Promoting Combinatorial Science, Technology and Innovation (STI) Programmatic Impacts: Evaluation of NSF SBIR/STTR Supplement for Membership in Industry/University Cooperative Research Centers

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Discussant: Shashank Priya, NSF
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Session Overview

• Promoting synergistic program impacts: Background of the National Science Foundation SBIR/STTR Supplement for Membership in Industry/University Cooperative Research Centers (IUCRCs) (Gray)

• Outcomes related to combinatorial innovation in government programs: Impact on member composition (Michaelis)

• Outcomes related to combinatorial innovation in government programs: Feedback from cooperative research center directors (McGowen)

• SBIR Membership Supplements in IUCRCs: Feedback on processes and outcomes from SBIR member firms (Gray)

• Discussant: Shashank Priya, NSF
Promoting synergistic program impacts: Background of the National Science Foundation SBIR/STTR Supplement for Membership in Industry/University Cooperative Research Centers (IUCRCs)

Denis Gray, PhD
Psychology in Public Interest Program
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Overview

• Background on NSF I/UCRC and SBIR/STTR Program
• Supplements: Mechanism for promoting interaction/synergy between programs (AEA Integrating Systems Thinking)
• SBIR/STTR membership in I/UCRC Supplement
• Theory of Change (ToC)
• Research objectives
SBIR/STTR Program

- **SBIR/STTR**
  - Established 1982: strengthen role of small innovative firms in U.S. innovation system
  - Federal agencies with >$100 million extramural research budgets allocate 2.8% to program (11 agencies): NSF
    - STTR (1992) require collaboration with a university partner
  - Phase I: technological merit, feasibility ($100-150k)
  - Phase II: continue progress to commercialization ($750k-$1 million)

- **Evaluation: multiple studies, positive findings**
  - Fills VC gap; moves federal research into private markets; increased productivity; inspire other entrepreneurs; speeds firm growth; stimulate technological innovation
I/UCRC

- IUCRC
  - Established 1980: contribute to nation's research enterprise by developing long-term partnerships; expand innovation capacity via support for training of graduate students
  - NSF IIP: Along with SBIR, GOALI, PFI, I-Corps, etc.
    - Modest NSF support
  - Funding: NSF Operational Support ($250k/yr) + Industry membership ($750k) + Other funding ($1M): 3 Phases
  - University-based industrial consortia (multi-university): pay annual membership fee; plan and select “pre-competitive” projects
    - Primarily large firms and federal R&D agencies
  - Most transactions take place at semi meetings (2)
- Evaluation: internal “improvement-focused” evaluation, multiple benefits
  - R&D efficiency; commercialization; human capital; self-sustaining centers

SBIR/STTR Membership in I/UCRC
Supplement Funding Mechanism

• Supplemental Funding
  – NSF: funding mechanism designed to provide additional support to awardees to achieve objectives complementary to program’s objective (NIH also)
  – Solicitation or “Dear Colleague Letter”
  – Examples:
    • Research Experiences for Undergraduates (REUs); Commercialization Assistance Program (CAP); Career-Life Balance (CLB); etc.
  – Internal review and support is added to award
Background on the “SBIR Membership in IUCRCs” Supplement

• Supplemental funding opportunity first announced in 2007 (updated in 2008, 2009): An experiment!

• Objective stated as:
  – The supplements are intended to accelerate the innovation process by partnering industry-relevant academic research with commercialization focused small business research.

• Invited active Phase II (IIB) SBIR/STTR awardees to request a supplement they could use to join an I/UCRC (including graduated I/UCRCs)
  – NSF would pay all but $5k of membership for 2 years or 2 x 1 year
    • Intention was to allow 2 years via SBIR and 2 years via IUCRC? (Larsen)

• As of 2013 72 SBIR/STTRs have taken 124 membership years in 26 Centers

• 2012 Cost of program is: ~ $805K
• Total cost of program is: ~$4.45M
• No systematic evaluation up to this point
“Theory of Change” for Supplement

### Need-Based
- Most supplements aim to address a program-specific or Foundation-wide need
- Many Foundation-wide
  - REU/RET/REV
- Typically direct provision of resources
  - CAP for SBIR/STTR; CLB
- Little systematic evaluation

### Synergy-Based
- Within-program supplement for awardees in 2 programs
- Similar goals, different partners and complementary innovation stages
- Mutual exchange of resources and services

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Incremental Program Innovation

Combinatorial Program Innovation
Combinatorial Innovation

• Innovation Theory:
  – *Combinatorial innovation*: innovations that are created by combining features or elements of two or more existing technologies (Varian, Farrell & Shapiro, 2004).
    • Adjacent possible: proximity often plays a role
  – Einstein: “Combinatorial play seems to be the essential feature of productive thought”
  – Examples: printing press (screw press for wine making + metal type); double-entry accounting; air conditioning

• Questions:
  – Can we produce innovative STI programs by combining the features of two or more existing organizational innovations?
    • Can we avoid combinatorial chaos?
STI Programs and U.S. Innovation Ecosystem

FEDERAL NSF PROGRAMS
- STC
- ERC
- I/UCRC
- SBIR/STTR

STATE PROGRAMS
- State CoEs
- MEP
- BUS. DEV. & ENTREPREN.

EMERGENT PROGRAMS
- PoCC & AIR

Resources Invested

Discovery

Development

Commercialization

FEDERAL LINKAGES

STATE LINKAGES

Translational Research

Valley of Death

Small Business

Consulting and Contract Research

Pilot Production

Industry

SBIR/STTR Membership in I/UCRC

Adapted from Kingon; Adapted from NSF IIP

Slide 6
SBIR and I/UCRC Social Networks (SN)

- SBIR small, shallow SN
  - 1 or 2 university ties; 1 or 2 large firm ties

- I/UCRC large, deep SN
  - 3 universities; 16 faculty; 25 students; 18 member firms
Overview of Evaluation Objectives and Methodology

**Goal:** Evaluate the impact of the *SBIR/STTR Membership in I/UCRCs Supplement* on IUCRC and SBIR/STTR programs

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<tr>
<th>Study Stage</th>
<th>Knowledge objectives</th>
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<tr>
<td><strong>Objective 1</strong></td>
<td>Assess the impact of the SBIR/STTR I/UCRC Membership Supplement on the I/UCRC membership profile</td>
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<td><strong>Objective 2</strong></td>
<td>Assess the reactions of center and site directors in the I/UCRC program regarding their experiences with SBIR/STTR firms as members in their center under the I/UCRC membership supplement.</td>
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<td><strong>Objective 3</strong></td>
<td>To understand the outcomes and impacts of participation in an I/UCRC for SBIR/STTR supplement members</td>
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