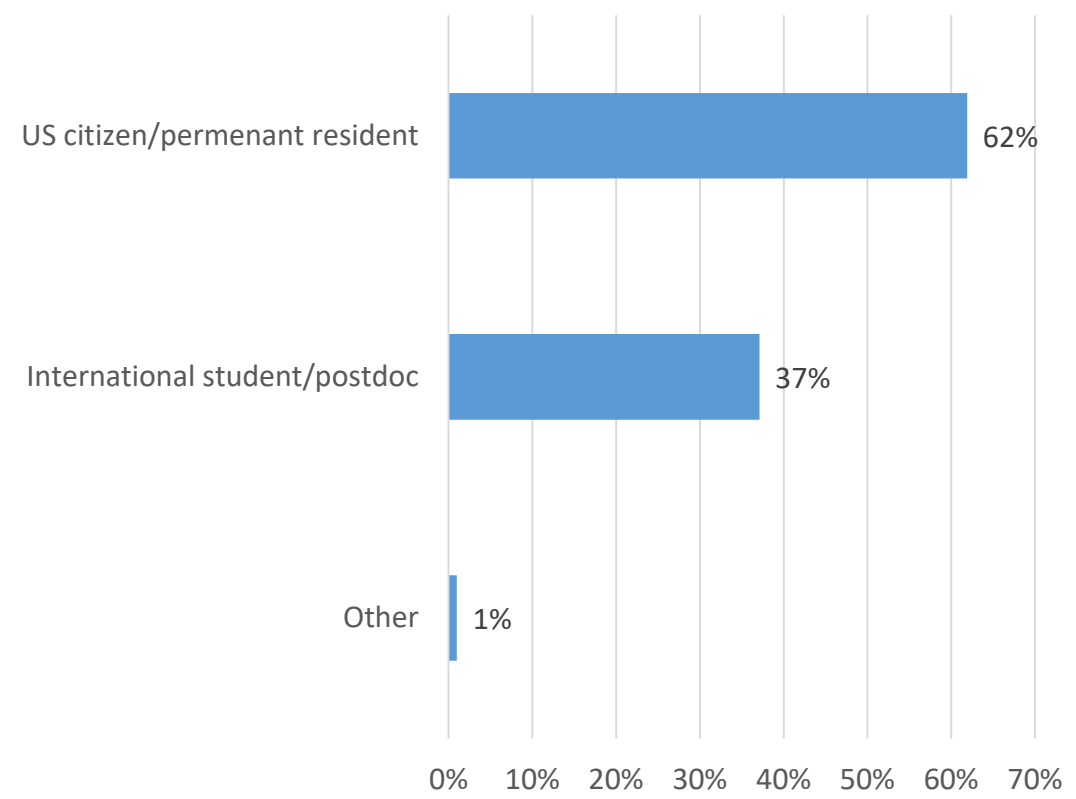
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# FY2019 Trainee Characteristics

What is your gender?



What is your citizenship status?







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# FY2019 Understanding Knowledge/Skill Development

- On average, students' were very satisfied with their experience participating in the Center = (Mean = 4.29/5.00)
- We wanted to better understand the relationship between the types of training students received and the skills the developed.
- Conducted a bivariate correlation to identify which training opportunities were associated with the development of which skills.
- Significant correlations presented in the table on next slide.



# FY2019 Understanding Knowledge/Skill Development

Correlations between participation in training opportunities and skills development

	a. Work on innovative research...	b. Pursue "real-world" research questions ...	c. Experiential hands-on learning...	d. Stay informed about Center projects ...	e. Access scientific resources not otherwise available...	f. Collaborate with gov't/ industry	g. Collaborate across universities ...	h. Work with people from different demographic or disciplinary backgrounds	i. Attend Center IAB meetings	j. Present at Center IAB meetings	k. Participate in other Center professional development opportunities
a. Technical knowledge and skills	.222**		.179*		.330**			.176*			
b. Oral communication skills		.207*			.165*	.204*					.241**
c. Written communication skills	.177*			.225**	.188*	.306**					.249**
d. Project management skills	.216**				.238**	.177*	.199*				.329**
e. Teamwork skills	.244**	.185*		.253**	.267**	.175*	.255**		.189*	.208*	.328**
f. Ability to publish				.195*	.291**	.184*	.225**	.190*	.164*		.230**
g. Understanding of how research applies to "real-world" problems		.205*		.294**	.275**	.185*	.199*	.295**	.193*		.260**
h. Understanding of industry research	.167*			.227**	.280**		.266**	.351**			.401**
i. Awareness of industry career paths				.336**			.202*	.252**			.241**
j. Awareness of member internships/job openings										.171*	.224**
N of significant skills developed	5	3	1	6	8	6	6	5	3	2	9



# FY2019 Understanding Student Satisfaction

- To better understand overall satisfaction ratings, we looked for correlations between skills developed and overall satisfaction. Significantly correlated skills were included in a multiple regression.
- The 10 assessed skills explain 47% of the variance in student satisfaction  $F(10, 135) = 11.175, p < .001$
- Students who reported a more positive impact on their technical knowledge and oral communication skills were significantly more satisfied. And those who reported a less positive impact on their teamwork skills were also more satisfied. Not clear why the teamwork correlation is negative. Perhaps students found teamwork to be so challenging that it limited their satisfaction.

Student Satisfaction	B	SE	$\beta$	<i>t</i>	<i>p</i>
Technical Knowledge	.338	.098	.297	3.441	.001**
Oral Communication	.192	.080	.237	2.406	.018*
Teamwork	-.169	.078	-.233	-2.151	.033*
Understanding Industry Research Trends & Needs	.145	.072	.211	2.008	.047*



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# FY2019 Understanding Student Satisfaction

- Overall, students that reported their Center experience having a higher impact on their technical knowledge, oral communication, and understanding of industry research trends and needs were more likely to be satisfied.
- Despite not being a formal path analysis, results provide preliminary evidence of alignment with the High-Performance Cycle (Locke & Latham, 1990)
  - Such that results support the notion that behaviors → outcomes → satisfaction.
  - More specifically, participation in Center training opportunities → new knowledge and skill development → satisfaction



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# How Should These Survey 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 and standard deviations, evaluators can see how their centers compare to national “norms”
- Informative for understanding program trends

## Questions?

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