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# **New IUCRC Evaluator Protocol Incorporating Economic Impact Assessment**

IUCRC Evaluator's Meeting  
June 6, 2013

*Denis Gray*

North Carolina State University



# Purpose and Overview

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- Review and debrief the implementation and success of the changes made in the evaluator protocol during 2012-13
- Make recommendations for continuing implementation
  - Need to move past pilot stage

## Overview

- Part 1: Process Outcome Questionnaire Changes
  - Discussion
- Part 2: Interview-based Economic Impact Interviews
  - Discussion



# Background

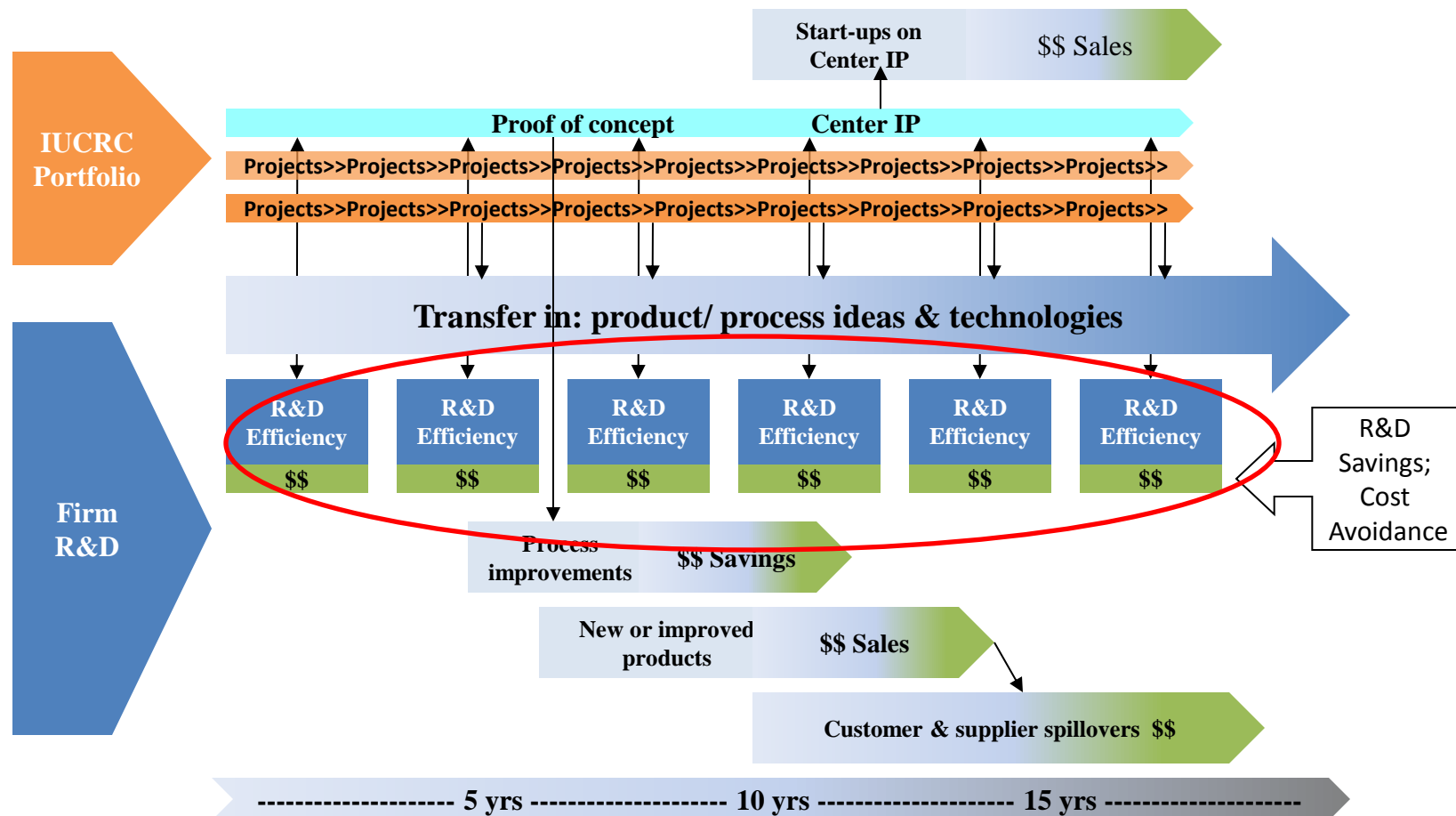
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- Increasing expectation and pressure from Congress and oversight agencies to demonstrate quantitative impact estimates of STI programs
  - IUCRC no exception
- Completed *Measuring Economic Impacts of IUCRCs: Feasibility Study* (Gray & Rivers)
  - Documented economic impacts
  - Recommended changes to the IUCRC evaluation protocol
    - Changes to Industry Process Outcome Questionnaire (Part 1)
    - Interview-based economic impact assessment (Part 2)



# IUCRC Economic Impact Model

How and when do quantifiable economic impacts show up?





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# Part 1: Process Outcome Changes



# Recommendations

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- 1. Modify the Process/Outcome Questionnaire to emphasize relatively proximate quantitative economic impacts.*
- 2. Develop a standardized protocol and training system that facilitates collection of economic impact data by local evaluators.*
- 3. Develop a simple and compelling methodology for reporting the impact data to important stakeholder groups.*
- 4. Link the revised assessment activities with the efforts to periodically collect “technology breakthrough” cases.*



# What is R&D Efficiency?

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- Operational definitions are hard to find but...
  - *From this vantage point R&D capabilities can be recognized as connected with knowledge about how to search efficiently... Strong knowledge enhances efficiency both by enabling R&D to proceed on a generally better set of candidate projects, and by enabling the set worked upon to reflect more accurately particular demands and needs. (Nelson, 1983)*
  - *Therefore, the efficient usage of the scarce resources devoted to R&D becomes increasingly important, especially in a globalized world... Countries utilizing their R&D resources inefficiently will be penalized with a growth discount. (Cullmann et al, 2009)*



# What is R&D Efficiency

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- *Companies can realize a 30% or greater increase in R&D efficiency—as measured by the return on invested R&D dollars—through proper planning processes and better allocation of resources. (Alix Parnters)*
- *Although the era of open innovation has begun for many firms, we still lack a clear understanding of the mechanisms, inside and outside of the organization, when and how to fully profit from the concept...**However, only first approaches of measurement systems and key performance indicators are known, which makes it hard to evaluate open versus closed innovation approaches.** (Enkel, Gassman, Chesbrough, 2009)*





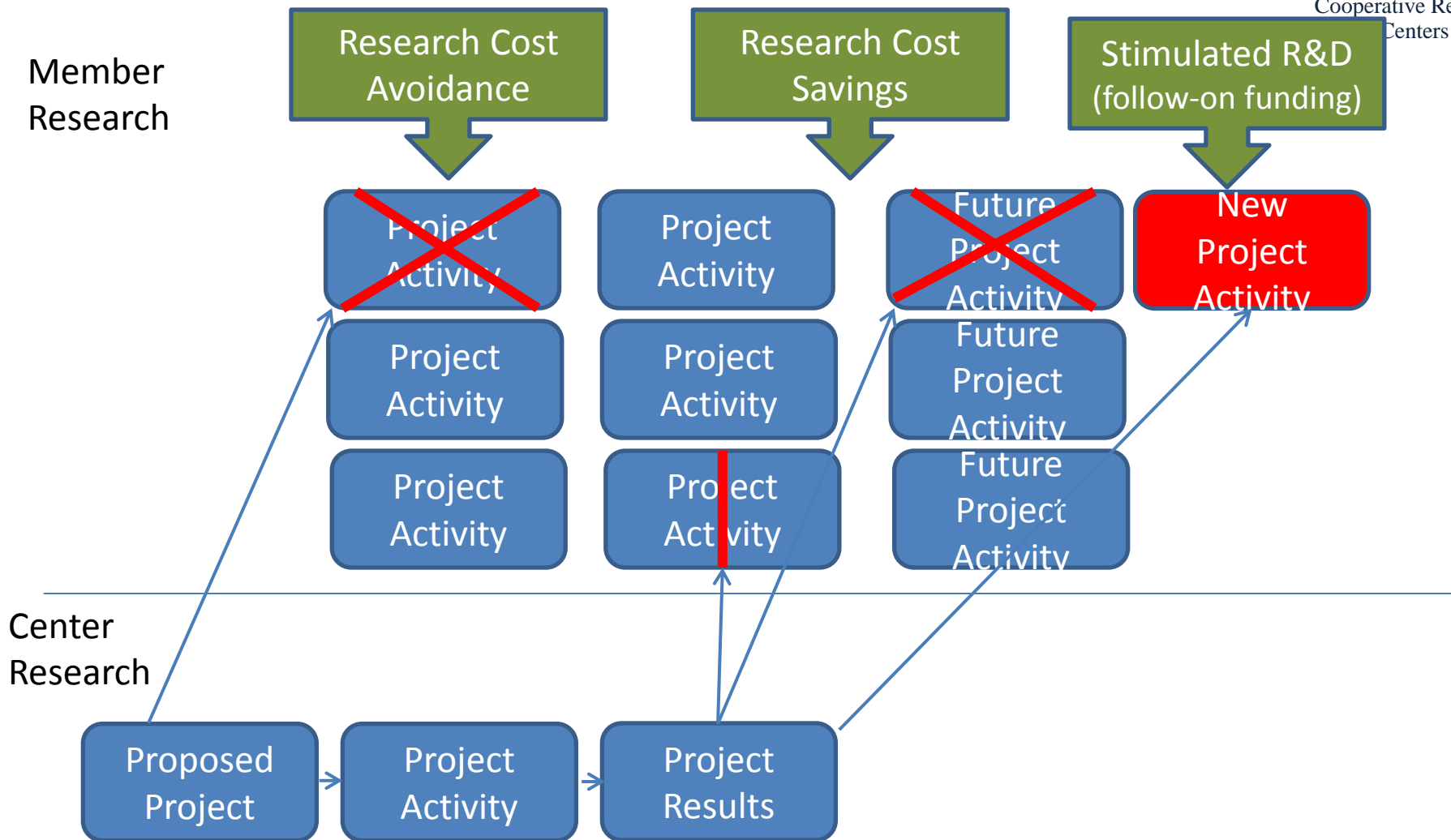
# Calculation of Economic Impacts (\$)

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- Research amplification (Q1 & Q2a)
  - *Percent Rel. x N of Center Proj. x Scien. Months x \$/Scien. Month (Gray & Steenhuis, 2003)*
- Cost Avoidance (Q2b & 2a)
  - *N of Proj. Avoid x Scien. Months x \$/Scien. Months (Gray & Steenhuis, 2003)*
- R&D Cost Savings
- Accelerated R&D savings (5a):
  - *\$ saved by accelerated projects*
- Avoided R&D (5b):
  - *\$ avoided by not starting projects*
- Stimulated R&D (5c):
  - *\$ invested in new or revised R&D directions*



# Defining Research Efficiency Measures





# Implementation

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- Questionnaire Implementation
  - Some snafus
    - Several centers used the old questionnaires (N=61)
      - Oops vs. began collecting before questionnaires available
    - System of pre-coding questionnaires with N of Center projects needs to be re-worked.
  - Respondent compliance
    - Response rate consistent with previous years
    - Negligible missing data
    - Some feedback:
      - “Way too early to observe these impacts”
      - “Not sure I can make these estimates”
- Overall
  - No serious problems



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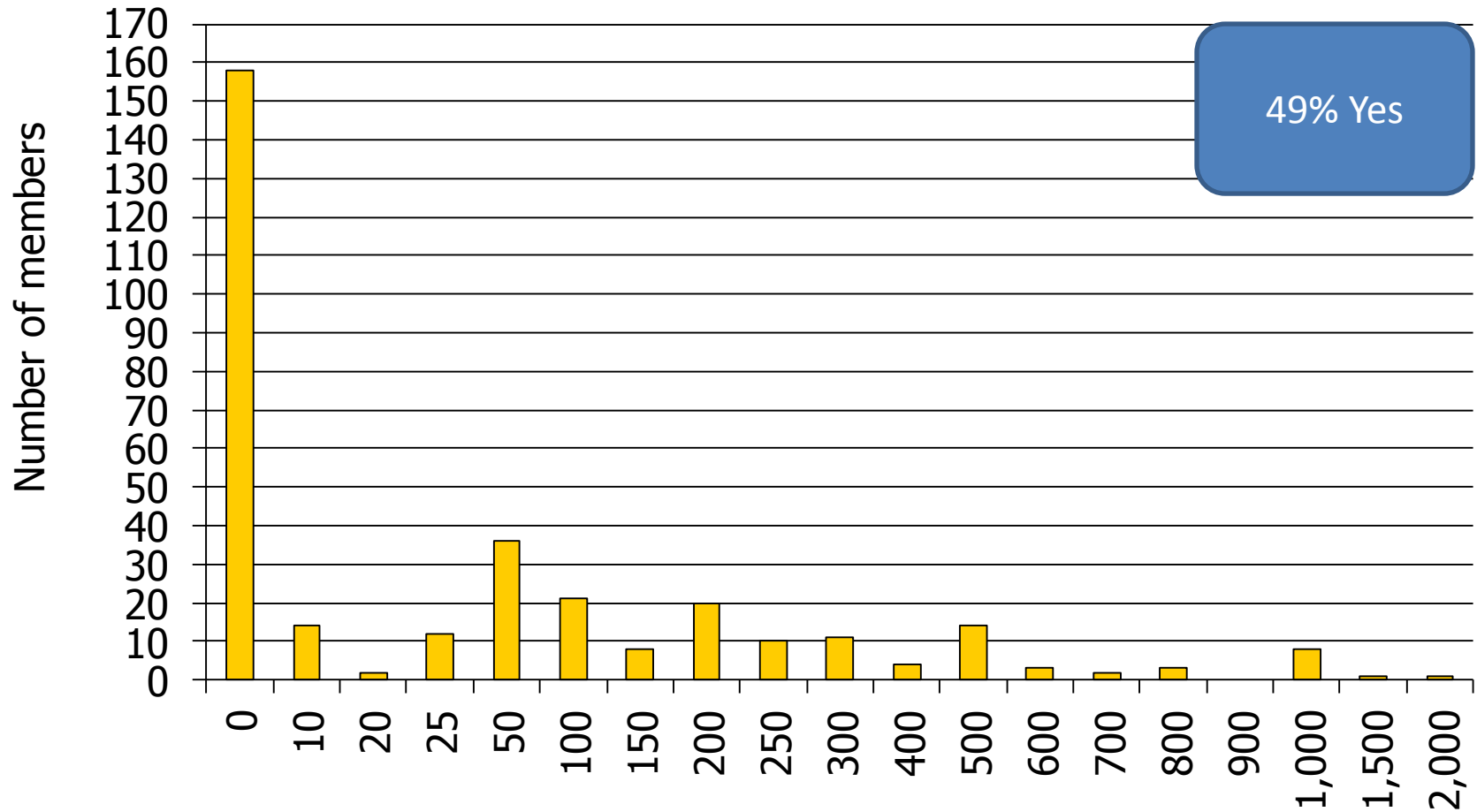
# Findings

# Stimulated R&D (follow-on funding)

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- What changed?
  - **Old:** Approximately how many **center-stimulated** research projects were supported by your organization (include internal projects and projects contracted to outside performers).
  - **New:** Access to Center research findings and outputs has **triggered the development** of new R&D projects at my organization, or significantly redirected current R&D. (Y/N)  
(5c)

# Value of Center-Stimulated Projects: FY 2011-2012



# Estimating IUCRC-Wide Center-Stimulated Funding

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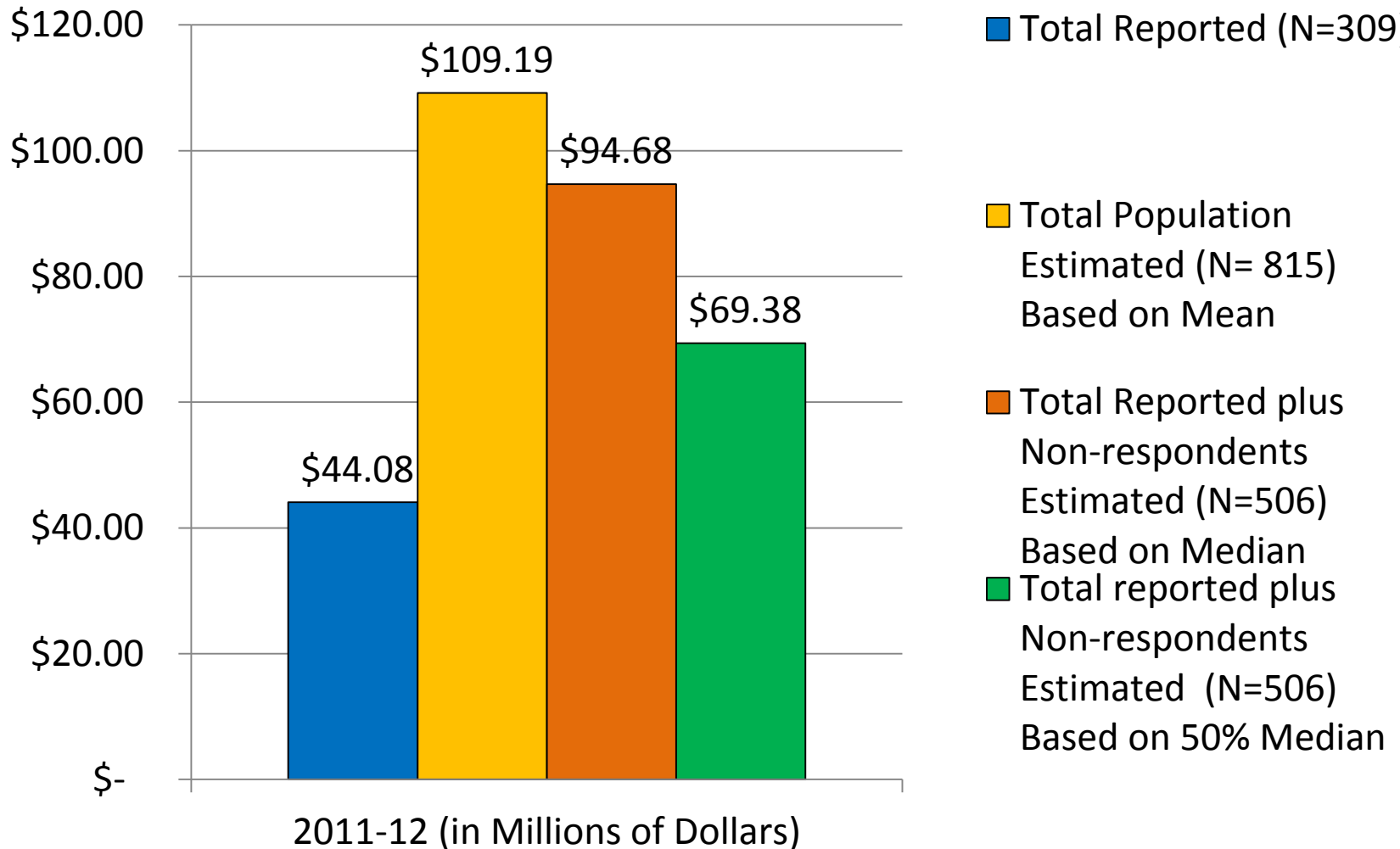
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- Program-wide center-stimulated funding for 11-12 is **\$44.08 million**
- There is a fundamental problem estimating both center and program-wide value of center stimulated projects
  - Response rate is running at ~40% of total population
- Our reported value is a VERY conservative estimate
  - Assumes none of the 60% non-responders invested in center stimulated projects
- Need to find a defensible approach to estimating
  - Non-responders
    - mean
    - median
    - 50% of median

# Estimating IUCRC-Wide Follow-on Funding in Millions



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# Research Cost Savings

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- New questions
  - Accelerated R&D savings (5a): Y/N
  - Avoided R&D (5b): Y/N
  - “If yes, taking into account personnel, facility and related costs how much would you estimate these accelerated AND/OR avoided project(s) would have cost your organization?”
- Industry perspective: “Some people do not realize how costly it is to not cut something off when you realize it is not going to work”. *R&D Manager of Large Chemical Company*



# Research Cost Savings

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## B. Research & Development Benefits

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	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 at the organization	199	64.2	111	35.8
5b. During the past year, access to Center research findings and outputs has helped the organization to decide against initiating a new project we otherwise would have conducted.	161	52.1	148	47.9
Yes to Either / No to Both	231	74.8	78	25.2



# Research Cost Savings

*If yes, taking into account personnel, facility and related costs how much would you estimate these accelerated AND/OR avoided project(s) would have cost your organization.*

<b>Member Level Scores</b>	<b><u>Member Level</u></b>		
	<b>Mean</b>	<b>Median</b>	<b>S.D.</b>
a. \$ value of accelerated/avoided projects (thousands) per respondent org. <i>Sample: all respondents: N of respondents = 255 ; N of Centers= 39</i>	226.90	50.00	813.13

<b>Center Level Scores</b>	<b><u>Center Level</u></b>		
	<b>Mean</b>	<b>Median</b>	<b>S.D.</b>
b. \$ value of accelerated/avoided projects (thousands) per center <i>Sample: all respondents: N of respondents = 255 ; N of Centers= 39</i>	1483.59	850.00	2524.86

<b>Program Level Scores</b>	<b><u>Program Level</u></b>
c. Total \$ value of accelerated/avoided projects supported by respondent orgs. <i>Sample: all respondents: N of respondents = 255 ; N of Centers= 39</i>	\$57,860,000

*\* It is worth noting that since only 41.53% of all members completed the questionnaire; this is a very conservative estimate of the value of accelerated/avoided projects supported by members.*



# Research Cost Avoidance

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- Background
  - Based on previous research on IUCRC (Gray & Steenhuis, 2003)
  - Builds on prior research on estimating impact of government support of R&D
    - Link 1996: Production function approach: relative value exceeds alternative investments
    - Link and Scott, 1998: evaluation of cost structures for alternative ways to achieve the same output (counterfactual evaluation model)
      - Demonstrate that relative value exceeds alternatives

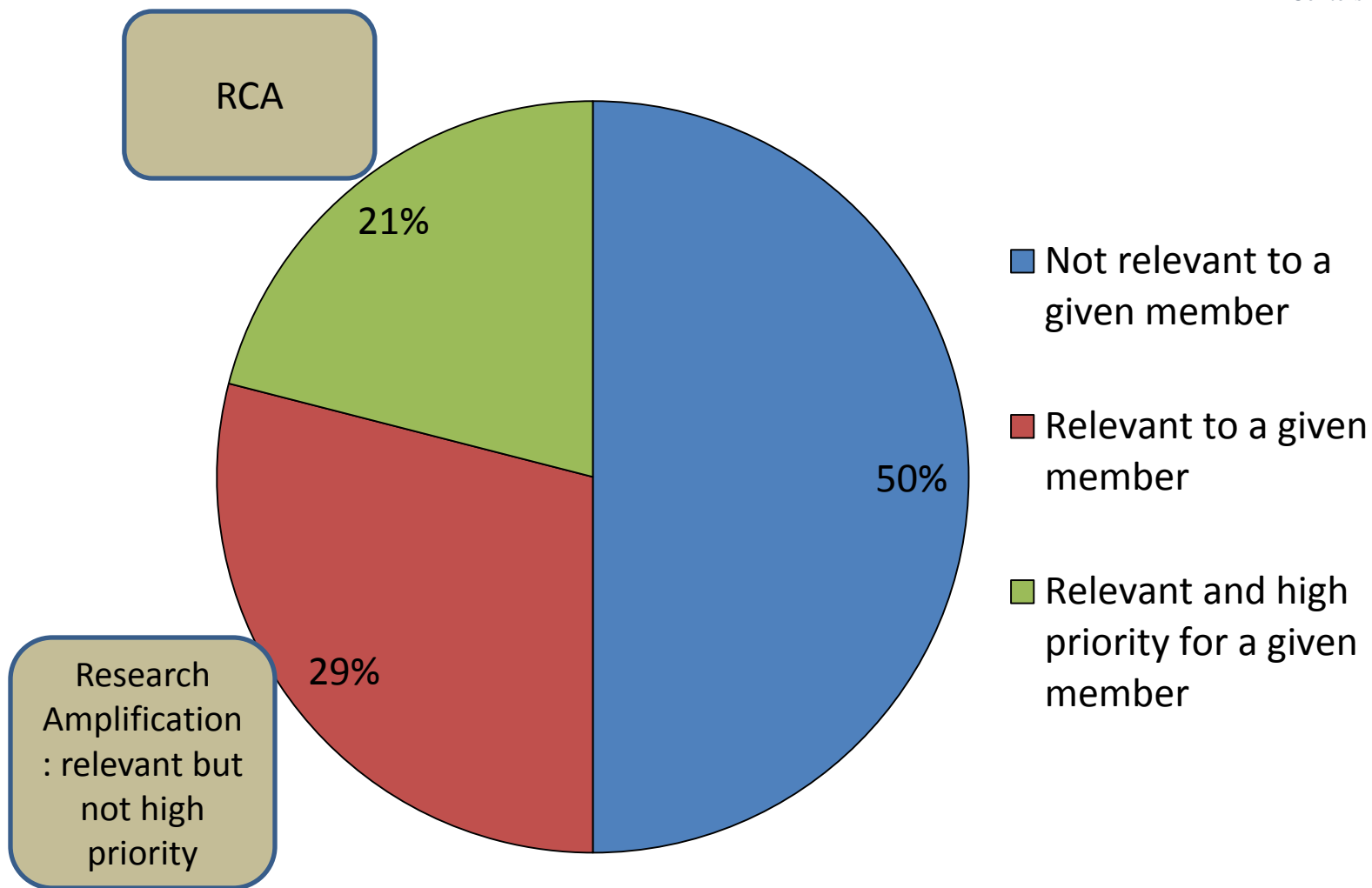


# Research Cost Avoidance

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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.

# Member Evaluation of Center Projects





# Research Cost Avoidance

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- Calculation:

- $RCA = \sum C_f - C_c$ .

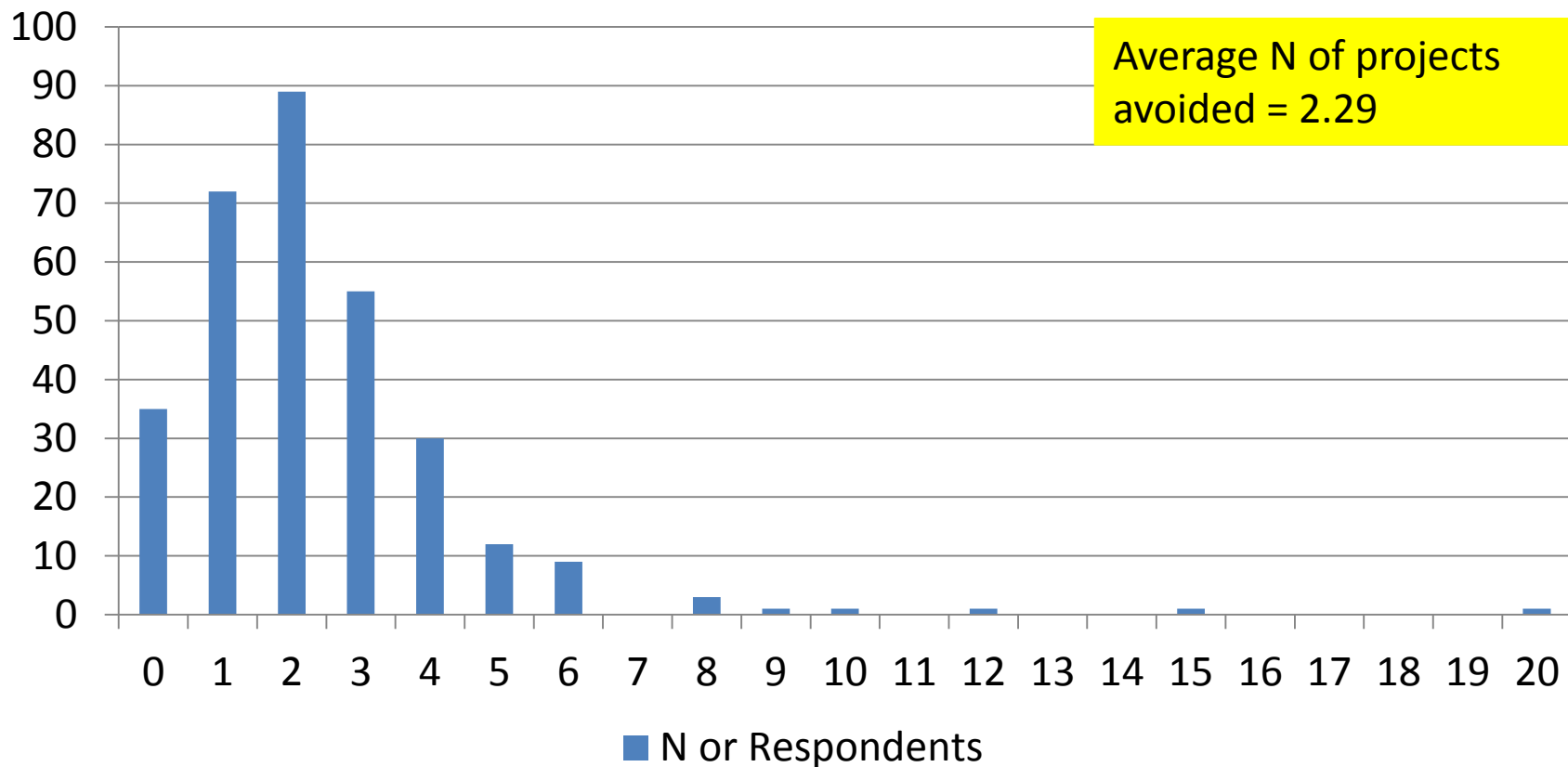
- Firm cost ( $C_f$ ) is calculated as follows:  $C_f = N_{projects} \times N_{sm} \times C_{sm}$ .

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



# RCA Findings

## N of Projects Avoided

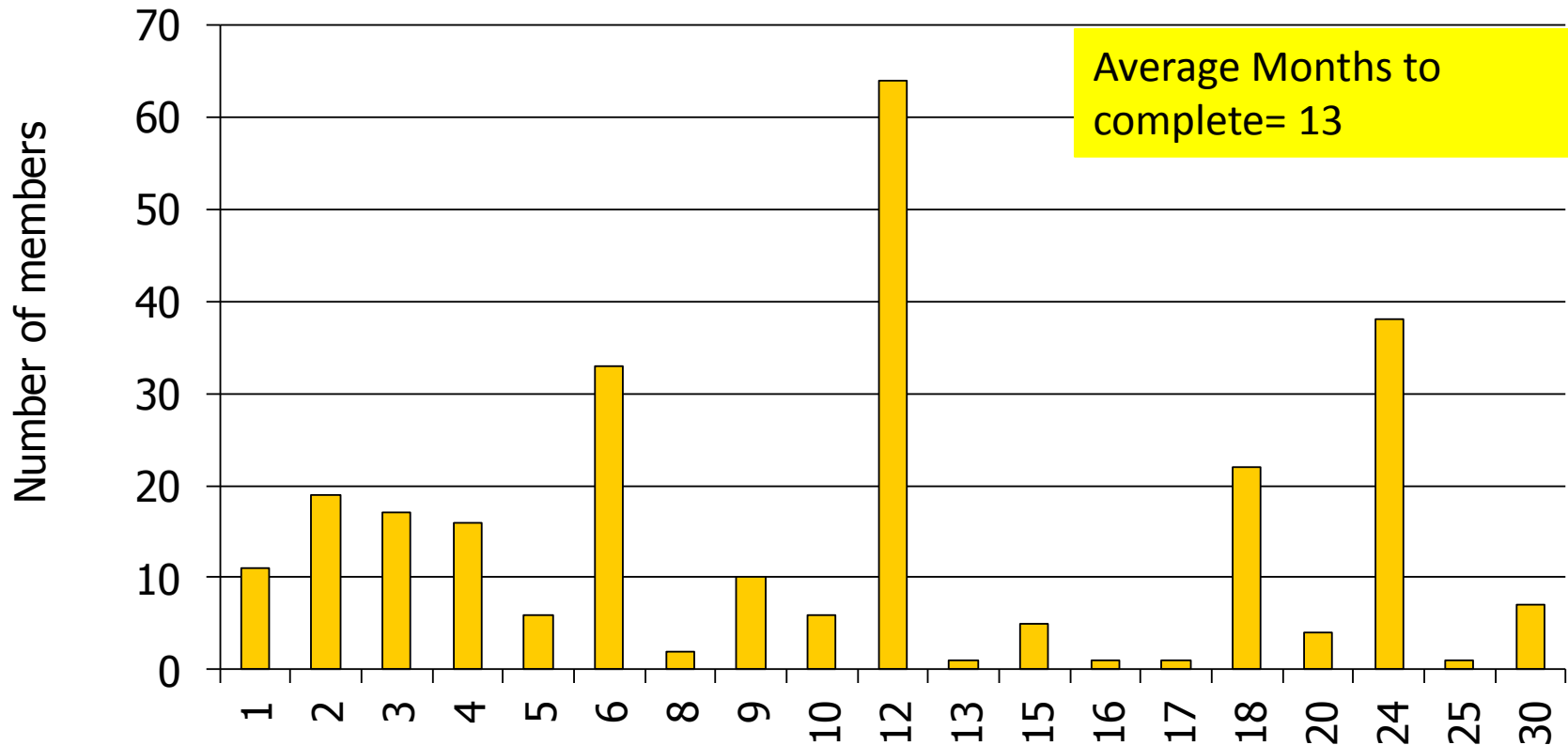




# N of months to complete a typical center project: FY 2011-2012



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# RCA Findings

## 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	487.55	243.91	847.55*
<i>Sample: N of respondents = 287, N of centers = 41</i>			
Center Level Scores	Mean	Median	S.D.
b. Average dollar value (in thousands) of avoided projects per respondent organization			
	4353.40	2897.37	5686.20
<i>Sample: N of respondents = 287, N of centers = 41</i>			
Program Level Scores	Sum		
c. Total dollar value of avoided projects by respondent organizations			
RCA program = Av. RCA member * N of members			\$153,090,700
<i>Sample: N of respondents = 314 N of centers = 45</i>			



# Summary of R&D Efficiency Impacts

	Member Level Mean	Center Level Mean	Program Total
Research Cost Avoidance	\$487,550	\$4,353,400	\$153,090,700
Research Cost Savings	\$226,909	\$1,483,590	\$57,860,000
Stimulated Research Projects	\$133,980	\$1,001,820	\$44,080,000

## Notes:

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



# Conclusions

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- Implementation of the revised questionnaire went relatively well
  - Need 100% follow through in future
  - Need alternative method of obtaining total number of center projects
  - Members were able to complete the questions (little missing data)
    - “Too early to estimate”, only serious complaint
- Have expanded our ability to quantify “R&D Efficiency” beyond “Stimulated Projects” with impressive estimates
  - Cost Avoidance
  - Cost Savings
- Provides enhanced documentation of the IUCRC impact
- Evaluators may need a RCA excel app to insure accurate calculation



# Issues for Discussion

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- Where do we go from here? How can we insure we can defend these estimates?
- Are the labels for the indices accurate?
  - Cost avoidance; Cost savings; Follow-on funding?
- Is the wording of the questions demanding enough to defend the estimates?
- Do these estimates have face validity?
  - What do members say about these estimates? Would they be willing to use their firm-level estimates internally?
  - How much overlap might there be among the estimates?
  - How careful should we be in the time frame of these impacts (“During the last year”)



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Part 2:  
Economic Impact Assessment: Interview-  
based Economic Development Assessment

Denis Gray  
North Carolina State University



# Purpose and Overview

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- Review and debrief the implementation in the evaluator protocol during 2012-13
- Make recommendations for continuing implementation

## Overview

- Review the Implementation Plan
- Open Discussion of Evaluator Experience



# Recommendations

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- 1. Modify the Process/Outcome Questionnaire to emphasize relatively proximate quantitative economic impacts.*
- 2. Develop a standardized protocol and training system that facilitates collection of economic impact data by local evaluators.***
- 3. Develop a simple and compelling methodology for reporting the impact data to important stakeholder groups.*
- 4. Link the revised assessment activities with the efforts to periodically collect “technology breakthrough” cases.*





# General Principles

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- **Impact data collection should become a higher priority for evaluators at centers as they become more mature with an emphasis on Phase 2 and 3 of NSF funding**
- **Assessment should emphasize data collection via personal interviews of targeted high impact beneficiaries**
- **Must allow respondent the option of the case and/or the economic estimate remaining confidential in reporting**
- **A method for logging reports of forecasted impacts will be developed so that the evaluator can conduct follow-up interviews with informants in order to validate these estimates.**
- **A method for documenting the causal impact of IUCRCs, particularly when other factors may be involved, should be developed**
- **Since centers graduate from the IUCRC program and these mature centers are likely to be promising sources of transfer-derived economic impact, provisions must be taken to include graduated centers in this procedure**



# Disclaimers for our new role

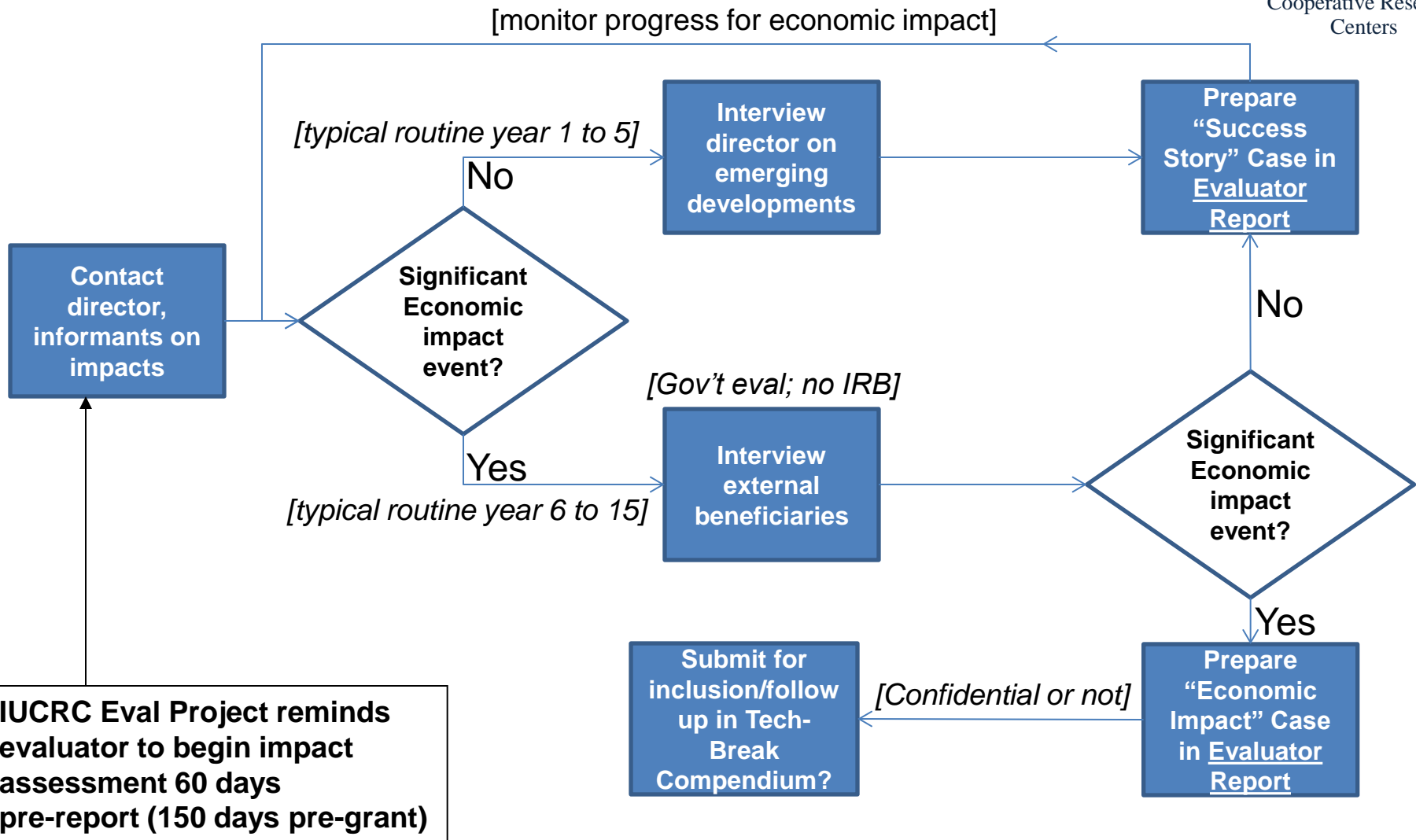
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- After 30 years of IUCRC evaluation experience and involvement in the economic impact study ...
  - Blockbuster impacts happen but they are few and far between
    - Expect a lot “we’re benefiting but nothing really big”
  - Many important center impacts cannot with all the nudging in the world be easily monetized
    - However, they can be documented and let the audience decide on their value
- There is no expectation or quota that every center will produce x breakthroughs or \$Y of impact

# Proposed economic impact assessment process



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# Supporting Economic Impact Assessment:

[www.ncsu.edu/iucrc](http://www.ncsu.edu/iucrc)



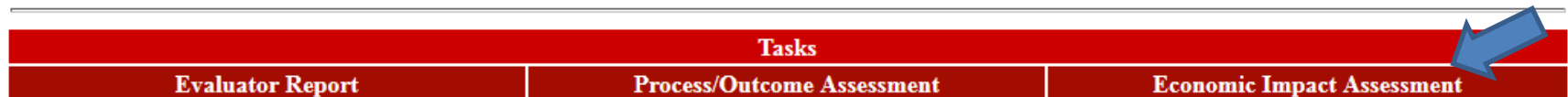
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Resources for Evaluators > Tasks > Evaluator Report  
> Economic Assessment

**TABLE 1:  
SUMMARY OF REQUIRED EVALUATION OUTPUTS**

Instrument/ Procedure	When Collected	Data Sources	Reports	Other
<b>Evaluator's Report</b>	Ongoing including attendance at meetings, etc.	All Center participants, Center documents. Must include <a href="#">Semi-Annual Meeting Best Practice Checklist</a> , the <a href="#">Evaluator Report Cover Sheet</a> , and <a href="#">Success Story</a> or <a href="#">Impact Assessment</a>	Written at end of planning grant, updated annually*	Full Report to Director for inclusion in IUCRC renewal application; copy to NCSU; include <a href="#">cover sheet</a>
<b>Process/Outcome Questionnaire</b>	Annually; August-November. Commence data collection after one year of operation (exclude planning grant)	IAB Members, Faculty	Report for Center Director	Submit data to NCSU
<b>Meeting Summary Report</b>	At any IAB meeting in which and NSF representative is not present	Center Director, meeting materials, Evaluator observations	Send to NSF shortly after the meeting	

*Section Updated January 3, 2013*



## 1.2 REQUIRED AND OPTIONAL ACTIVITIES



# Finding Economic Impact Resources

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## Economic Impact Assessment

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### 3.7 Identifying and Documenting IUCRC Center Success Stories and Economic Impacts: Guidelines, Scheduling and Supporting Materials

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In a recent [report](#), the NCSU IUCRC Evaluation Team was able to demonstrate that they could document significant economic impacts in mature IUCRCs by engaging in a proactive assessment strategy that involved either face-to-face or telephone interview methodology and provision of confidentiality, if requested,

#### Supporting Materials:

The following materials and tools are intended to facilitate the collection of well documented success cases that include credible economic impacts.

[EconImpact 1: Guidelines for identifying beneficiary organizations](#)

[EconImpact 2: Guide for first contact briefing with Center director](#)

[EconImpact 3: Sample guide for interview with Center director](#)

[EconImpact 4: Sample email from Center director to beneficiary](#)

[EconImpact 5: Sample email from evaluator to beneficiary](#)

[EconImpact 6: Guide for pre-screening interview with beneficiary](#)

[EconImpact 7: Guide for interview with beneficiary](#)

[EconImpact 8: Sample summary report of impacts](#)



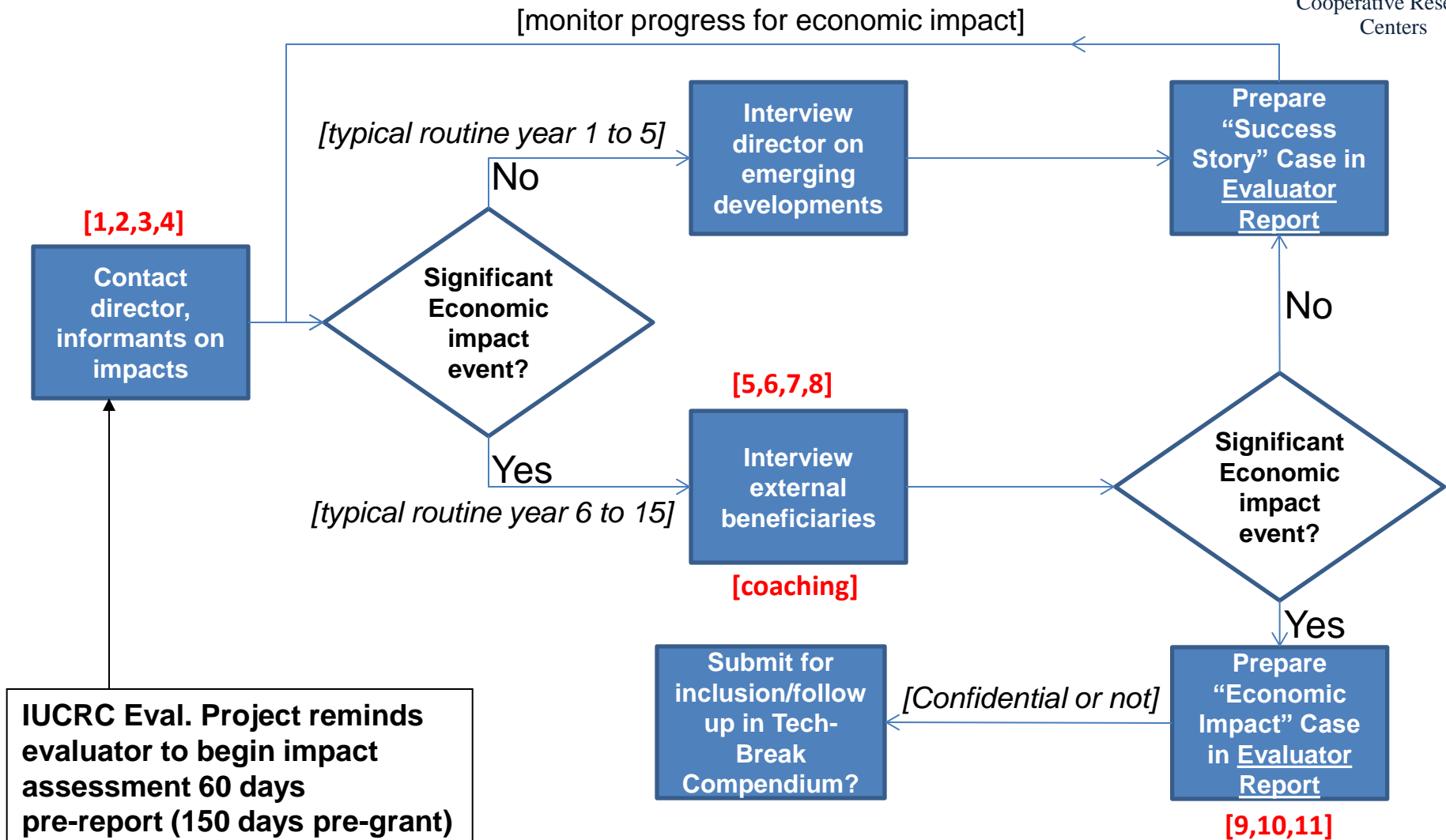
# Coaching help for impact assessment

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- NSF has provided travel and effort in the budget of the IUCRC Evaluation Project for telephonic and/or in person coaching for impact assessment interviews
  - Contact NCSU Evaluation Team



# Resources for conducting assessments





# How Evaluator Duties Change

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- Begin exploring potential impacts earlier in reporting year
- Solicit nominations from multiple sources
- When warranted, engage in personal and/or telephonic interview with nominated beneficiary
  - Solicit help from IUCRC Evaluation Team on interviewing technique
  - Ask George Vermont what “SWAG” means
- Contact beneficiaries who are not members
- Engage in subsequent follow up interviews for early stage impacts that have forecasted economic value (document in Evaluator Report)
- Clarify whether case and/or economic impact must be kept confidential
- Prepare local and national report according to confidentiality understanding





# Issues for discussion

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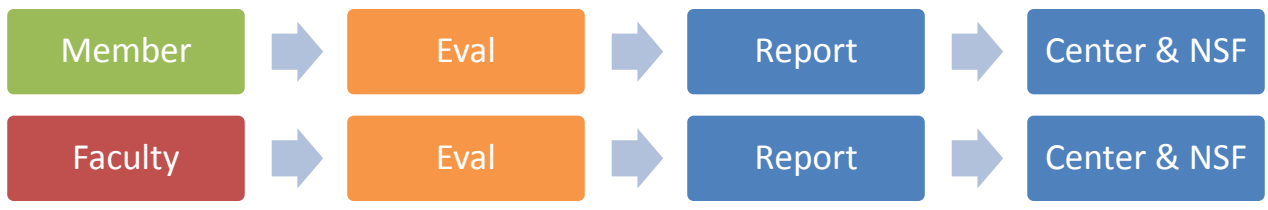
- How did the reminder notification system work?
- Identifying potentially “high impact” beneficiaries?
  - Interviewing my director and others about possible beneficiaries
- Getting access to potential beneficiaries
- Usefulness of the tools on the website
- Conducting the beneficiary interview
  - To be or not to be confidential
  - How to get an economic impact estimate
- What and where of my success story/economic impact report
- What should be the frequency of this activity?
- How can and should this activity be integrated with other “economic impact” assessment activities
- General discussion: What else?



# IUCRC Impact Data Gathering

## Evaluator

Proc./Outc.  
Questionnaire

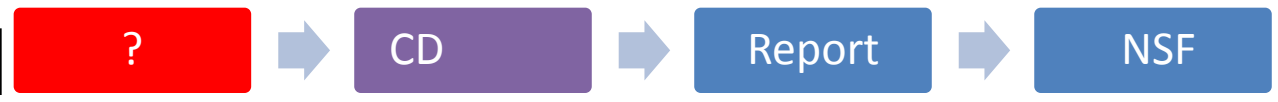


Eval. Report



## C. Director

Annual Report



Structure Data



## Ad hoc

Breakthrough



Econ. Impact

