National Science Foundation
Industry/University
Cooperative Research Centers

DRAFT

July 2017

2015-2016 Process Outcome Survey Results

Descriptive Statistics Compiled from Industry, Faculty & Student Surveys

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CONTENTS

REPORT PROCESSING & DATA ISSUES

This report provides descriptive statistics on the IUCRC Process Outcome Questionnaires. Data were collected during the fall of 2016 and spring 2017 and refer to the Center activity for FY 2015-2016.

Since most evaluators use this report to benchmark their Center compared to a program-wide "norm", we have reported "Center-level" means and standard deviations, with the exception of the sections on Research Cost Avoidance, Research Savings, and Stimulated New Research (see below). That is, means (unweighted) for each center were used to calculate a Center-level mean. Because questions that require a numeric answer (e.g. number of dollars) often have highly skewed distributions, we also reported the medians for these variables. For forced choice questions, frequencies for individual respondents were also reported.

Industry Questionnaires

All data were collected using a single industry questionnaire form. See the I/UCRC Evaluation project website for current and past versions of the surveys (http://www.ncsu.edu/iucrc/ResourcesForEvaluators.htm#Surveys). However, three centers (respondent N = 21) used a pilot version of the industry survey currently under development. The pilot survey includes some of the same questions as the current industry survey. When that was the case, pilot data were included in this report. Questions including data from the pilot survey are indicated with a foot note.

Faculty Questionnaires

The faculty questionnaire includes two versions: a long version (13 items) that is used by centers during the first phase (in year 1-5) and a short version (6 items) that is used by centers during the second and third phase (in year 6-15) of NSF funding. Since both the faculty long and faculty short questionnaires share some of the same questions, data for these shared questions were pooled for analysis. In the tables below, questions only included in the long version are noted as follows: (L).

Student Questionnaires

The student questionnaire was implemented as a required instrument towards the end of the 2016 reporting year. Centers for whom data collection had not already been completed were asked to complete the survey (Response Rate: Center N = 5; Student N = 57).

RESPONSE RATES

Category	Center Level		Individual Level	
	Industry	Faculty	Industry	Faculty
Response Frequency				
Continuing Population from CD report	68	68	1227	1041
1st Year Reporting Population from CD report	+1	+0	+5	+0
Retired/Defunct Centers	5	5	113	53
Retired/Defunct Centers Reporting[a]	+3	+0	+54	+0
Phase III Centers Exempt	4	4	102	117
Phase III Centers Reporting[b]	+1	+0	+11	+0
Population[c]	64	59	1082	871
Centers Excused from Evaluation[d]	6	14	86	242
Centers that did not return data	0	0	0	0
Available Population[e]	58	45	996	629
Data Received	58	45	366	240
Received / Population	90.63%	76.27%	33.83%	27.55%
Received / Available Population	100%	100%	36.75%	38.16%

a. Retired/defunct Centers are not required to submit data, but some do submit some data. If relevant, those data were included in the analysis.
b. For Phase III Centers entering the program in 2011 under solicitation 09-565, process outcome data collection is optional. No other program solicitation provides that option. Phase III Centers entering after 2011are included in the continuing population.
c. Population was defined as centers that were at least 1 year old.
d. Centers were excused for reasons such as being in the midst of center restructuring and respondent refusal to complete surveys.
e. Numbers based on population minus excused and not returned counts.

LONG FACULTY FORM VS. SHORT FACULTY FORM

	Long Form	Short Form
# of items	13	6
# of questions in common	6	6
# of unique questions	7	0
# of Centers using form	25	20
Sample size	115	125

Industry Results:2015-2016

Table 1: Research Program

1. Think about the currently funded Center research projects:

	0-19% (1)		20-39% (2)		40-59% (3)		60-79% (4)		80-100% (5)		Missing Data	Center Level	
	N	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**Mean**	**S.D.**
a. Percentage of currently funded research projects relevant to the organization's current or future R&D needs.	33	9.7	95	27.9	101	27.6	73	19.9	39	11.4	25	2.97	0.73

	Mean	**S.D.**
b. Number of scientist-months (full-time) your organization would take to plan, conduct, and complete a typical Center project internally *Sample: N of respondents = 338; N of centers = 57*	12.42	6.24
c. Number of the Center's research projects considered high enough priority that your organization would conduct internally or by contract within the next few years if the Center was not doing this research *Sample: N of respondents =340; N of centers = 57*	2.57	1.51

	Mean N of Center Projects	**SD N of Center Projects**	**Mean % of Projects Avoided**	**SD % of Projects Avoided**
Average % of the Center's research projects considered high enough priority that the organization would conduct internally or by contract % projects avoided = N of avoided projects (Q1c)/N of Center projects) *Sample: N of centers reporting N of Projects = 55, N of respondents = 347*	14.11	7.79	20.88	13.62

Research Cost Avoidance Estimates:**

Research Cost avoidance (RCA) is defined as savings a member obtains by having "necessary" research projects performed by a center rather than performing them internally. The following RCA calculations are based on a member's report of the number of projects they consider a "high enough priority they would conduct internally" (Q1c), number of scientist months it would take to complete a typical center project (Q1b), the cost of a scientist month (based on archival data), and cost of center membership (archival data). For a more detailed explanation of how this estimate is calculated see Appendix A.

Average Research Cost Avoidance (RCA)

Member Level Scores	**Mean**	**Median**	**S.D.**
a. Average dollar value (in thousands) of avoided projects per respondent organization Av.RCA member = (N of projects * N of months * Average salary per month) – Primary Fee *Sample: N of respondents = 327, N of centers = 54*	573.66	265.79	1539.99*
Center Level Scores	**Mean**	**Median**	**S.D.**
b. Average dollar value (in thousands) of avoided projects per respondent organization *Sample: N of respondents = 327, N of centers = 54*	3473.81	1619.39	4795.17
Program Level Scores	**Sum**		
c. Total dollar value of avoided projects by respondent organizations RCA program = Av.RCA member x N of members *Average derived from sample: N of respondents = 327, N of centers = 54*	$187,585,951		

*61 members (19%) have negative RCA that results in large standard deviation.

** It is worth noting that since only 34% of members completed the questionnaire; this is a very conservative estimate of the value of accelerated/avoided projects supported by members.

2. During the past year, how satisfied were you with the following features of the Center's research program?

	Individual Frequencies											Center Level	
	Not Satisfied (1)		Slightly Satisfied (2)		Somewhat satisfied (3)		Quite Satisfied (4)		Very Satisfied (5)		Missing Data		
	N	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**Mean**	**S.D.**
a. Capabilities of the researchers & quality of the research program*	0	0.0	3	0.8	22	6.1	185	51.7	148	41.3	8	4.29	0.48
b. Breadth of the research topics covered	0	0.0	4	1.2	64	18.9	171	50.6	99	29.3	28	3.98	0.54
c. Focus of the research	1	0.3	13	3.8	64	18.9	190	56.2	70	20.7	28	3.89	0.46
d. Relevance of research to my organization's needs	5	1.4	32	9.5	88	26.2	149	44.3	62	18.5	30	3.68	0.56

* Includes data from 3 centers using a pilot version of the survey.

Table 2: Benefits

A. Networking and Human Resource Benefits

	Individual Frequencies											Center Level	
	No Impact (1)		Slight Impact (2)		Moderate Impact (3)		High Impact (4)		Very High Impact (5)		Missing Data		
	N	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**Mean**	**S.D.**
4a. Enhanced cooperation and networking with industry and university scientists outside your organization	8	2.2	59	17.9	109	33.0	104	31.5	50	15.2	36	3.24	0.62
4b. Enhanced ability to identify and recruit well-qualified graduate students you would like to hire.*	90	31.3	61	21.2	66	22.9	47	16.3	24	8.3	78	2.40	0.81

*For 4b, 56% (N=44) of answers coded as "missing" (Total N=78) represent "not applicable." In other words, for the majority of industry representatives who did not answer this question, recruitment of students is considered not applicable for their organization.

4c. During the past year, how many students trained in the Center research projects were hired by your organization?
Sample: N of members = 325; N of centers = 56

	Member Level	
Member Level Scores	**Mean**	**S.D.**
a. Number of students hired per respondent organization	0.30	0.81
Center Level Scores	**Center Level**	
b1. Number of students hired per respondent organization per center	0.24	0.36
b2. Number of students hired by respondent organizations per center	1.73	3.07
Program Level Scores	**Program Level**	
c. Total number of students hired by respondent organizations	97	

B. Research & Development Benefits

	Yes		No	
	N	%	N	%
5a. During the past year, access to Center research findings and outputs has helped accelerate the pace and/or completion of some R&D projects already underway *(or contracted by)* at the organization.	183	54.8	151	45.2
5b. During the past year, access to Center research findings and outputs has helped the organization to decide against starting one or more new R&D projects that otherwise would have been initiated.	163	48.9	169	51.1

Research Cost Savings

If yes, 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?*
Sample: all respondents: N of respondents = 311; N of Centers = 56

	Member Level		
Member Level Scores	**Mean**	**Median**	**S.D.**
a. Dollar value of accelerated/avoided projects (in thousands) per respondent organization	123.11	81.25	115.75
	Center Level		
Center Level Scores	**Mean**	**Median**	**S.D.**
b. Dollar value of accelerated/avoided projects (in thousands) per center	801.85	387.50	1185.96
Program Level Scores	**Program Level**		
c. Total dollar value of accelerated/avoided projects supported by respondent organizations	$43,300,000		

* It is worth noting that since only 34% of members completed the questionnaire; this is a very conservative estimate of the value of accelerated/avoided projects supported by members.

Interpreting Research Cost Savings

- The average member saved $123K in R&D costs in the last year as a result of participation in the IUCRC program.
- Centers have an average of 18 members. The average Center saved its members $802K in R&D costs in the last year as a result of participation in the IUCRC program.
- There were 68 active Centers, serving 1227 members in FY2015-2016. The IUCRC program saved participating companies a total of $43.3M in R&D costs in the last year as a result of participation in the IUCRC program.
- These figures are based on feedback from firms responding to this survey. Member response rate was 34% (366 out of the available population of 996 responded to the survey) from 58 centers included in the data collection. Therefore, these are conservative estimates of the Research Cost Savings at the member, center and program levels.

	Yes		No	
	N	**%**	**N**	**%**
5c. During the past year, access to Center research findings/outputs has triggered development of new R&D projects at my organization, or significantly redirected *pending projects within my organization.*	143	42.9	190	57.1

Stimulated Research

	Member Level		
Member Level Scores	**Mean**	**Median**	**S.D.**
Includes All Cases			
a. Number of center-stimulated research projects per respondent organization *Sample: N of respondents = 313 ; N of centers = 55*	0.58	0.50	0.46
b. Dollar value of center-stimulated projects (in thousands) per respondent organization *Sample: all respondents: N of respondents = 324; N of Centers = 55*	113.10	50.00	157.27
Includes Only Cases Citing 1 or more projects			
c. Number of center-stimulated research projects per respondent organization *Sample: N of respondents = 127; N of Centers = 45*	1.56	1.50	0.59
d. Dollar value of center-stimulated projects (in thousands) per respondent organization *Sample: N of respondents = 141 ; N of Centers = 46*	336.74	158.33	742.40
e. Dollar value of each center-stimulated project (in thousands) *Sample: N of respondents = 118; N of Centers = 44*	233.01	100.00	411.12
	Center Level		
Center Level Scores	**Mean**	**Median**	**S.D.**
Includes All Cases			
f. Number of center-stimulated research projects per center *Sample: N of respondents = 313; N of Centers = 55*	4.35	3.00	3.84
g. Dollar value of center-stimulated projects (in thousands) per center *Sample: all respondents: N of respondents = 342; N of Centers= 55*	896.04	362.50	1270.95
Program Level Scores	**Program Level**		
h. Total number of center stimulated projects supported by respondent organizations *Sample: N of respondents = 313; N of Centers = 55*	200		
i. Total dollar value of center-stimulated projects supported by respondent organizations *Sample: all respondents: N of respondents = 324; N of Centers = 55*	$43,010,000		
j. Total dollar value of center-stimulated projects supported by total estimated population based on member level mean. *All respondents: N of Total Population Estimated = 996; N of Centers = 58*	$130,575,600		

* It is worth noting that since only 34% of members completed the questionnaire; this is a very conservative estimate of the value of center stimulated projects supported by members.

C. Commercial Benefits

6a. During the past year, to what extent has participation in the Center enhanced your organization's commercialization efforts via new technical knowledge; expanded intellectual property resources; improved or new products, processes, services, improved sales; or new or retained jobs?

Individual Frequencies													Center Level	
No Impact (1)		Slight Impact (2)		Moderate Impact (3)		High Impact (4)		Very High Impact (5)		N/A (9)		Missing Data		
N	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**Mean**	**S.D.**
77	23.2	65	19.6	100	30.1	39	11.7	11	3.3	40	12.0	34	2.39	0.68

Table 3: Center Administration and Operations

7. During the past year, how satisfied were you with center administrative operations?*

Individual Frequencies											Center Level	
Not Satisfied (1)		Slightly Satisfied (2)		Satisfied (3)		Quite Satisfied (4)		Very Satisfied (5)		Missing Data		
N	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**Mean**	**S.D.**
2	0.6	6	1.7	51	14.2	151	42.1	149	41.5	7	4.16	0.49

* Includes data from 3 centers using a pilot version of the survey.

8. How can the Center improve its administration and operations? Please mark areas that need improvement.*

	Individual Frequencies	
	N of Responses	**% of Respondents^**
a. Planning the Research Program	46	12.6
b. Project Selection	60	16.4
c. Project Development and Management	46	12.6
d. Dissemination of Results via Publications	54	14.8
e. Technology Transfer	52	14.2
f. Intellectual Property Management	26	7.1
g. Fundraising & Recruiting New Members	70	19.1
h. IAB Meeting Planning	28	7.7
i. IAB Meeting Content	17	4.6
j. IAB Meeting Execution	30	8.2
k. IAB Meeting Follow-up	30	8.2
l. Communications	54	14.8
m. Center Personnel	11	3.0
n. Other	20	5.5
Total N	544	148.8

* Includes data from 3 centers using a pilot version of the survey.

^ Respondents were encouraged to check as many boxes as applied. Therefore, the percentage across all items may total to greater than 100%.

Table 4: General Evaluation

9. Will your organization renew its membership?*												
Individual Frequencies											**Center Level**	
Definitely Not (1)		Probably Not (2)		Uncertain (3)		Probably Yes (4)		Definitely Yes (5)		Missing Data		
N	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**Mean**	**S.D.**
2	0.6	7	2.0	45	12.7	144	40.8	155	43.9	13	4.22	0.46

* Includes data from 3 centers using a pilot version of the survey.

11. Organization Type/Size		
	Individual Frequencies	
	N	**%**
1. For-Profit Large (> 500 Employees)	183	55.0
2. For-Profit Small (11- 500 Employees)	59	17.7
3. For Profit-Micro (< 10 Employees)	24	7.2
4. Government (Federal/State/Local)	48	14.4
5. Non-Profit / Other	19	5.7
Total Reported	333	100%

Faculty Results: 2015-2016

Table 1: Research

1. Compared to the research projects that you typically conduct outside the Center, would you describe your Center funded research as: (L)*

Individual Frequencies											Center Level	
Much more basic (1)		More basic (2)		Same (3)		More Applied (4)		Much more applied (5)		Missing Data*		
N	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**Mean**	**S.D.**
1	0.9	3	2.7	30	26.5	63	55.8	16	14.2	2	3.79	0.60

* Indicates a question that is unique to the long version of the faculty questionnaire.

2. During the past year, how satisfied were you with the following?

	Individual Level											Center Level	
	Not Satisfied (1)		Slightly Satisfied (2)		Somewhat Satisfied (3)		Quite Satisfied (4)		Very Satisfied (5)		Missing Data		
	N	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**Mean**	**S.D.**
a. Quality of the Center-supported research program	2	0.8	4	1.7	13	5.5	106	44.5	113	47.5	2	4.32	0.49
b. Relevance of the Center's research program to my professional goals	2	0.8	3	1.3	19	8.0	93	39.1	121	50.8	2	4.41	0.41

Table 2: Impact

4. During the past year, what impact has participation in the Center had for YOU in the following areas? (L)*

	Individual Level											Center Level	
	No Impact (1)		Somewhat Positive Impact (2)		Moderately Positive Impact (3)		Very Positive Impact (4)		Extremely Positive Impact (5)		Missing Data		
	N	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**Mean**	**S.D.**
a. The feeling of accomplishment I get from the research I do.	1	0.9	3	2.7	19	17.0	56	50.0	33	29.5	3	4.09	0.50
b. Opportunities for research contracts/grants.	3	2.7	9	8.1	25	22.5	40	36.0	34	30.6	4	3.80	0.54
c. Recognition I receive for the work I do.	2	1.8	10	8.9	22	19.6	48	42.9	30	26.8	3	3.83	0.53
d. Access to useful equipment.	20	18.2	7	6.4	27	24.5	34	30.9	22	20.0	5	3.24	1.03
e. Ability to support graduate students.	5	4.6	7	6.5	22	20.4	38	35.2	36	33.3	7	3.80	0.68
f. Ability to publish my work in quality proceedings and journals.	6	5.6	7	6.5	31	29.0	35	32.7	28	26.3	8	3.74	0.66

* Indicates a question that is unique to the long version of the faculty questionnaire.

Table 3: Commitment

5. Which option best expresses your current intentions?

	Individual Frequencies											Center Level	
	Definitely Not (1)		Probably Not (2)		Uncertain (3)		Probably Yes (4)		Definitely Yes (5)		Missing Data		
	N	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**Mean**	**S.D.**
Next year I will submit my best research ideas in a center funded proposal*	3	1.3	13	5.5	40	16.9	88	37.3	92	39.0	4	4.13	0.52

* Item presented for the first time on the 2006-2007 Faculty Questionnaire

Table 4: Satisfaction

6. During the past year, how satisfied were you with center administrative operations?

Individual Frequencies											Center Level	
Not Satisfied (1)		Slightly Satisfied (2)		Somewhat Satisfied (3)		Quite Satisfied (4)		Very Satisfied (5)		Missing Data		
N	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**Mean**	**S.D.**
4	1.7	6	2.5	16	6.8	88	37.1	123	51.9	3	4.30	0.43

Student Results: 2015-2016

Table 1: Satisfaction

1. How satisfied are you with the following features of the center?

	Individual Frequencies									Center Level	
	Not at all Satisfied (1)		Moderately Satisfied (2)		A Great Deal Satisfied (3)		Completely Satisfied (4)		Missing Data		
	N	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**Mean**	**S.D.**
a. Technical quality of research	0	0.0	4	7.0	11	19.3	42	73.7	0	3.65	0.30
b. Communications between students and industrial scientist	2	3.5	8	14.0	19	33.3	28	49.1	0	3.17	0.52
c. Communications between students and faculty	1	1.8	5	8.8	10	17.5	41	71.9	0	3.64	0.26
d. Communication among the students	1	1.8	5	8.8	12	21.1	34	59.6	5	3.49	0.38
e. Opportunity to learn about research in industrial settings	2	3.5	6	10.5	15	26.3	34	59.6	0	3.38	0.53
f. Opportunity to participate in applied research	0	0.0	4	7.0	17	29.8	36	63.2	1	3.63	0.25

Table 2: Comparative Evaluation

2. Comparing your work in the center with other faculty projects you have participated in, how satisfied are you?

	Individual Frequencies									Center Level	
	Compares Unfavorably (1)		About the Same (2)		Compares Favorably (3)		NA (9)		Missing Data		
	N	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**Mean**	**S.D.**
a. Technical quality of research	1	1.8	15	26.3	35	61.4	35	61.4	6	2.60	0.28
b. Communications between students and industrial scientist	2	3.5	21	36.8	26	45.6	26	45.6	8	2.46	0.16
c. Communications between students and faculty	1	1.8	17	29.8	31	54.4	31	54.4	8	2.59	0.22
d. Communication among the students	0	0.0	19	38.0	25	50.0	25	50.0	13	2.45	0.31
e. Opportunity to learn about research in industrial settings	2	3.6	17	30.9	29	52.7	29	52.7	9	2.54	0.27
f. Opportunity to participate in applied research	1	1.8	16	29.1	31	56.4	31	56.4	9	2.67	0.24

Appendix A

Calculation of Research Cost Avoidance for Center Members:

Research cost avoidance is a way of estimating one benefit firms may realize from center participation. *Research cost avoidance is defined as savings a firm obtains by having "necessary" research projects performed by a center rather than performing them internally.* 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 $50,000 of R&D costs. A firm's research cost avoidance (RCA) can be estimated by knowing a firm's costs to carry out a project (C_f) and the cost of center membership (C_c). C_f can be calculated by knowing: number of center projects a firm considers "high enough priority they would have conducted them internally or by contract" ($N_{projects}$), how many scientist months those projects would take to complete (N_{SM}), the cost of a scientist month (C_{sm}). Member firms provide estimates of $N_{projects}$ (Q1c) and N_{SM} (Q1). We obtain estimates of C_{sm}[1] from archival sources and C_c from center records. The formula for obtaining an estimate for cost avoidance is:

$$RCA = \sum C_f - C_c.$$

C_f is calculated as follows: $C_f = N_{projects} \times N_{SM} \times C_{sm.}$

Once a firm's cost avoidance has been estimated, one can calculate the average RCA for members in a particular center or for the whole program and RCA totals for a given center or program. For a more detailed description of research supporting this estimate please refer to: Gray, D.O. & Steenhuis, H-J (2003). Quantifying the benefits of participating in an industry university research center: An examination of research cost avoidance. *Scientometrics*, *58*, 281-300.

[1] In an attempt to develop a conservative and defensible estimate of firm costs, we used salary data from the Engineering Workforce Commission as the basis for our calculations. More specifically, we used data from the *Engineers' Salaries: Special Industry Report, 2011* survey as our starting point. Industry costs were calculated by using the median salary for individual with a PhD, who was early career (4+ years), and in the appropriate field for the industry in question (e.g., engineering). This value was multiplied by 1.35 to reflect a conservative estimate of fringe benefit costs and then multiplied by 1.50 to reflect a conservative overhead rate. This annual rate was then divided by 12 (and rounded to the nearest thousand) to produce an estimate of the cost/month for an industry scientist.