The Architecture of Integration: Coordinated Agricultural Projects

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Session #5. Translating Climate Science into Actionable Knowledge: The Role of the Social Sciences

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U.S. agriculture is increasingly impacted by the effects of a changing climate
• 3 Coordinated Agricultural Projects (CAP)
• 115 PI’s across 20 states
New Opportunities and Challenges

The integration of science is essential to:

1. Address complex, difficult problems
2. Identify processes and structures needed to answer complex questions
3. Create new knowledge
4. Bi-directional testing & evaluation of new knowledge with stakeholders
5. Prepare the next generation of scientists
Directing three separate projects while working to integrate science goals, learn from each other, and finding ways to connect our teams.
Team Integration Architectures

Are highly complex and diverse with similarities and differences. Understanding these architectures provide operational guidance to leadership and offer a valuable platform for exploration, innovation, and achieving the practical work of the team.
The trend to classify cross-disciplinary research is useful to generate dialogue that illustrates relationships.

Tress, Tress, & Fry 2004

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Multidisciplinary

- Discipline
- Non-Academic Participants
- Research Project Goal

- Academic Knowledge Body
- Non-Academic Knowledge Body
- Thematic Umbrella

- Movement Toward Goal
- Cooperation
- Integration

Tress, Tress, & Fry 2004

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Interdisciplinary

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Transdisciplinary

Tress, Tress, & Fry 2004

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Categorization serves as a start...

Terminology and framework provides a useful start but doesn’t represent complexity of large projects like the USDA-NIFA Climate CAP’s
Big Project Integration Architecture

- Each project and each team’s collaboration is unique
- These collaborative structures are dynamic throughout project life

**disciplinarity**
- Within one academic discipline
- Disciplinary goal setting
- No cooperation with other disciplines
- Development of new disciplinary knowledge and theory

**multidisciplinarity**
- Multiple disciplines
- Multiple disciplinary goal setting under one thematic umbrella
- Loose cooperation of disciplines for exchange of knowledge
- Disciplinary theory development

**participatory**
- Involves academic researchers and non-academic participants
- Exchange of knowledge between knowledge bodies not integrated
- May be disciplinary or multidisciplinary
- Not necessarily research; goal may be academic or not

**interdisciplinary**
- Crosses disciplinary boundaries
- Common goal setting
- Development of disciplines and non-academic participants
- Development of integrated knowledge and theory

**transdisciplinary**
- Crosses disciplinary and scientific academic boundaries
- Common goal setting
- Integration of disciplines and non-academic participants
- Development of integrated knowledge and theory among science and society

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How to cultivate and enhance team capacity to accomplish big science?
Create a team structure that:

• Functionally meets objectives and goals specific to the team
• Has clear connections and lines of accountability between and across individuals
• Places individuals into specific working groups based on their expertise
• Places individuals in “gaps” - key roles to help bridge and connect working groups
• Boundaries, but flexible
Traditional Organizational Charts

CSCAP Organizational Chart

REACCH Organizational Chart

PINEMAP Organizational Chart
Organizational Reality
Interactions emerge dynamically within a project

Figure 3. TWCA Connections

TWCA Connections (Feb, 2012)

The connections shown in this diagram are primarily about communication and interaction, with associated potential for integration/1D activities throughout the duration of the project. However, some lines begin to point to "outputs" as well, such as modeling tools to assist with farm management and recommended guidelines.

Dotted lines indicate that the activity will be mostly "in the future." Solid lines indicate that at least some interaction is already happening.

* Project members from all teams will provide input into the Education Team; this drawing does not include all the lines for those connections.

Lots of relationships exist between objective teams & stakeholders. For example, there may be lots of interconnections w/growers - some from current project, some from history of ongoing relationships. Similar relationships exist to "other projects" that people work on. (Almost no one is "full time")

May, 2012 Report: Transdisciplinary Science at Work
Linda Urban, IPT532, Spring 2012
Ways to Document & Understand Team Processes and Integration

Multiple data sources available to identify areas of integration and discover where, when, and how future integration can be encouraged:

– Surveys
– Focus groups
– Qualitative interviews
– Archival analysis of meeting activities and action items/or lack of
– External evaluator observations
– Social Network Analysis
– Ethnography
### Baseline Team Assessment

<table>
<thead>
<tr>
<th>Activity</th>
<th>Never</th>
<th>Once or twice a year</th>
<th>Quarterly</th>
<th>Monthly</th>
<th>Weekly</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Read journals or publications outside your primary, secondary, or third disciplines (listed in response to Question #2)</td>
<td>12.4%</td>
<td>21.5%</td>
<td>19.8%</td>
<td>28.9%</td>
<td>17.4%</td>
</tr>
<tr>
<td>b. Attended meetings or conferences outside your primary, secondary, or third disciplines</td>
<td>38.8%</td>
<td>45.5%</td>
<td>12.4%</td>
<td>3.3%</td>
<td>0.0%</td>
</tr>
<tr>
<td>c. Participated in working groups or committees with the intent to learn from researchers in other disciplines</td>
<td>24.8%</td>
<td>40.5%</td>
<td>20.7%</td>
<td>12.4%</td>
<td>1.7%</td>
</tr>
<tr>
<td>d. Submitted grant proposals, other than the CSCAP, in partnership with colleagues or others outside your primary, secondary, or third disciplines</td>
<td>51.2%</td>
<td>36.4%</td>
<td>10.7%</td>
<td>1.7%</td>
<td>0.0%</td>
</tr>
<tr>
<td>e. Received grant funding awards, other than the CSCAP, in partnership with colleagues or others outside your primary, secondary, or third disciplines</td>
<td>57.0%</td>
<td>36.4%</td>
<td>6.6%</td>
<td>0.0%</td>
<td>0.0%</td>
</tr>
<tr>
<td>f. Obtained new insights into your own work through discussion with colleagues from other disciplines</td>
<td>10.7%</td>
<td>26.4%</td>
<td>23.1%</td>
<td>18.2%</td>
<td>21.5%</td>
</tr>
<tr>
<td>g. Modified your own work or research agenda as a result of discussions with colleagues from other disciplines</td>
<td>18.2%</td>
<td>32.2%</td>
<td>28.1%</td>
<td>18.2%</td>
<td>3.3%</td>
</tr>
<tr>
<td>h. Established links with colleagues from other disciplines that led to or may lead to future collaborative work</td>
<td>14.0%</td>
<td>47.1%</td>
<td>18.2%</td>
<td>14.9%</td>
<td>5.8%</td>
</tr>
</tbody>
</table>

**Collaboration questions modified from the Transdisciplinary Research on Energetics and Cancer Initiative, published in American Journal of Preventive Medicine, 2008**

- **Online survey of project participants**
- **Pre-existing multi, interdisciplinary relationships**
Baseline Key Findings & Next Steps

1. **Learn** about each other’s science
2. **Find connections** among our sciences
3. **Ask complex questions** that our sciences, when integrated, might answer
4. **Create clusters of** individuals willing to ask new questions and seek new solutions
Social Network Analysis (SNA) is a tool that can be used to describe patterns of interactions in a project and to help participants understand and optimize their collaboration.
Sociocentric Network Analysis (SNA) as a Monitoring Tool for Reflection & Learning

1. Collect **data from members**
2. Create social network **diagram**
3. Revealed **patterns**
4. Participatory SNA **perceptions of interactions**
5. Repeat during **project life cycle**
Highlights the strength of existing networks, as well as challenges of integrating across networks and pulling “unconnected” collaborators into the network.
Survey to gather social network data

REACCH SNA (Connections between individuals)

No awareness: You do not know who this person is.

No direct contact: You know who this person is, but do not have direct contact with them. (You might have met them or seen them at a meeting.)

Communication/Coordination: You share (or have shared) information and/or align activities with this person, to support mutually beneficial goals.

Collaboration: You have actively worked together to set common goals, realize a shared goal, or develop integrated knowledge.

Identified wish/need for future interaction: You think there is an opportunity for cooperation or collaboration with this person, but that hasn’t happened yet.

Unification/coadunation: You think there is a merging of identities, structure, and culture. Unification through growth.

1. What interaction have you had with each person?

<table>
<thead>
<tr>
<th>Person</th>
<th>No awareness</th>
<th>No direct contact</th>
<th>Communication/Coordination</th>
<th>Collaboration</th>
<th>Unification/coadunation</th>
<th>Need for future interaction</th>
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<tbody>
<tr>
<td>Person A</td>
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<td>Person B</td>
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<td>Person C</td>
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<td>Person D</td>
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<td>Person E</td>
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Unexplored Territory

Understanding the architecture of integration with our teams, and quantifying or otherwise measuring that structure as we go is helping us venture out into unexplored territory.
Institutional Adaptation

- Institutional change in how we think about and do science, strengthen our capacities to better connect theory, data, and reality
- Integrate science
- Accomplish innovation
Adaptation Needed Across Many Systems

1. **Resistance** *(status quo; manage to resist change disturbance)*

2. **Resilience** *(moderate effects but retain form and function after disturbance)*

3. **Transformation** *(transition to a new system with different structure and function better suited to new conditions)*
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Thank You!

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