NC STATE UNIVERSITY

Industry/University Cooperative Research Centers

Highlights of Survey Data FY2018
IUCRC Evaluation Project

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North Carolina State University

Industry/University Cooperative Research Centers

Overview

- Response rate
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- Industry Findings
  - Pulse Survey: Slides 6-13
  - Benefits Inventory: Slides 14-39
- Faculty Findings
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- Student Findings
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FY2018 Response Rates

	Center Level				Individual Level			
	Pulse	Benefits	Faculty	Student	Pulse	Benefits	Faculty	Student
Continuing Population from CD report [1]	68	68	68	68	1164	1164	907	1256
1st Year Reporting Population from CD report [2]	+6	+0	+1	+0	+39	+0	+1	+0
NCE/Retired/Defunct Centers	11	11	11	11	140	140	112	123
NCE/Retired/Defunct Centers Reporting[3]	+4	+4	+2	+0	+73	+73	+19	+0
Population [4]	67	61	60	57	1136	1097	815	1133
Centers That Did Not Return Data [5]	11	7	10	39	160	131	126	762
Available Population [6]	56	54	50	18	976	966	689	371
Data Received	56	54	50	18	413	357	326	159
Received / Population	83.58%	88.52%	83.33%	31.58%	36.36%	32.54%	38.00%	14.03%
Received / Available Population	100%	100%	100%	100%	42.32%	36.96%	47.32%	42.86%

[1] Individual-level numbers for Pulse, Benefits and Faculty surveys are different from 2017-2018 CD report because they include 2016-2017 numbers for Grid-Connected Advanced Power Electronic Systems. The CD data for this center was not collected for 2017-2018 report due to a new reporting schedule.

[2] 1st Year Reporting Population from CD report includes numbers from Wind Hazard and Infrastructure Performance which as not listed in FY2017-2018 CD report because it was launched after the end of that fiscal year.

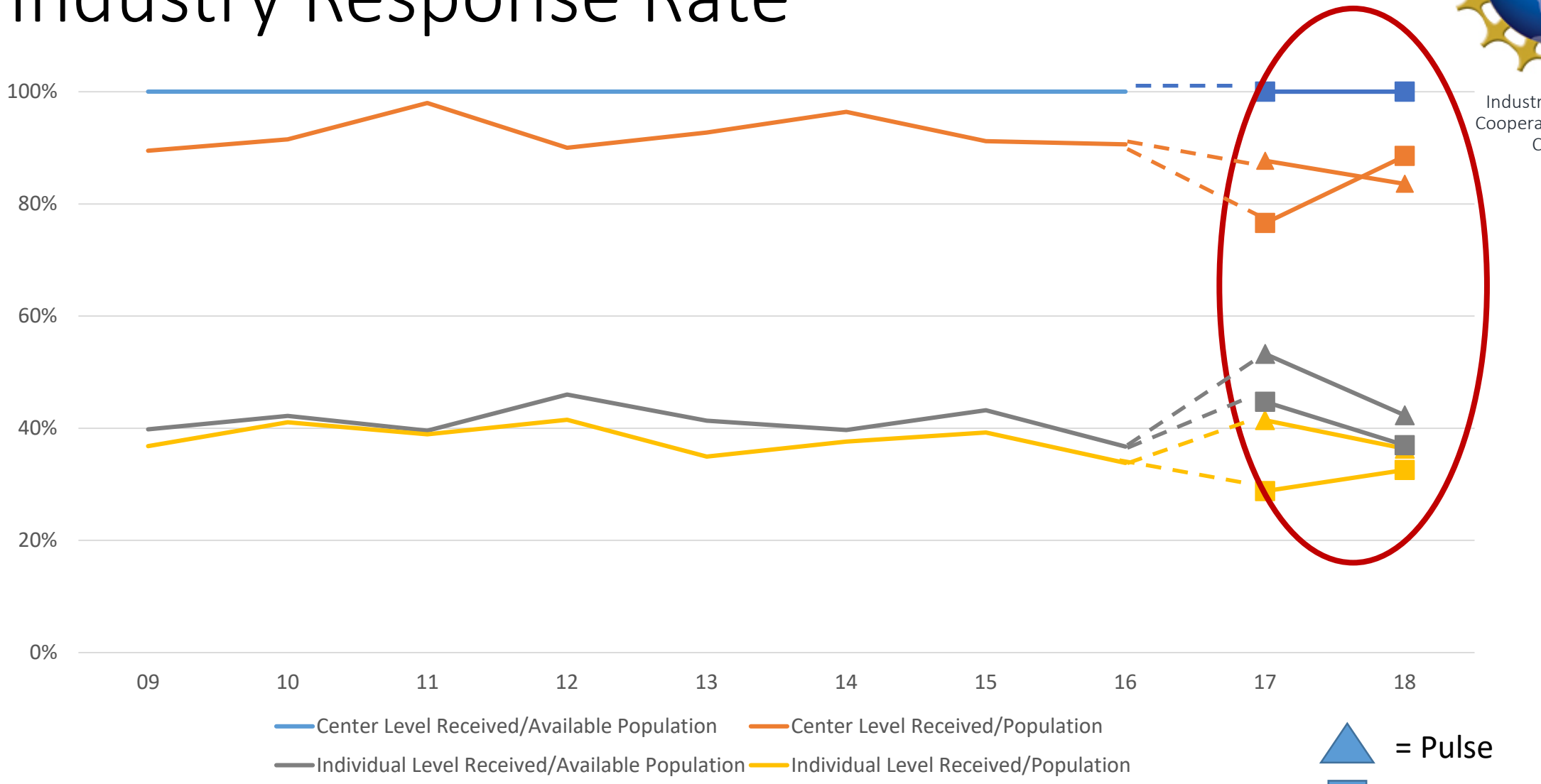
[3] Retired/defunct Centers and Centers on no cost extension (NCE) are not required to submit data, but some do. If so, those data were included in the analysis.

[4] Population was defined as centers that were at least 1 year old.

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

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

Industry Response Rate



Industry/University Cooperative Research Centers

= Pulse

= Benefits

Impact of Measuring Economic Impact on Response Rate

Industry/University Cooperative Research Centers

- Spring 2019, administered 2 versions of the benefits inventory:
  - 1 included questions that asked members to estimate the dollar value of benefits they received
    - Research cost savings and follow-on research investment
  - 1 version did not include those dollar value questions
  - Sample (Centers administering the benefits survey on LIFE, Jan-Jun 2019) = 22
  - 12, 55% had dollar questions
- Correlation between whether center had dollar questions (0 – no, 1 – yes) and that center's benefit inventory response rate (%):
  - $r = -0.150$, $p = 0.505$
- Adding dollar value questions to the survey does not significantly impact response rate

Industry/University Cooperative Research Centers

Industry Pulse Survey

Organization Type/Size

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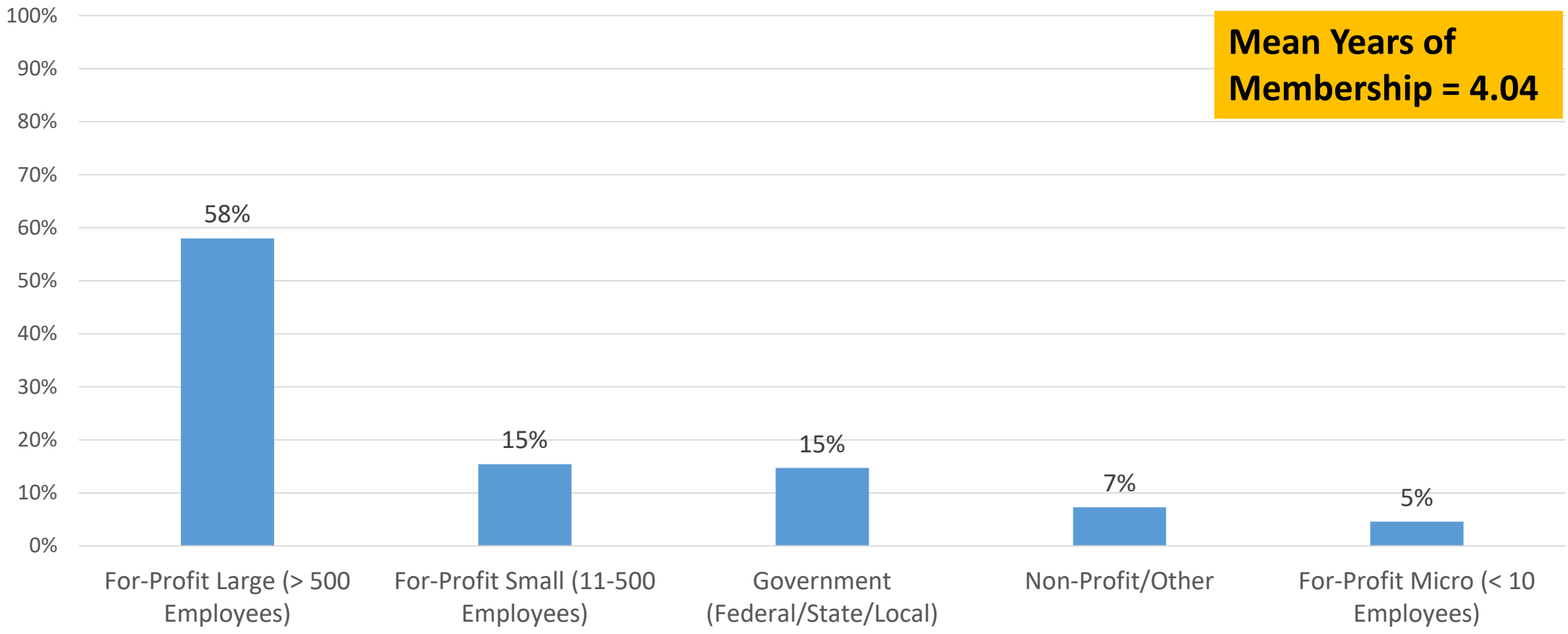
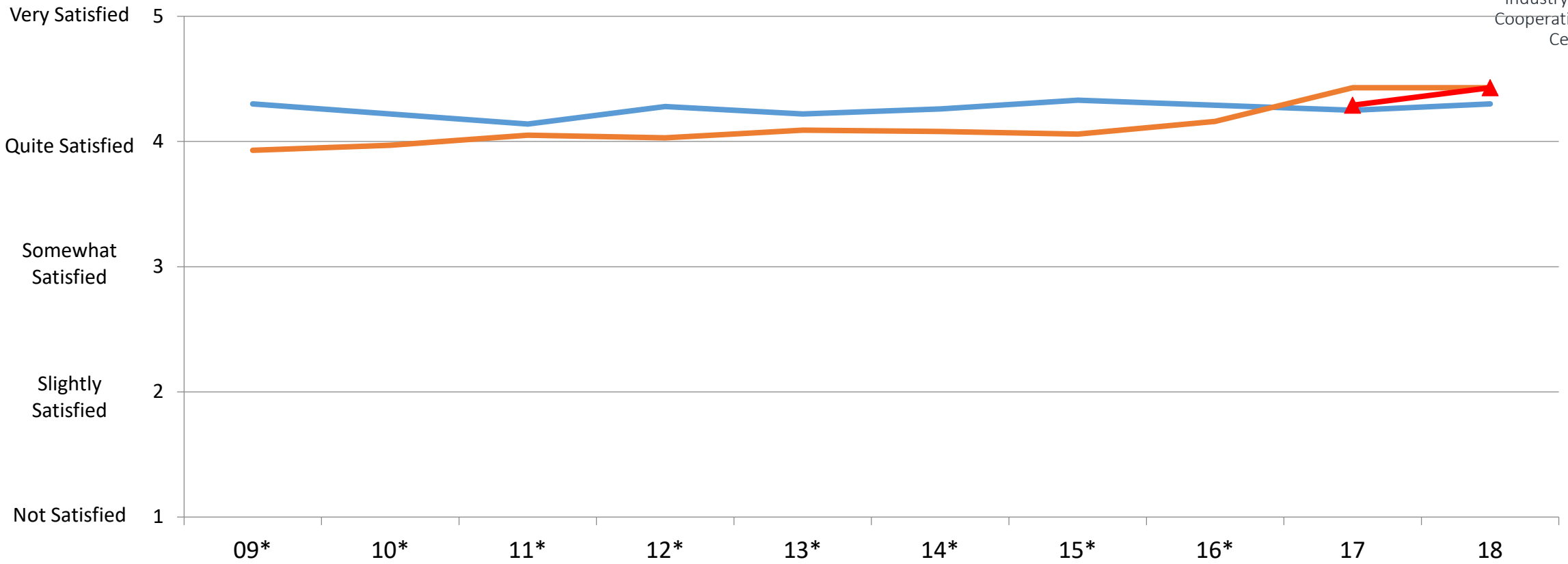


Mean Years of Membership = 4.04

Industry Satisfaction

Industry/University Cooperative Research Centers

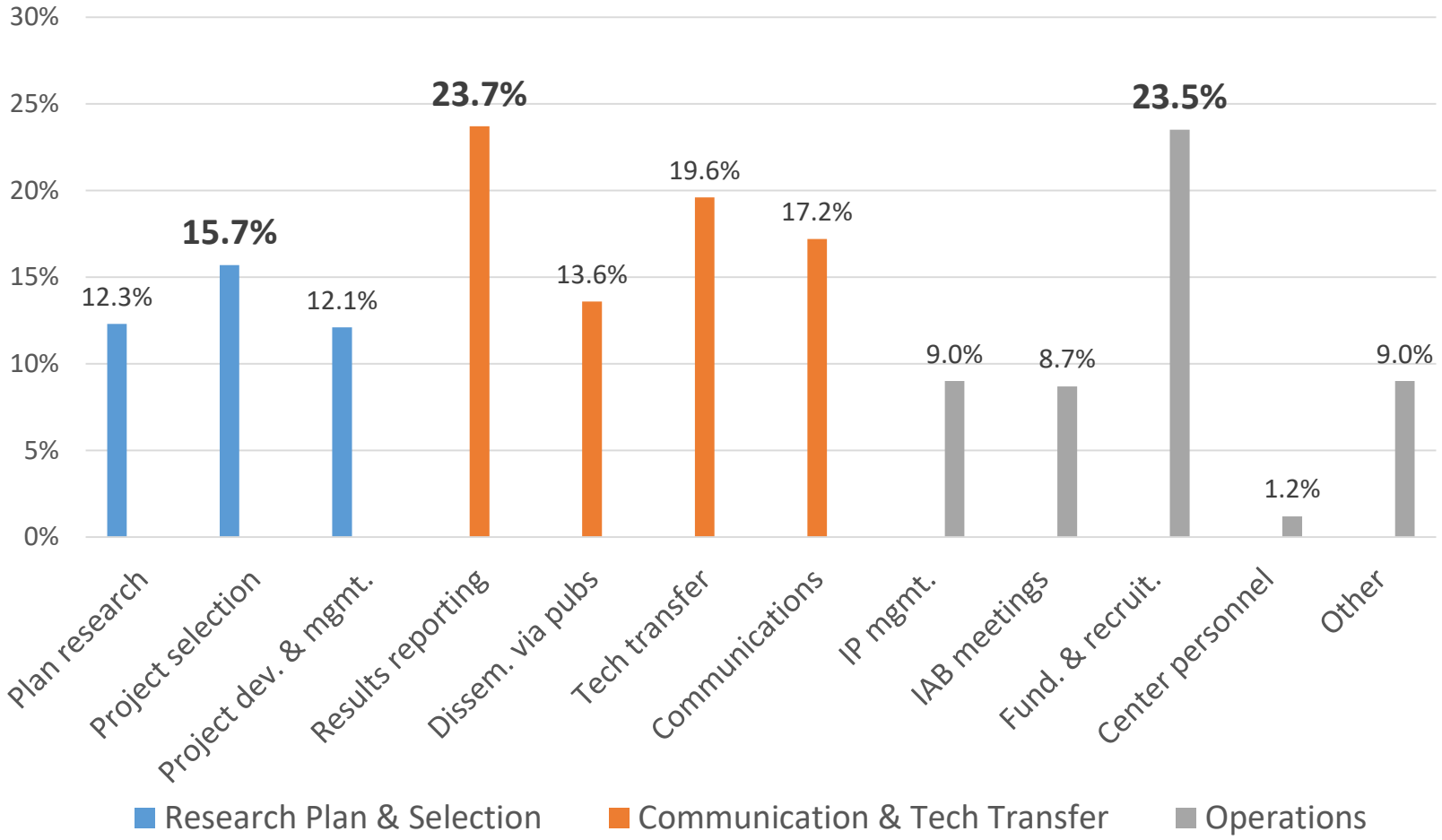


Center Research* Center Administration Center Meetings

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

Areas for Improvement

Industry/University Cooperative Research Centers



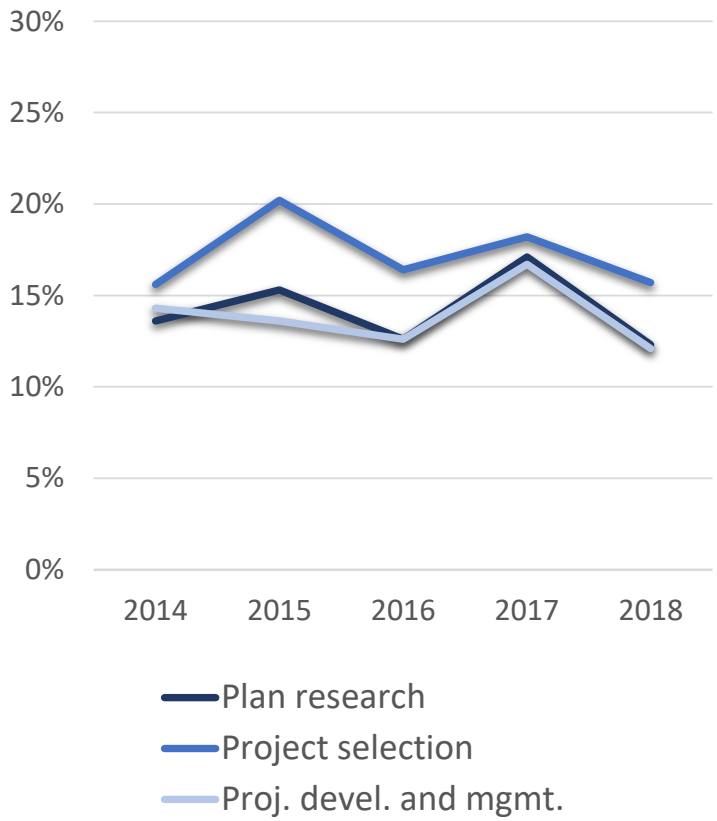
"Need to figure out a strategy to bring in new members to increase to research funding pools and to provide more diversity of opinions"

"On the one hand, I like the 20 minutes per project updates, since that forces the story to be punchy and to the point. On the other, a pre-read or some other form of written communication with some more data or detail prior to the meeting would also be good, as some of the details are missed."

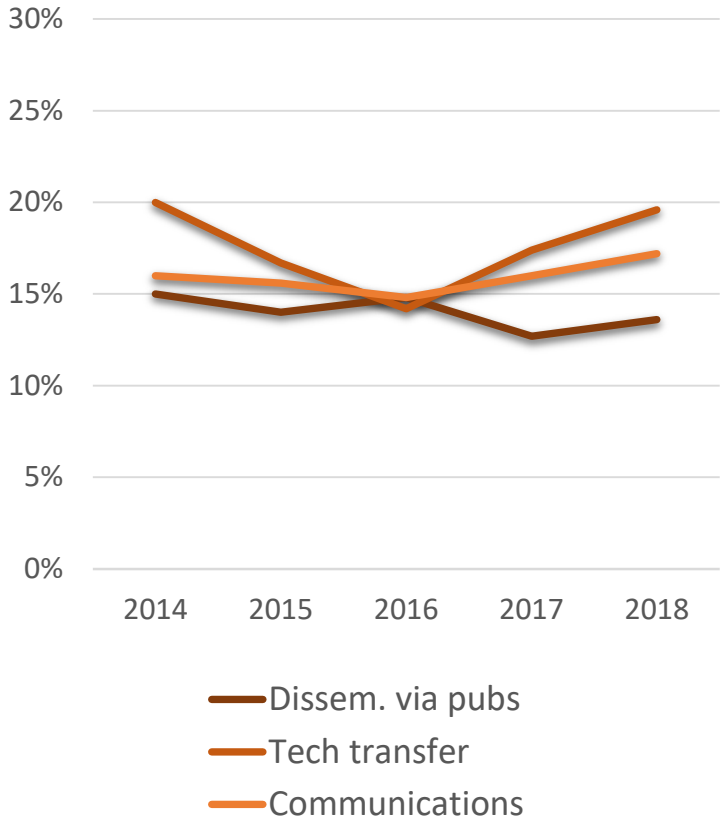
Areas of Improvement Over Time

Industry/University Cooperative Research Centers

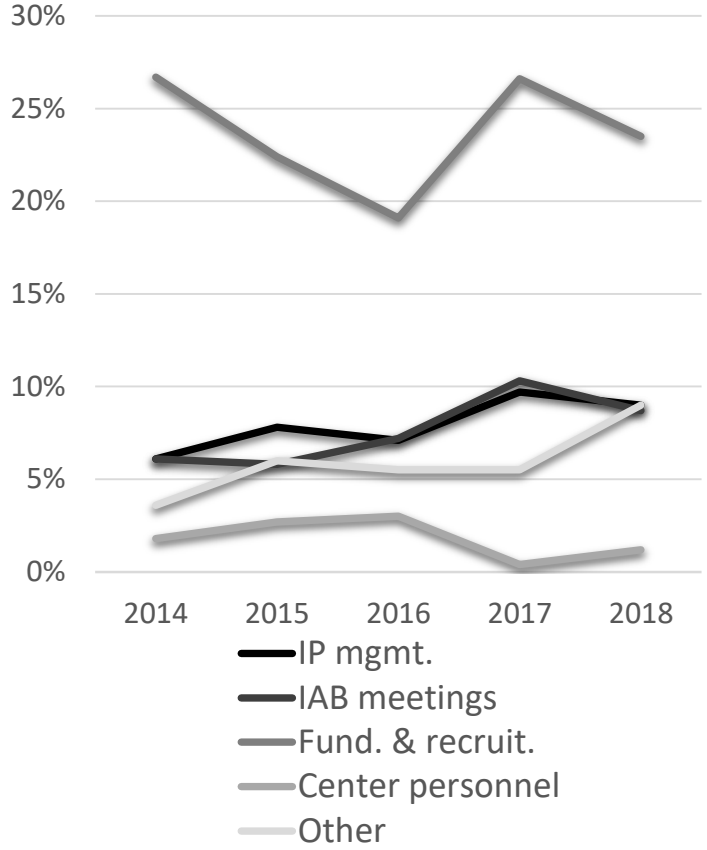
Research Planning & Selection



Communication & Tech. Transfer

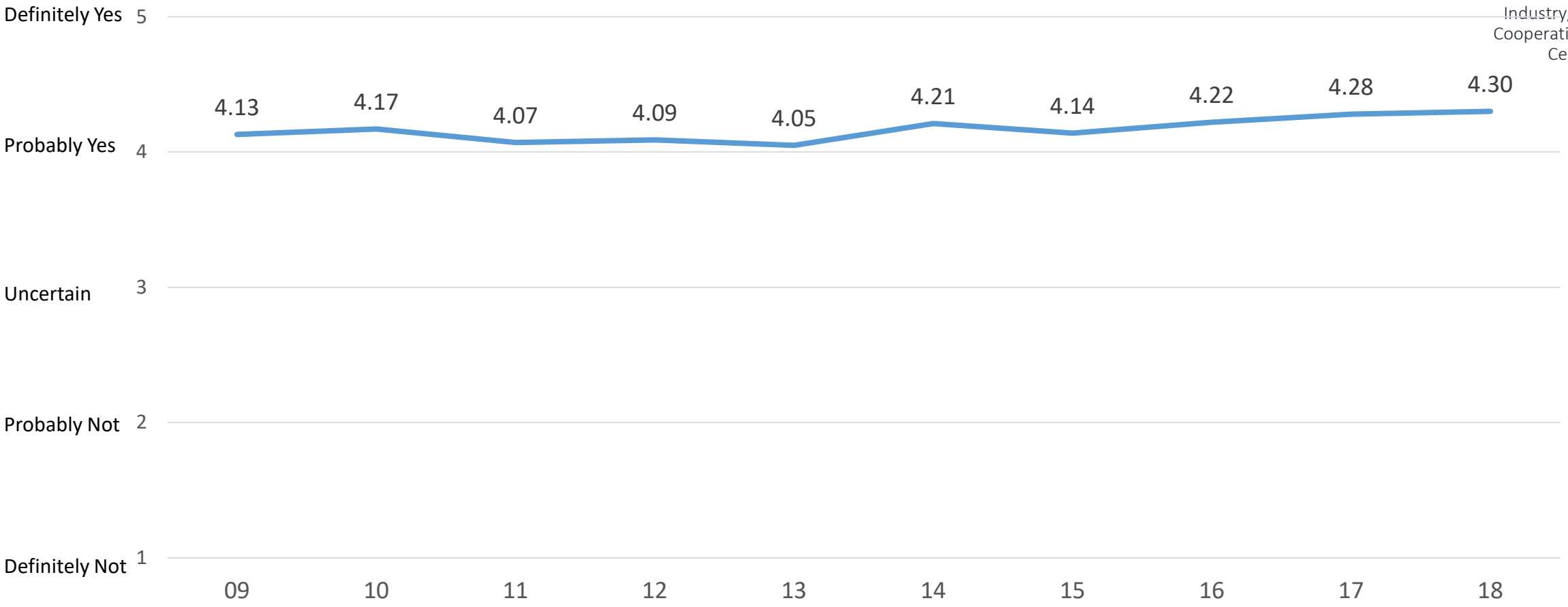


Operations



Renewal Intentions

Industry/University Cooperative Research Centers



Predicting Renewal Intentions: Regression

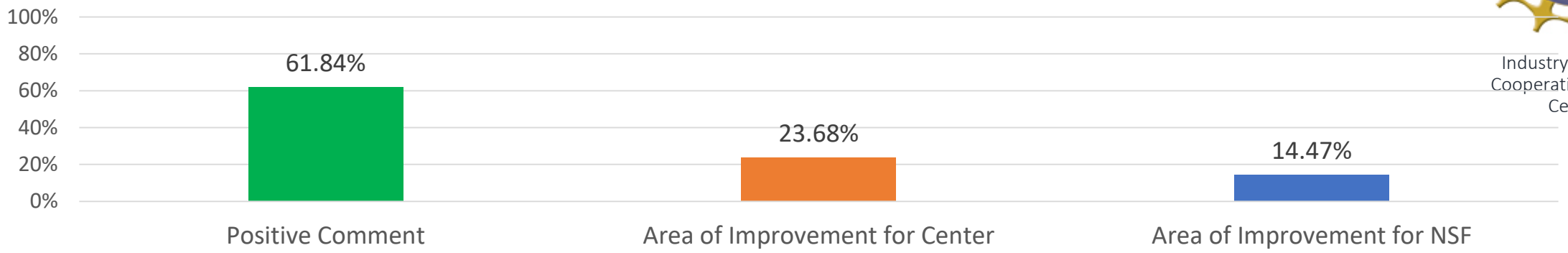
Industry/University Cooperative Research Centers

- 1st looked at bivariate correlations. Found that satisfaction metrics, as well as several areas for improvement were significantly correlated with renewal intentions.
- Variables that were significant at the bivariate level were included in the multiple regression. Significant predictors of renewal intentions reported below.
- 13% of decision to renew is predicted by satisfaction with center research and meetings, communication, and fundraising and recruitment, F (3, 394) = 19.649, $p < .001$, $R^2 = .130$
- Members who are more satisfied with center research, center meetings, who think the center needs to improve it's fundraising and recruitment, and who did not have concerns about center communication had more positive intentions to renew their membership

Renewal Intentions	B	SE	β	*t*	*p*
Satisfaction: Center Research	.149	.053	.151	2.795	.005
Satisfaction: Center Meetings	.184	.057	.190	3.204	.001
Area for Improvement: Communication	-.217	.087	-.125	-2.485	.013
Area for Improvement: Fundraising & Recruitment	.161	.076	.106	2.111	.035

Comments for NSF

Industry/University Cooperative Research Centers



- *"This is an excellent program and the funding schema is very clever, keep this up."*
- *"This organization is very well run, efficient and provides huge value in research, with many projects directly applicable from industry."*
- *"This is a very important center not only for providing research, but also for training qualified graduates that are in exceptionally short supply."*

- *"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."*

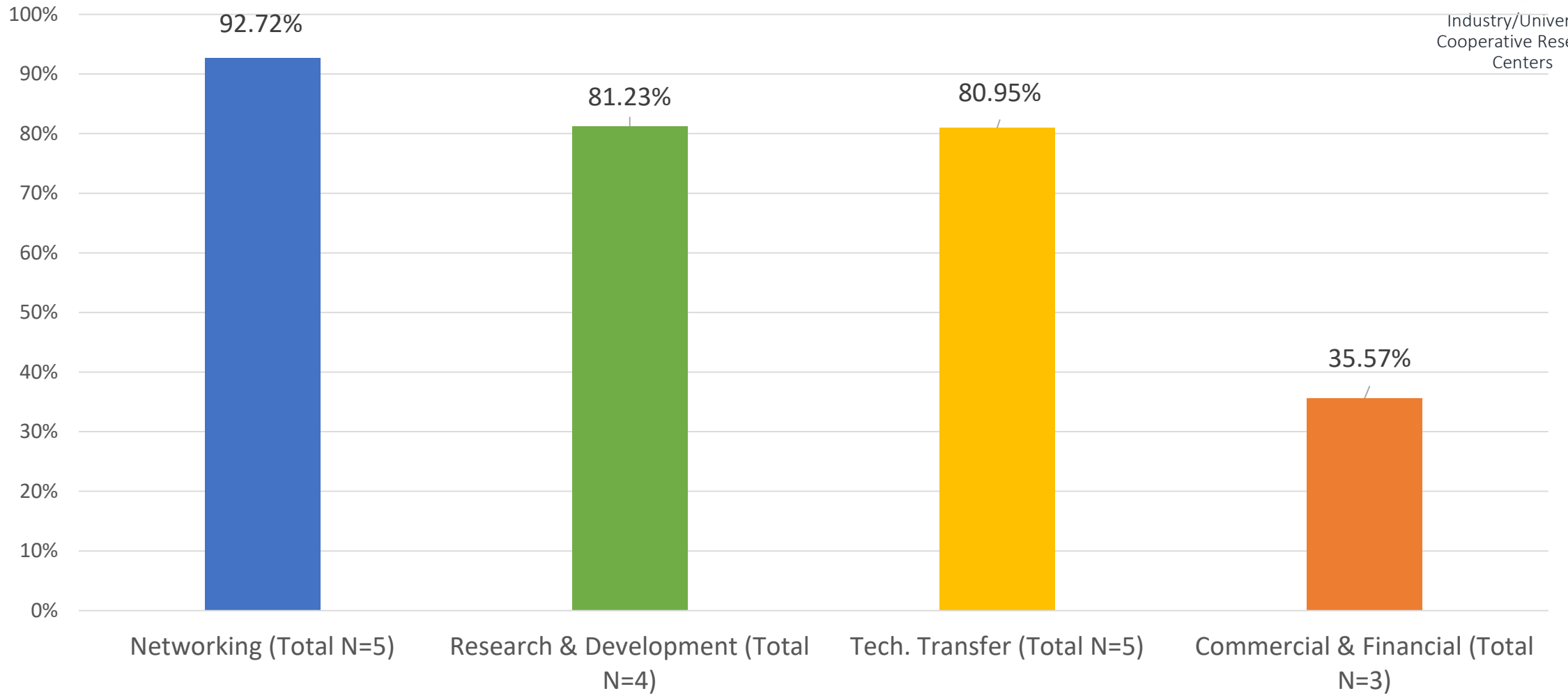
- *"Try not to burden this small center with too many quarterly reports or other bureaucratic overhead that sucks up time and energy."*
- *"We are disappointed that the program director hasn't been able to make it to a meeting this year. As new members, we feel it is important to make direct contact with our Program*

Industry/University Cooperative Research Centers

Industry Benefits Inventory

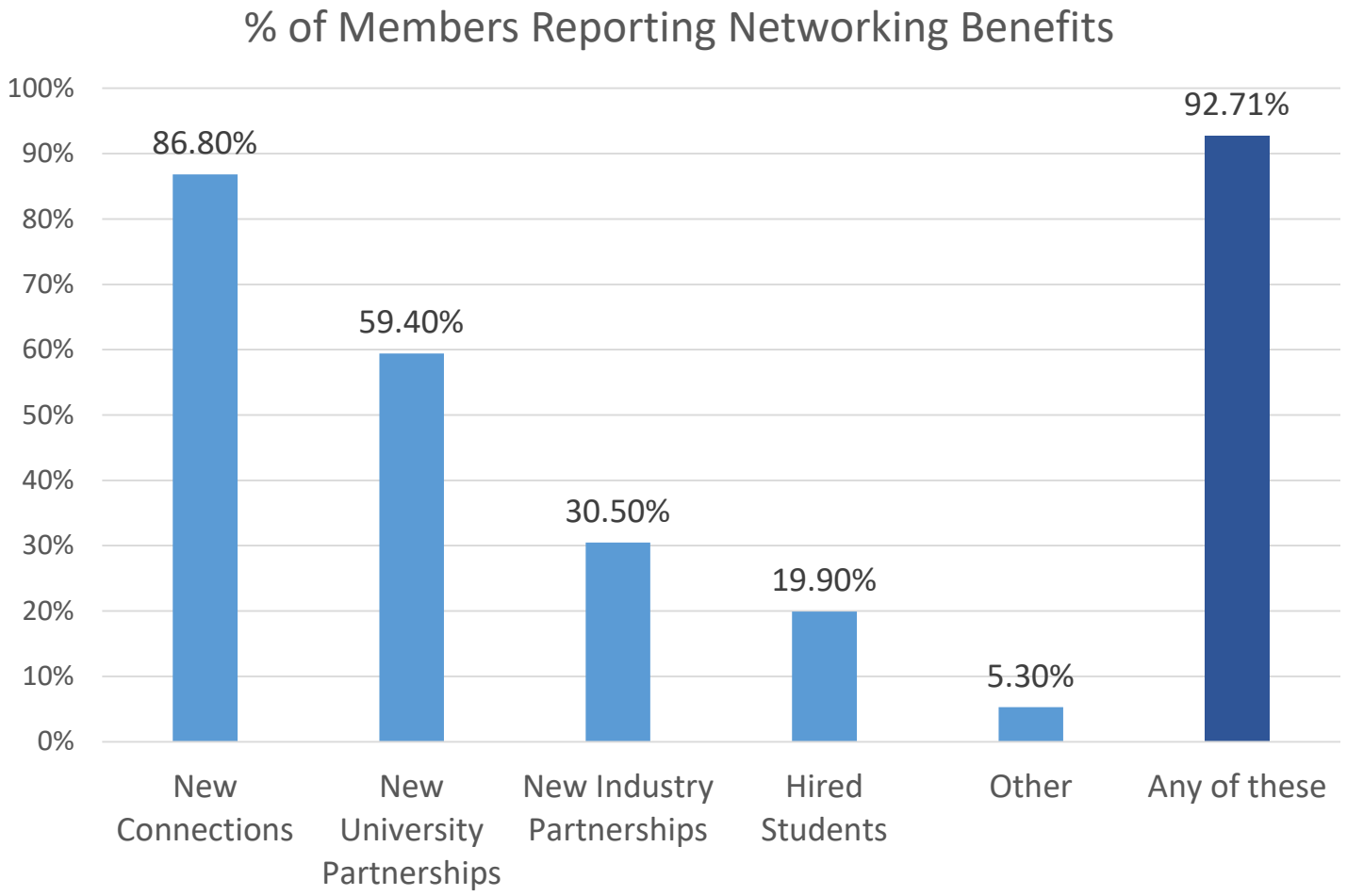
Percent of Members Reporting Any Benefit: by Category

Industry/University Cooperative Research Centers



Networking Benefits Summary

Industry/University Cooperative Research



*"The connections afforded by the center enabled the organization to **hire new employees** with strong research experience and technical background."*

*"Making progress to **start a new company** to implement a solution based on the research from a partnership formed with a university partner."*

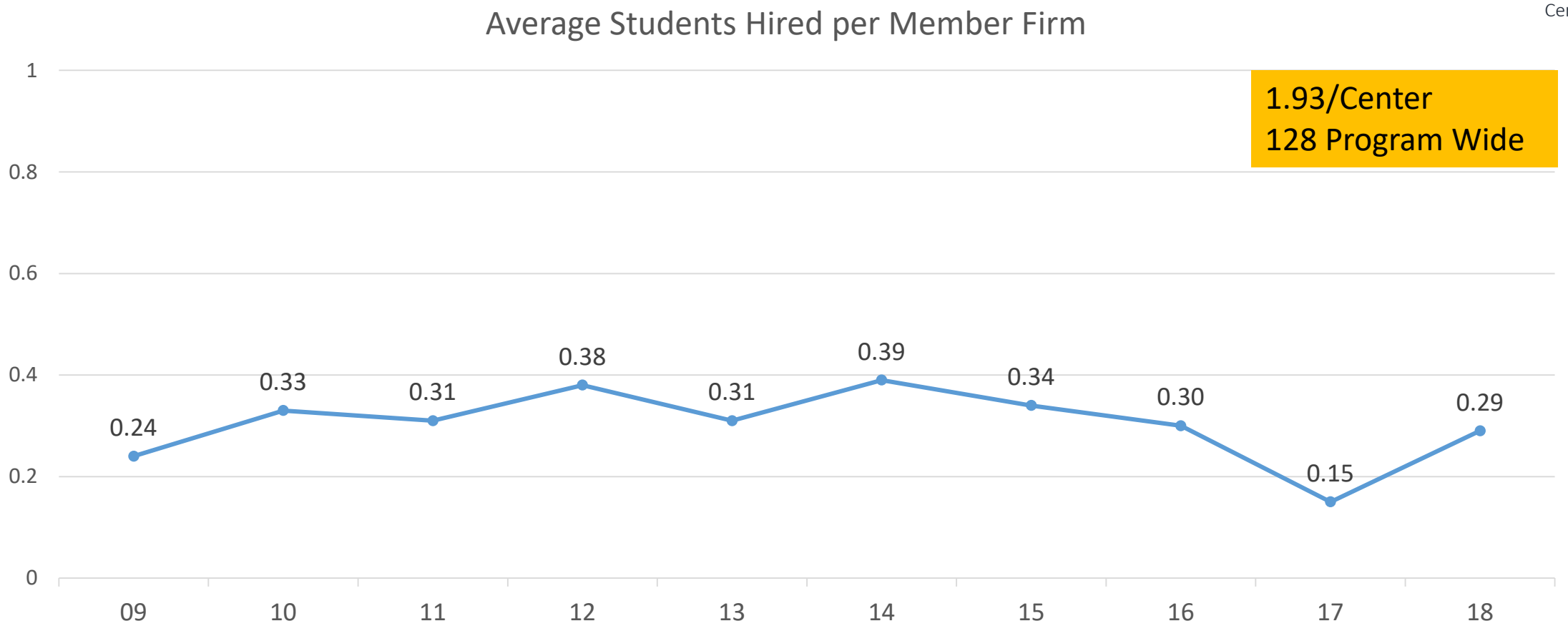
*"The center is important in maintaining and **supporting EXISTING connections** and partnerships."*

*"Led to **new potential sales opportunities** at accounts we either could not penetrate or did not know had a need for our products."*

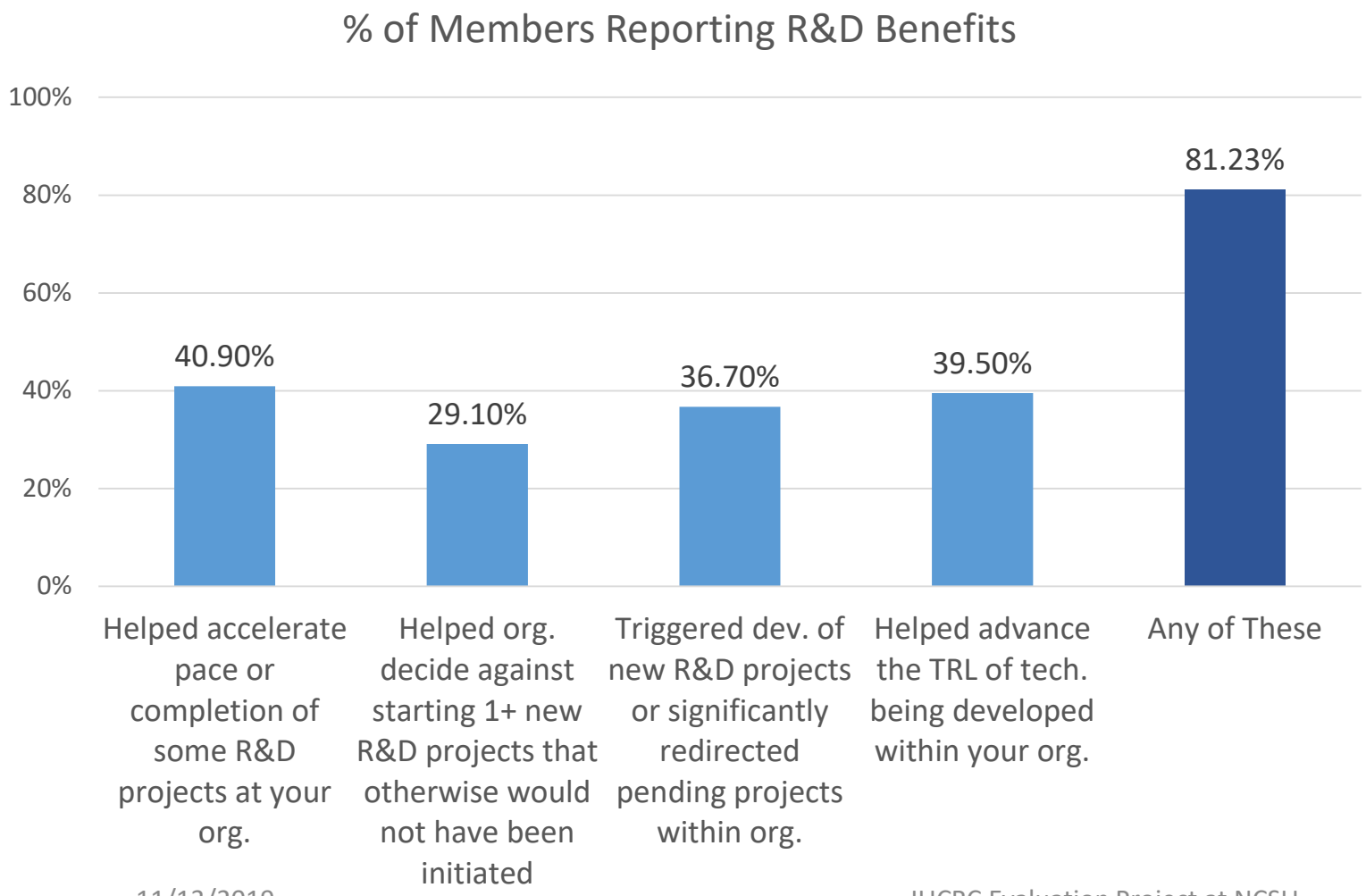
*"The **ability to access experts** in the field has been greatly beneficial to our organization. Leveraging the research faculty for technical questions and discussions helps to give confidence to our management about the decisions we are making."*

Networking Benefits: Students Hired

Industry/University Cooperative Research Centers



R&D Benefits Summary



*"Could potentially help us **monetize several million dollars of R&D already spent**, by increasing the value with addition improvement."*

*"The most important impact of the center work has been in **accelerating R&D at my institution** by laying the ground work or clearly showing wrong or incorrect research pathways."*

*"The value has been **cutting edge technology results that would have cost 10 times the amount put into this** research, not to mention the benefits of society/humankind in which the specific results contribute."*

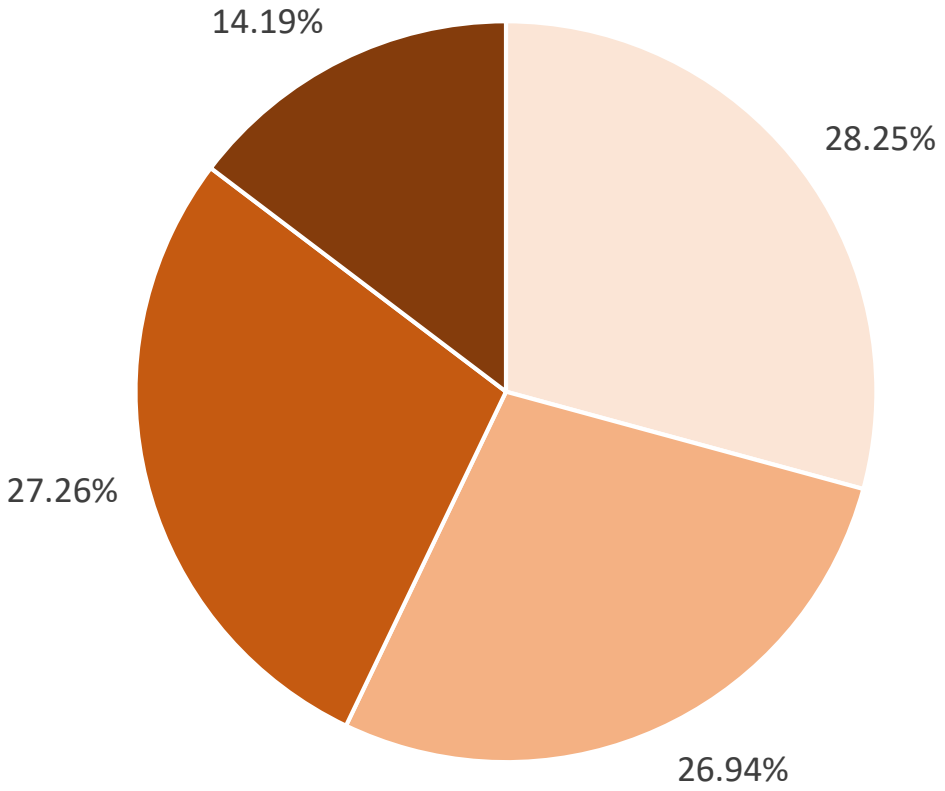
*"**Time to market**. With the center research and technology, we were able to deploy a solution with 18 months of project conception to production."*

*"Through multiple projects aligned to our research needs, we are able to **explore novel new high risk and high reward research which have changed our research path**."*

R&D Benefits: Research Relevance for the Average Member

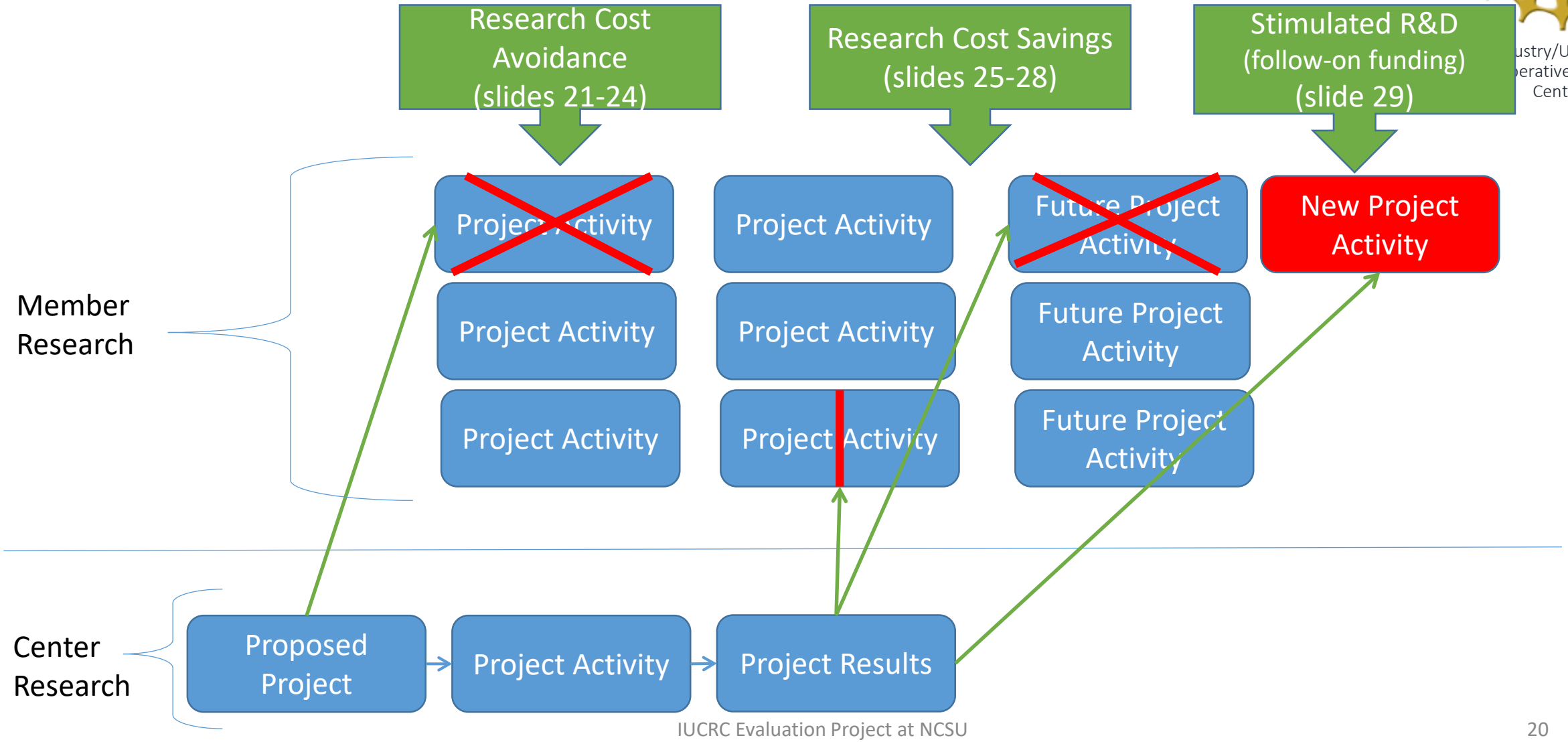
Industry/University Cooperative Research Centers

For an Average Member, 72% of Center research is 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)

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- 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 of Proj. Avoid x Scien. Months x $/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

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

Industry/University Cooperative Research Centers

- 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	$756.24	$533.67	799.45*
Center Level Scores	**Mean**	**Median**	**S.D.**
b. Average dollar value of avoided projects per respondent organization	4999.60	5699.90	5430.75
Program Level Scores		**Sum**	
c. Total dollar value of avoided projects by respondent organizations RCA program = Av. RCA member * N of members		$269,978,439	

*52 members (16%) have negative RCA that results in large standard deviation.

RCA: Member Level Average (in thousands)

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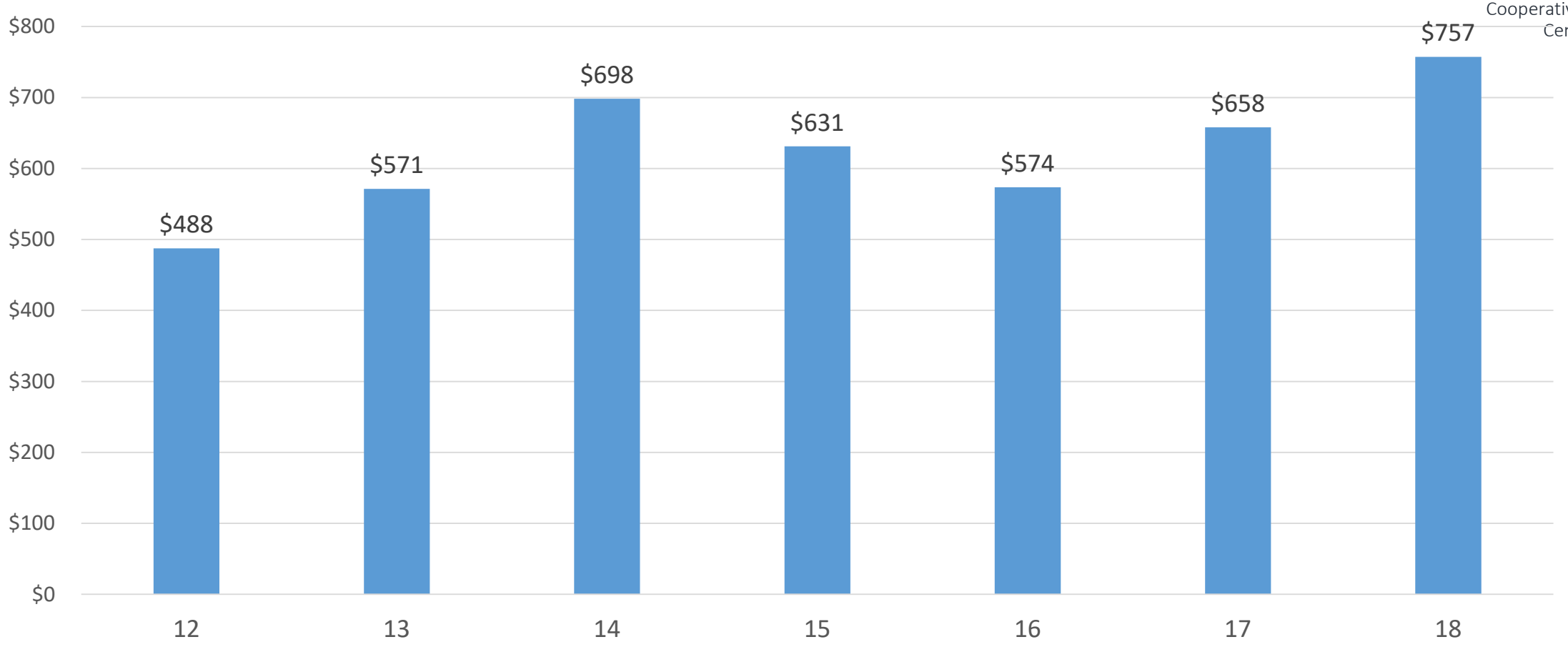
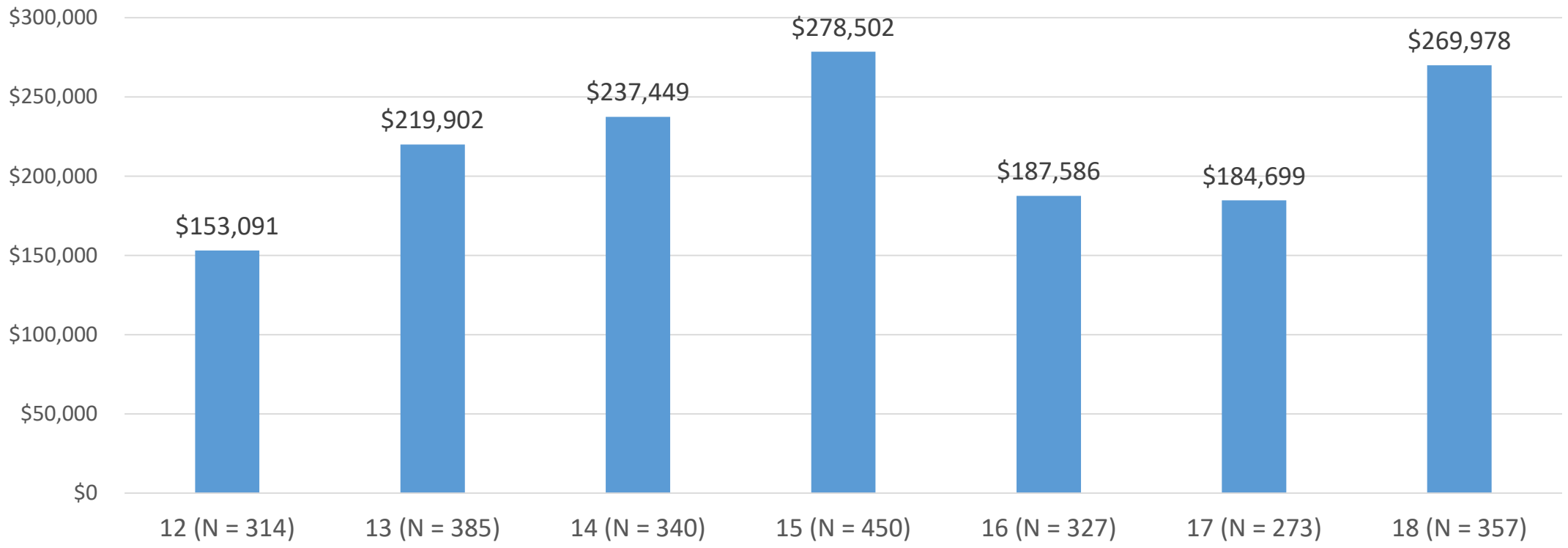


RCA: Program Level Total (in thousands)

Industry/University Cooperative Research Centers



R&D Benefits: Research Cost Savings

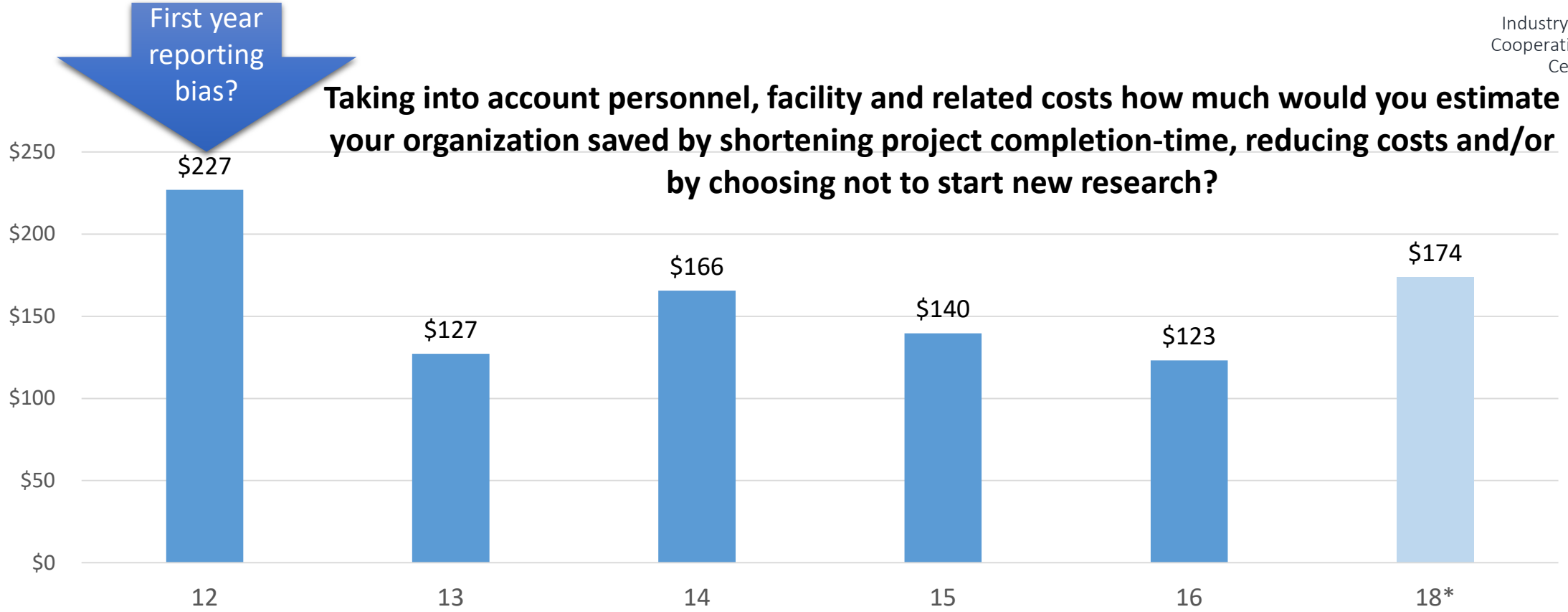
Research Cost Savings – estimated dollar value of research dollars saved

- 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?
- For FY2017-2018, the dollar value questions were administered to only a *sample* of 12 centers (68 member responses) as part of the experiment to test their effect on the Benefits survey's response rate. See slide #5 for more information about the experiment and its results.

Level of Analysis	Dollar Value
Member Level Average	$173,684
Center Level Average	$825,000
Program Total Reported	$9,900,000

Research Cost Savings: Member Level Average (in thousands)

Industry/University Cooperative Research Centers

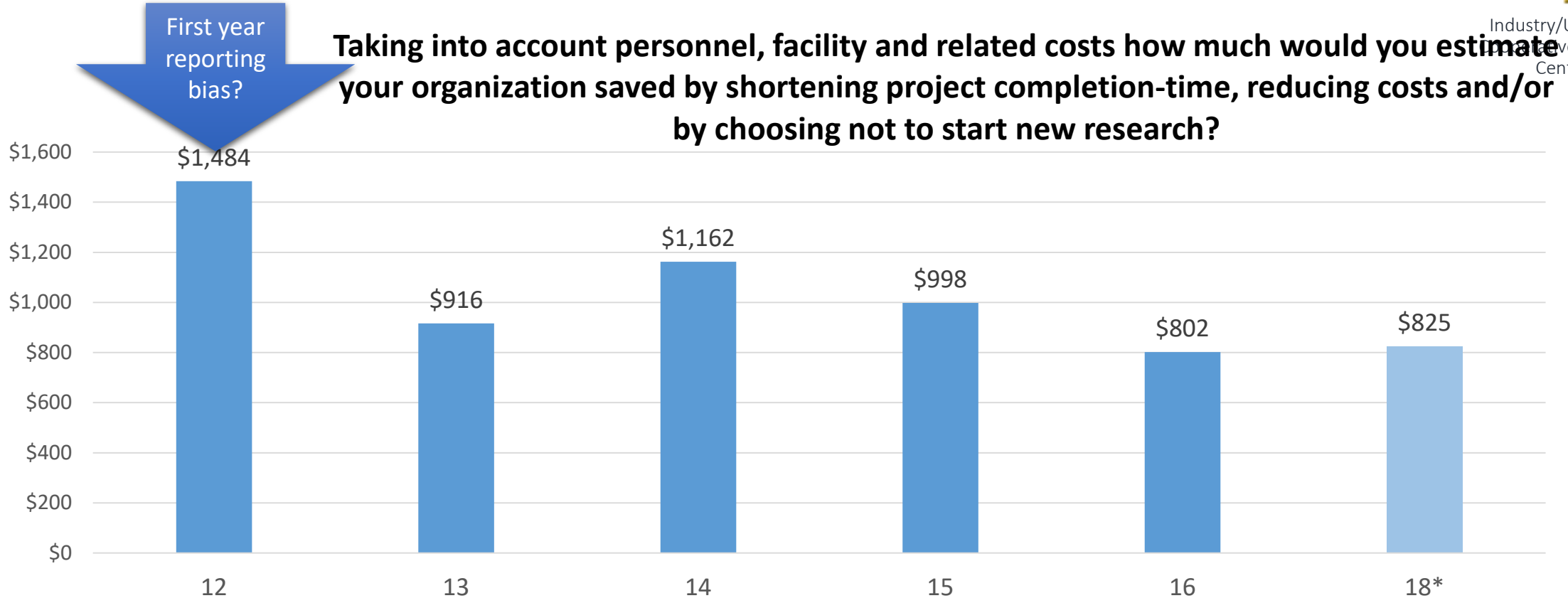


*For FY2018, the dollar value questions were administered to only a *sample* of 12 centers as part of the experiment to test their effect on the Benefits Inventory's response rate. See slide #5 for more information about the experiment and its results.

Research Cost Savings
Center Level Average (in thousands)

Industry/University Cooperative Research Centers

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?



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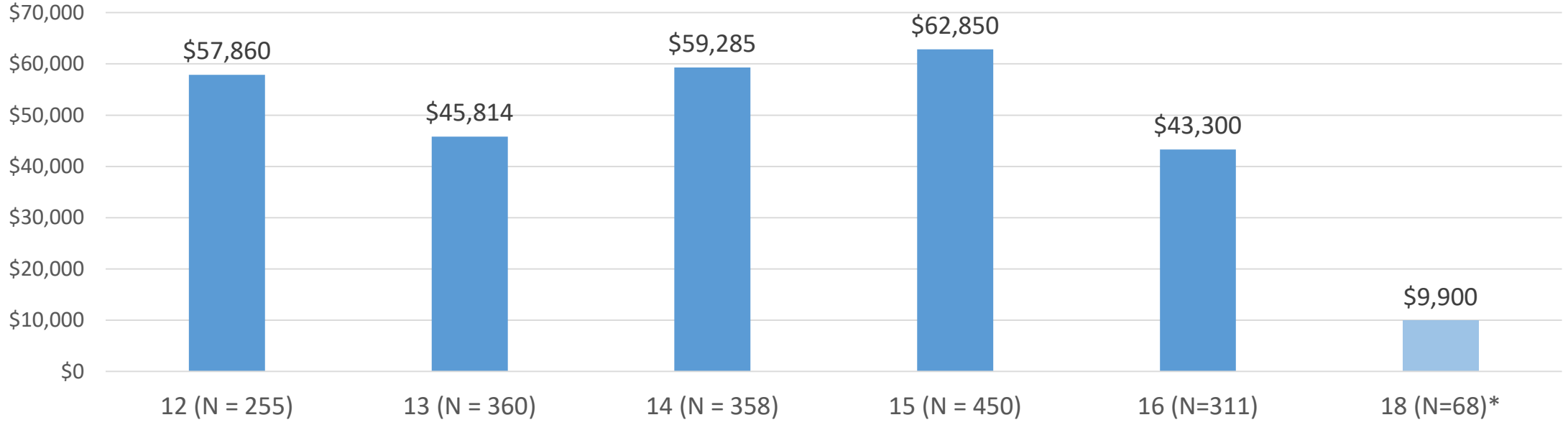
Research Cost Savings: Program Level Total (in thousands)

Industry/University Cooperative Research Centers

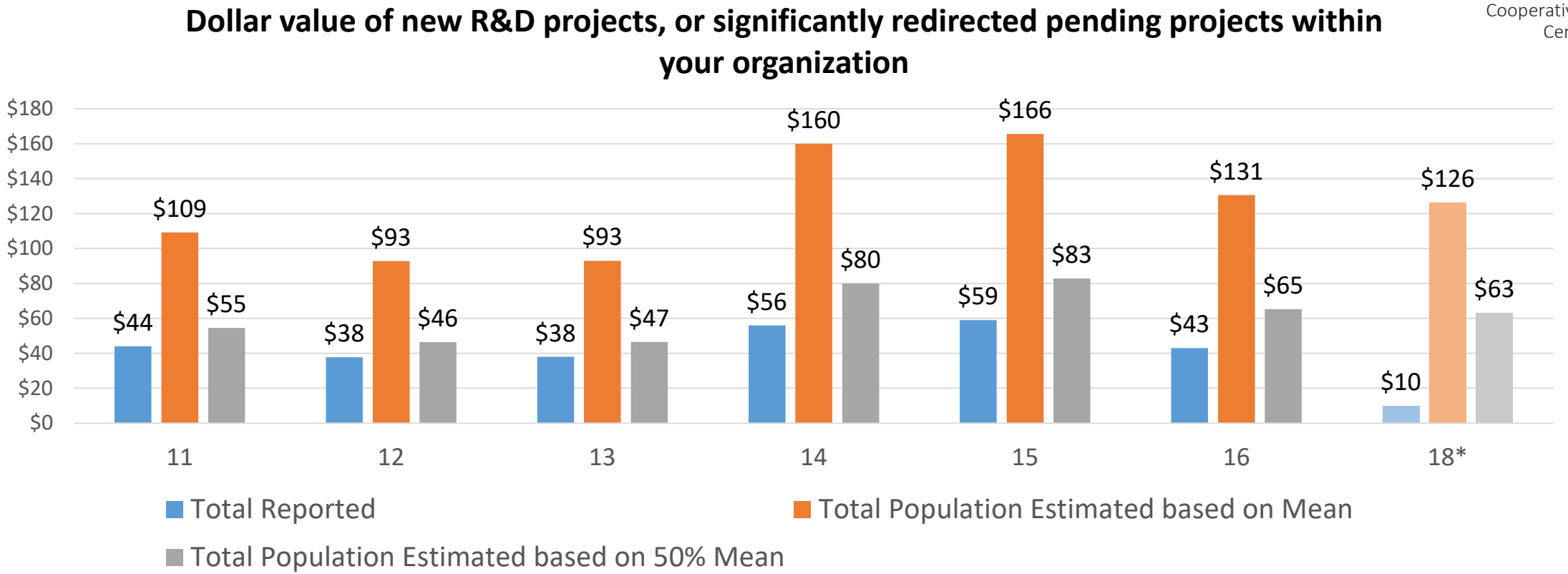
Taking into account personnel, facility and related costs how much would you estimate your organization saved by shortening project completion-time, reducing costs and/or by choosing not to start new research?



*For FY2017-2018, 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. See slide # … for more information about the experiment and its results.

Follow-on Funding: Program Total (in thousands)

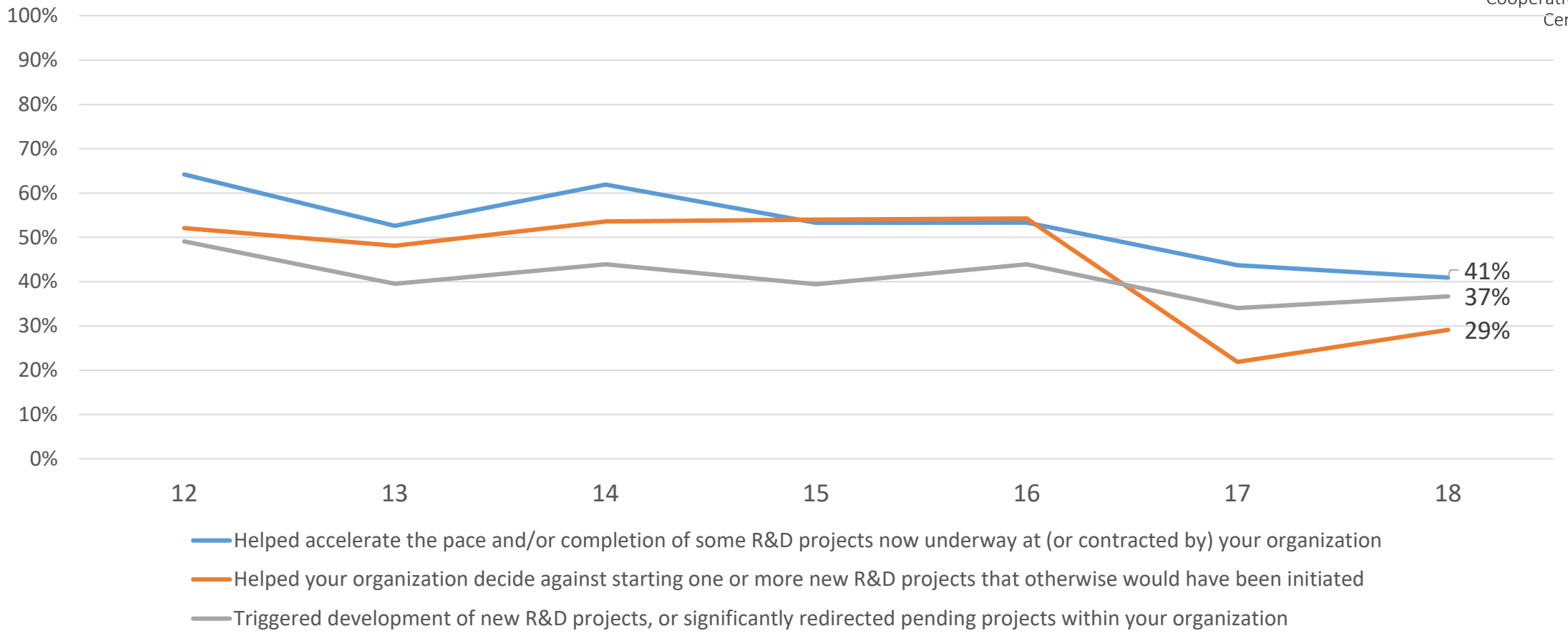
Industry/University Cooperative Research Centers



*For FY2017-2018, 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. See slide #5 for more information about the experiment and its results.

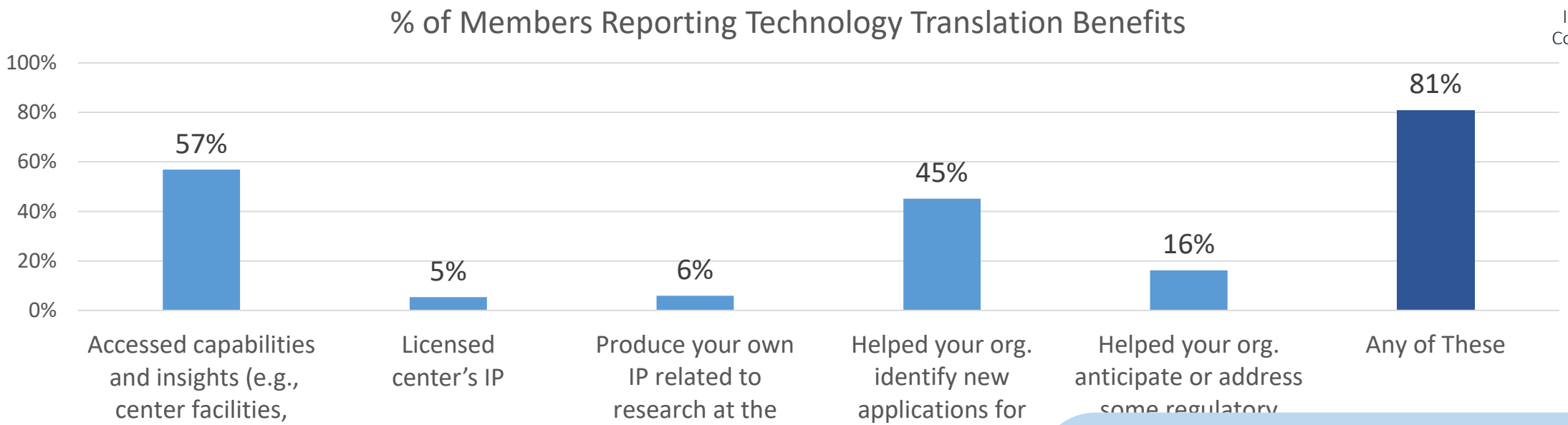
R&D Impacts: Trend Over Time

Industry/University Cooperative Research Centers



Technology Translation Benefits Summary

Industry/University Cooperative Research Centers

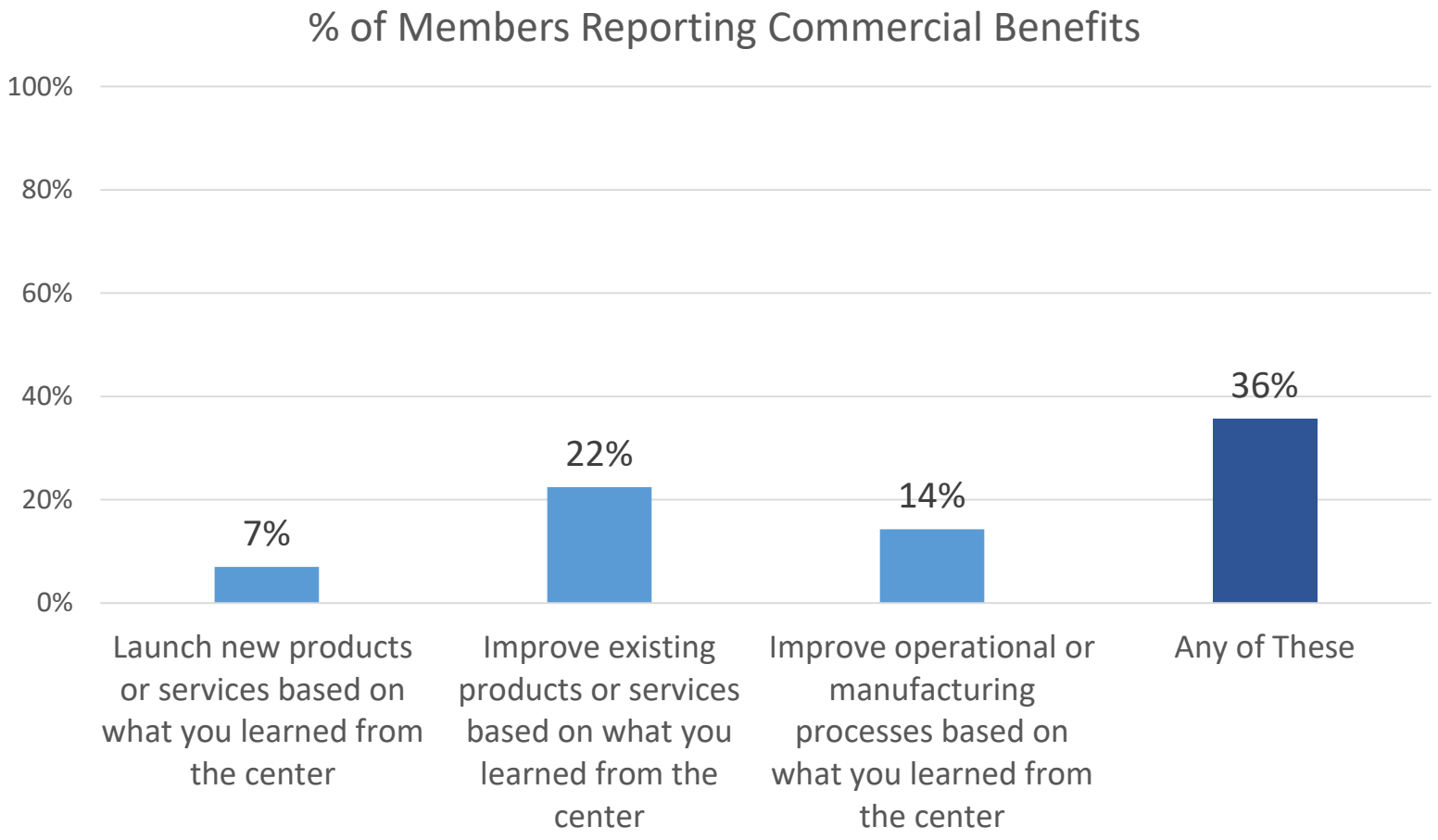


*""**Keeping informed on the latest state of numerous technologies** that we may incorporate in future products. This is one mechanism for us to spread out the research risks and invest in focused areas.""*

*"Utilizing pre-competitive Center results toward **evaluating technology feasibility**; leveraging student skill sets to attempt hand-over of bench testing capabilities in-house."*

Commercial & Financial Benefits Summary

Industry/University Cooperative Research Centers



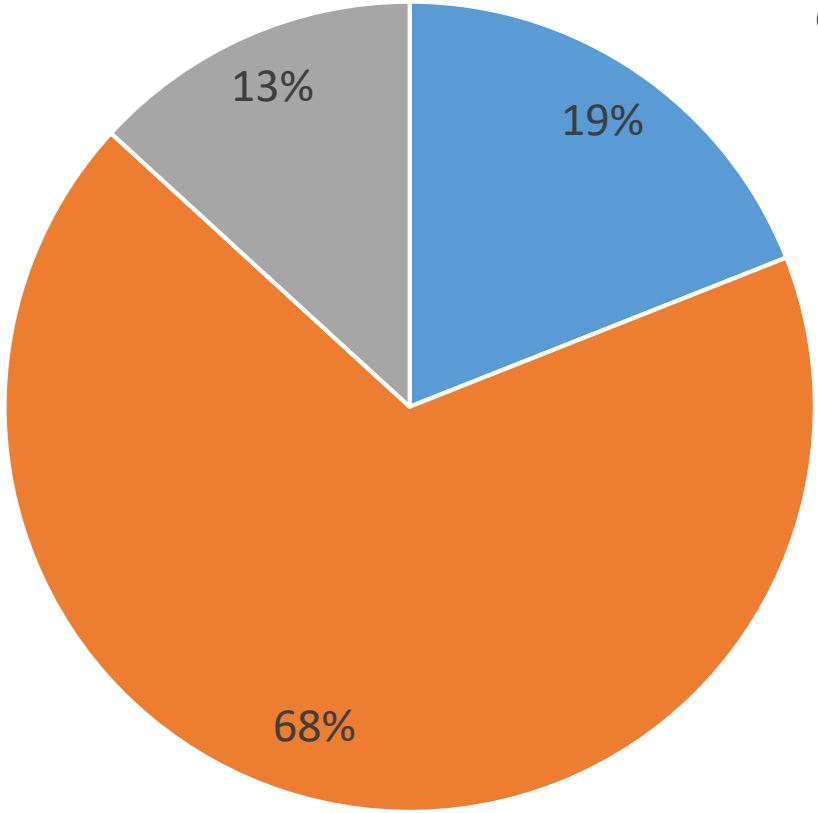
*"We have **licensed [center] technology** at the member rate, which we believe will save $35,000 + in fees.."*

"The most important benefit to us is that the center helped to analyze and **develop new product features** where we don't have the financial and technical resources to engage in. We therefore save R&D dollars for about 1-2 engineers from the technology translation."

Center Contribution to Commercial Outcomes

Industry/University Cooperative Research Centers

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

Effect of Member Years on Benefits

Industry/University Cooperative Research Centers

- 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 benefits F(4, 329) = 4.525, *p* =.006
- Specifically, members with more years of membership were more likely to report that they licensed Center's IP (technology or knowledge transfer benefit), *p* =.006

Member Years	B	SE	β	t	p
Networking: Hired any students as a full-time employee, contractor, intern	.766	.569	.074	1.348	.179
R&D: Helped your org. decide against starting 1 or more new R&D projects that otherwise would not have been initiated	.828	.489	.092	1.694	.091
Commercial or Financial: Improved existing products or services based on what you learned from the Center	.813	.543	.082	1.497	.135
Tech. Transfer: Licensed Center's IP	2.694	.982	.148	2.743	.006**

*Note. *p<.05, **p<.01*

Predicting Commercial Outcomes

Industry/University Cooperative Research Centers

- Wanted to know if there are any leading indicator benefits that may predict commercial outcomes.
- Ran a bivariate correlation to identify benefits that were correlated with any of the commercial benefits evaluated. Benefits that were significantly correlated at the bivariate level were included in a multiple logistic regression.
- Ran logistic multivariate regressions with each of the 3 commercial outcomes (Launch new products or services based on what you learned from the Center, Improve existing products or services based on what you learned from the Center, and Improve manufacturing or operational processes based on what you learned from the Center) and all other benefits

Predicting Commercial/Financial Benefits: Launch new products or services

Industry/University Cooperative Research Centers

- The logistic regression model was statistically significant $X^2(4) = 34.37$, $p < .01$. Members who *developed partnerships with faculty* were **3.74 times more likely**, and members whose participation in the center helped *advance the TRL of their internally developed technology* were **6.63 times more likely** to launch new products or services based on what they learned at the center.

Launch new products or services based on what you learned from the Center	B	SE	Wald	*p*	Exp(B)
Networking: Developed partnerships with university faculty or research scientists	1.319	.644	4.192	.041*	3.740
Networking: Hired any students as a full-time employee, contractor, intern	.863	.459	3.522	.061	2.368
R&D: Helped advance the Tech. Readiness Level of technology being developed within your org.	1.892	.575	10.816	.001**	6.629
Tech. Transfer: Accessed capabilities and insights to which your firm would not otherwise access	.298	.518	.332	.565	1.347

Note. *p<.05, **p<.01

Predicting Commercial/Financial Benefits: Improve existing products or services

Industry/University Cooperative Research Centers

- The logistic regression model was statistically significant $X^2(4) = 36.77$, $p < .01$. Members whose participation in the center helped *advance the TRL of their internally developed technology* were **1.76 times more likely**, and members who *accessed capabilities and insights to which their firm would not otherwise have access* to were **2.75 times more likely** to improve products or services.

Improve existing products or services based on what you learned from the Center	B	SE	Wald	*p*	Exp(B)
Networking: Developed partnerships with university faculty or research scientists	.084	.282	.088	.767	1.087
Networking: Hired any students as a full-time employee, contractor, intern	.585	.308	3.617	.057	1.795
R&D: Helped advance the Tech. Readiness Level of technology being developed within your org.	.565	.273	4.282	.039*	1.759
Tech. Transfer: Accessed capabilities and insights to which your firm would not otherwise access	1.012	.303	11.179	.001**	2.750

Note. *$p<.05$, **$p<.01$

Predicting Commercial/Financial Benefits: Improve manufacturing or operational processes

Industry/University Cooperative Research Centers

The logistic regression model was statistically significant $X^2(4) = 28.87$, $p < .01$. Members whose participation in the center helped *advance the TRL of their internally developed technology* were **2.49 times more likely**, and members who *accessed capabilities and insights to which their firm would not otherwise have access* to were **4.52 times more likely** to improve manufacturing or operational processes.

Improve manufacturing or operational processes based on what you learned from the Center	B	SE	Wald	*p*	Exp(B)
Networking: Developed partnerships with university faculty or research scientists	.324	.355	.832	.362	1.382
Networking: Hired any students as a full-time employee, contractor, intern	.459	.357	1.660	.198	1.583
R&D: Helped advance the Tech. Readiness Level of technology being developed within your org.	.912	.335	7.400	.007**	2.489
Tech. Transfer: Accessed capabilities and insights to which your firm would not otherwise access	1.508	.433	12.133	.000**	4.516

Note. *$p<.05$, **$p<.01$

Industry/University Cooperative Research Centers

Faculty Questionnaire

Select Results

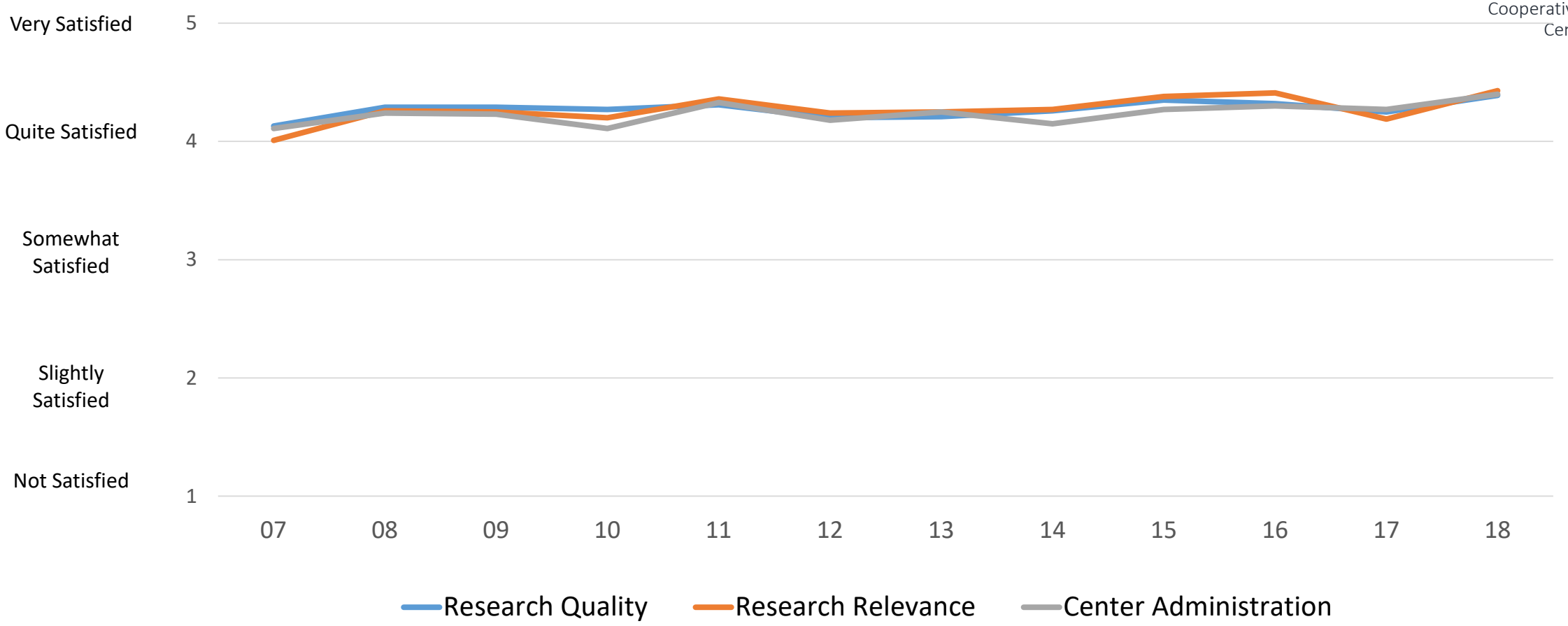
Faculty Long and Short Forms

Industry/University Cooperative Research Centers

	Long Form	Short Form
# of items	13	6
# of questions in common	6	6
# of unique questions	7	0
# of centers using form	17	17
Sample size	141	185

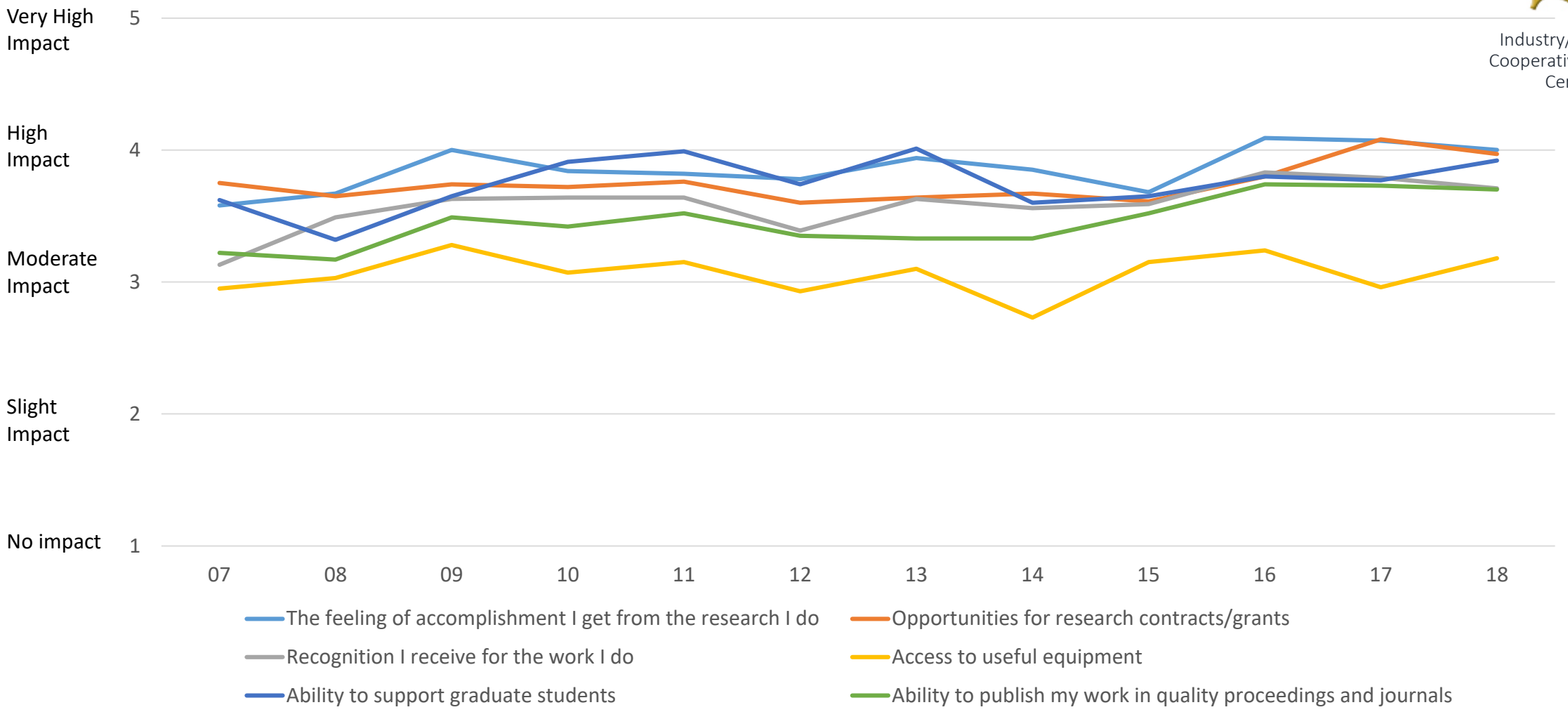
Faculty Satisfaction

Industry/University Cooperative Research Centers



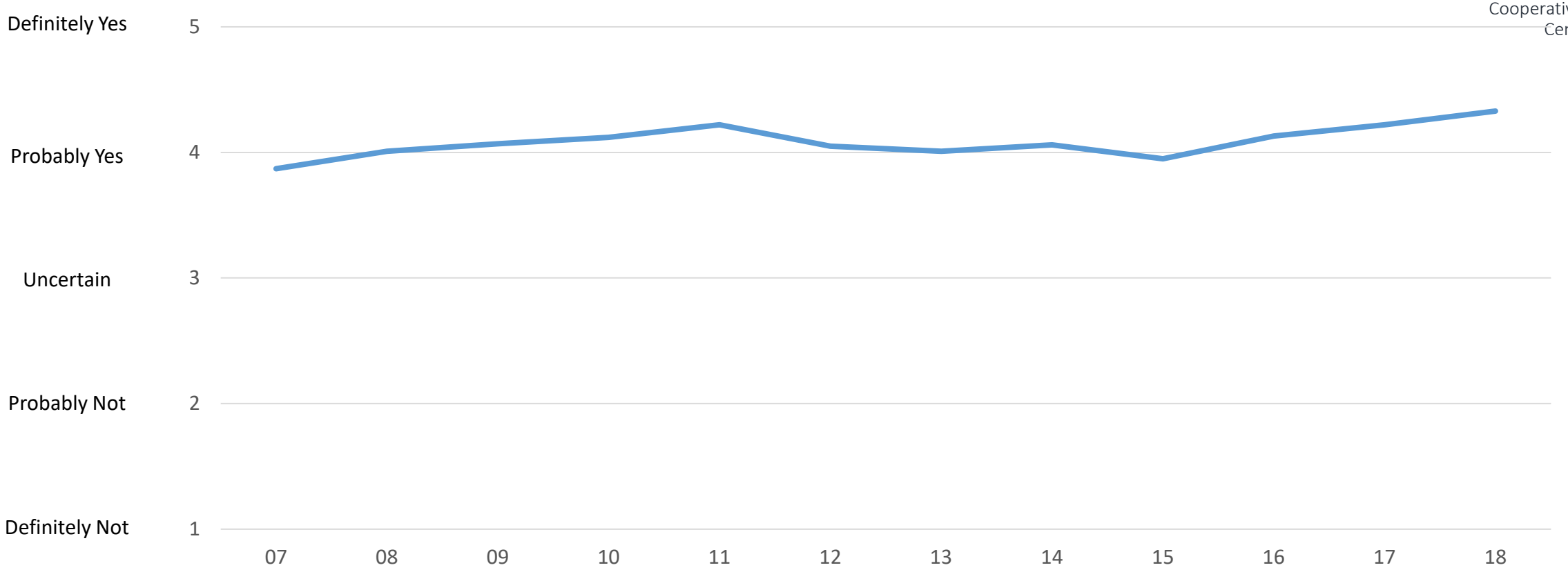
Faculty Benefits (Long version only)

Industry/University Cooperative Research Centers



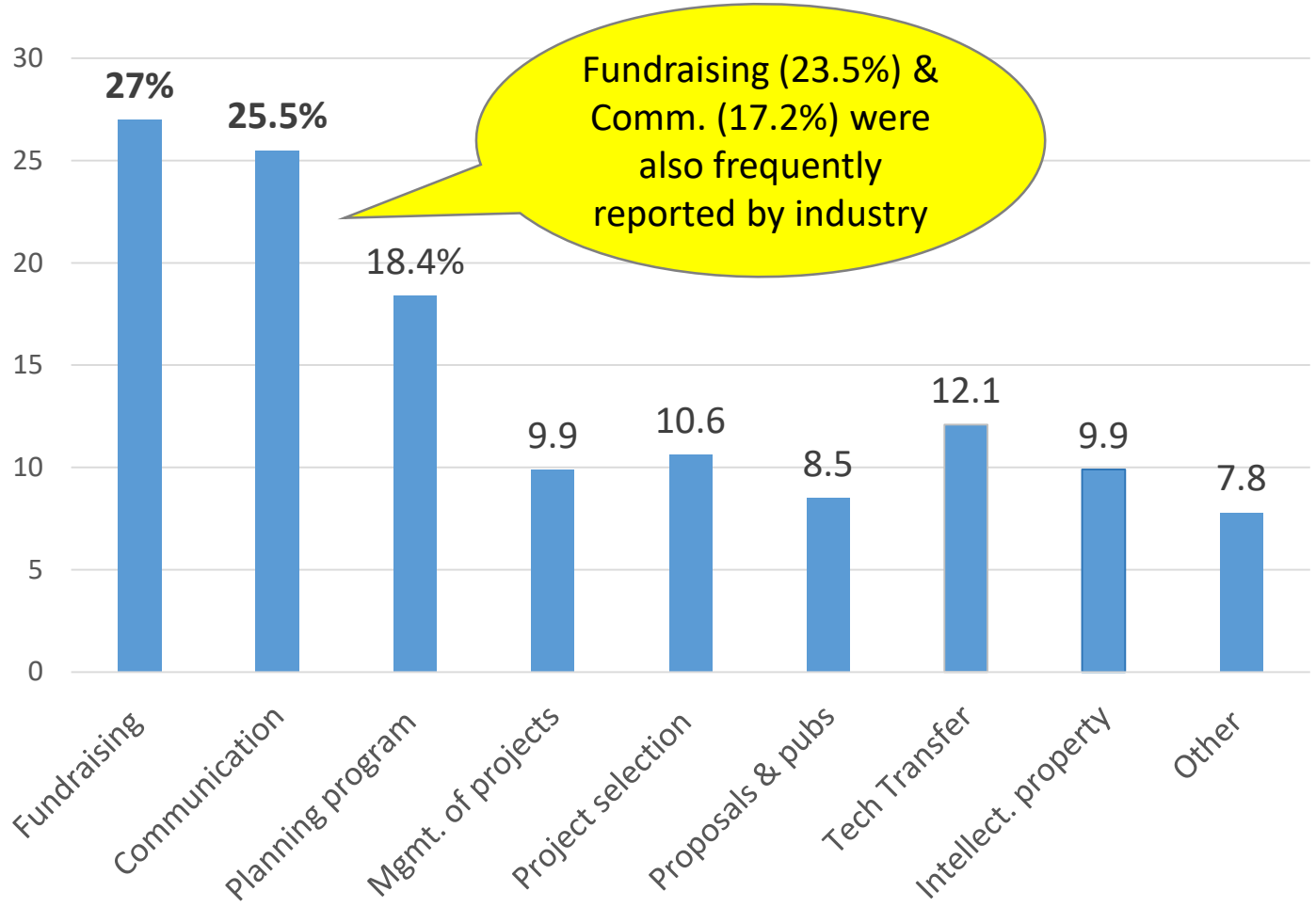
Faculty Commitment to submit best research ideas in a center funded proposal

Industry/University Cooperative Research Centers



Faculty Areas for Improvement

Industry/University Cooperative Research Centers



"Need to produce more promotional materials, summarize achievements, and present them to more potential members. Also better explain how the IUCRC program works."

"Communication is too focused on a hierarchical structure; there should be an email distribution list to all participants in the academic partners, and all should be able to use it for communicating organizational information."

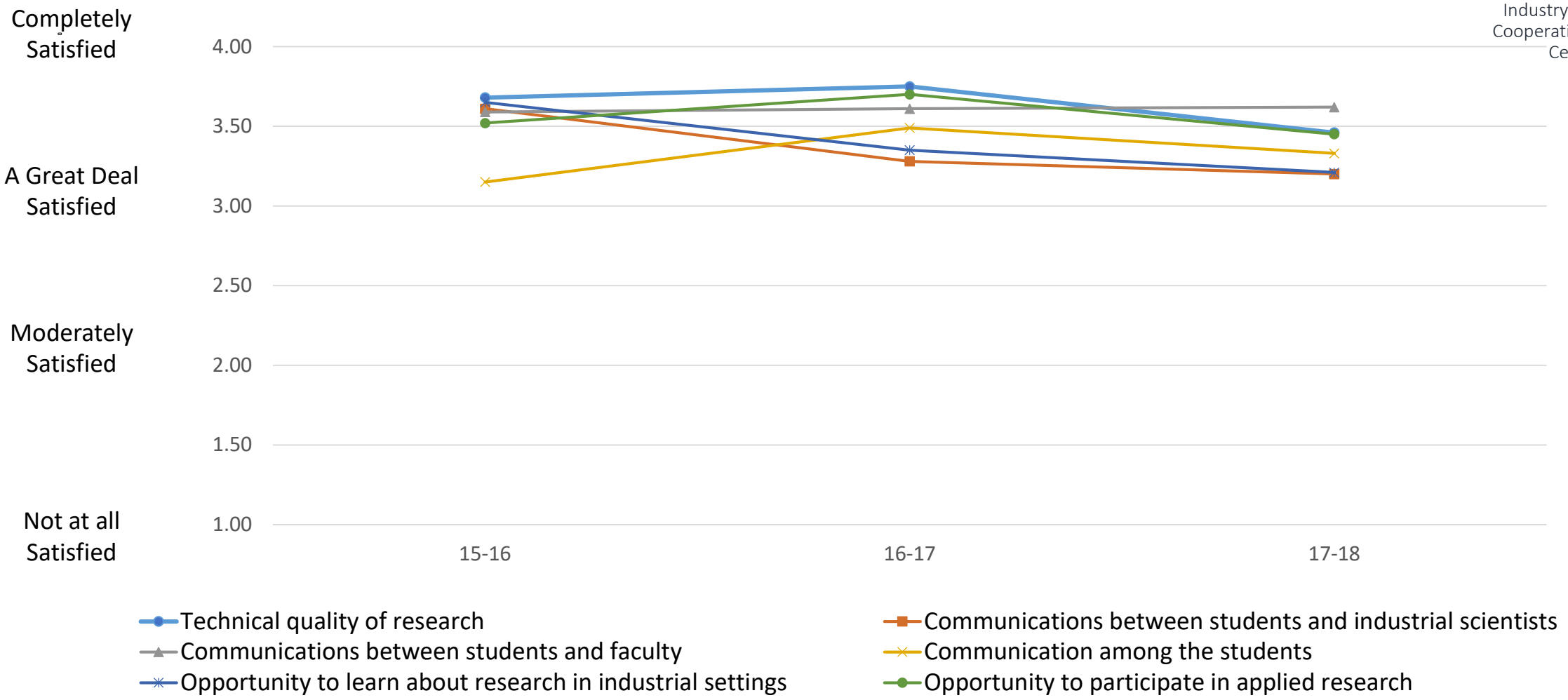
"Sometimes it is difficult to get good input for what to propose the next year that is continuing from last year. Sometimes there are a lot of new project ideas, but it isn't really helpful to always start over every year with a new topic."

Industry/University Cooperative Research Centers

Student Questionnaire

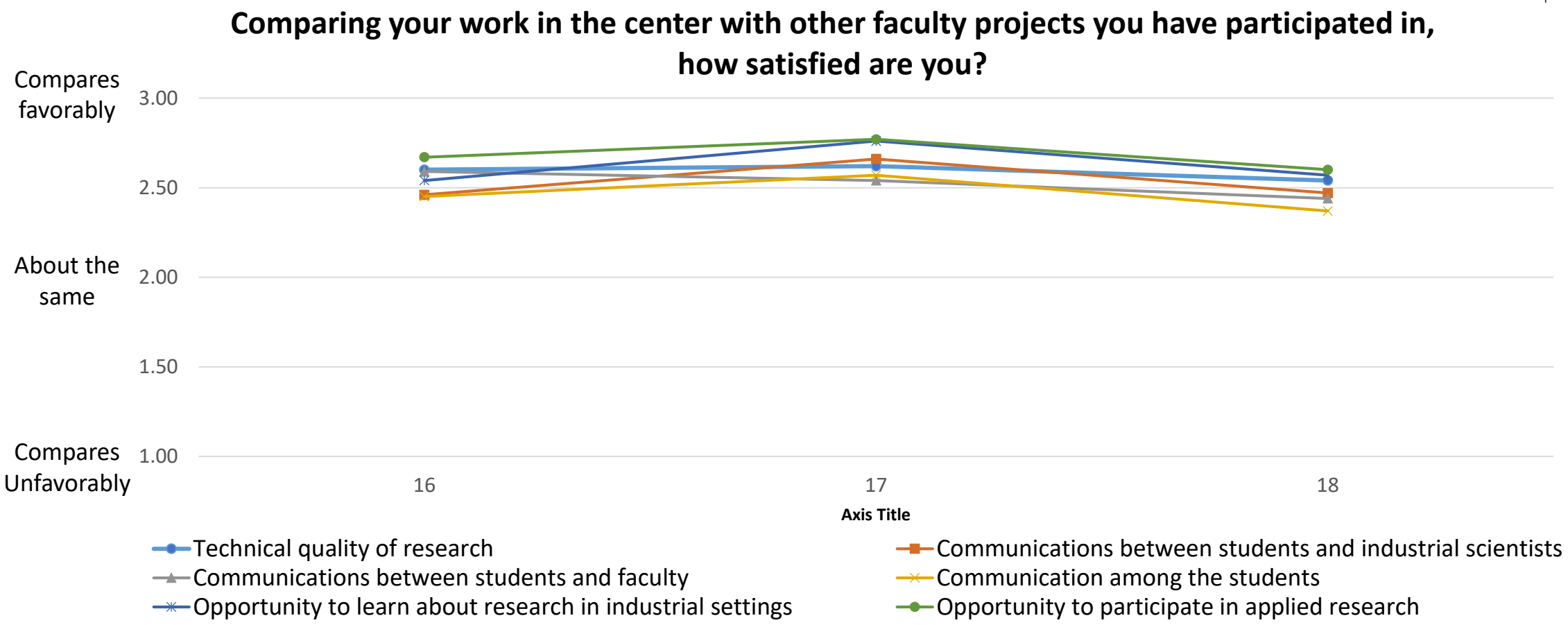
Satisfaction with Center Experience

Industry/University Cooperative Research Centers



Comparative Evaluation

Industry/University Cooperative Research Centers



How Should These Survey Results be Used?

Industry/University Cooperative Research Centers

- 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 looking at the impact of survey design on response rate

Questions?