A multi-layered approach to adaptive capacity across social networks: a case study in rural Kenya

Camille Washington-Ottombre (Oberlin College)
Bryan C. Pijanowski (Purdue University)
In addition to disposable physical capital and institutions, social capital frames the adaptive capacity of social systems (e.g. Smithers and Smit, 1997).

Social capital can be envisioned as an investment made through social relations whose topography can be represented by social networks (Lin, 1982).

Hence, numerous studies have analyzed the relationships between the structure of social networks and the adaptive capacity of a social system (e.g. Webb and Bodin, 2008).

They have highlighted tensions between social networks’ structure and the resilience, adaptability, and transformability of a social system
Introduction (2/2)

• How can the narrative that links the resilience, adaptive capacity, and transformability of a social system to the structure of social networks be enhanced?

• Building on the literature to construct both a multi-layered understanding of adaptive capacity and ways to measure it.

• Apply this theoretical framework and subsequent measurements to the study of two social networks in Kambita village using a survey on social networks.
### Theoretical insights for measuring social networks’ adaptive capacity

<table>
<thead>
<tr>
<th>Layers of adaptive capacity</th>
<th>Social Network Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Capacity to build social memory</strong></td>
<td>Encouraged by the <strong>tightness</strong> of the network, the <strong>proximity</strong> between individuals, and the <strong>plurality</strong> and <strong>redundancy</strong> of ties.</td>
</tr>
<tr>
<td><strong>Capacity to innovate</strong></td>
<td>Defined by the <strong>diversity and redundancy</strong> of ties in a system as well as the <strong>strength</strong> of those ties.</td>
</tr>
<tr>
<td><strong>Capacity to diffuse innovations</strong></td>
<td>Depends on the <strong>modular structure</strong> of the network and encouraged by the existence and place of <strong>bridges</strong></td>
</tr>
<tr>
<td><strong>Capacity to diversify strategies</strong></td>
<td>Degree of <strong>different and shared properties</strong> among comparable nodes in the network</td>
</tr>
</tbody>
</table>
Archetypical social network of a resilient, adaptive, and transformative social system
Methods (1/2)

• Survey and interviews in Kambita village (semi-arid).

• Survey respondents were asked to name, specify the type of relationships, and the frequency of the relationships of 3 persons in the community to whom they listen to or imitate most when it comes to practices of (1) farming (SN-FARM) and (2) other income generating activities (SN-OTHER).

• Construct a social matrix that coded undirected dyadic ties and sociograms.
## Methods (2/2)

<table>
<thead>
<tr>
<th>Layers of adaptive capacity</th>
<th>Social Network Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Metrics using Ucinet 6.232</td>
</tr>
<tr>
<td>Capacity to build social memory</td>
<td>Density, geodesic distance, closeness centrality, Freeman network closeness centralization, Freeman degree centralization, Freeman betweenness centralization index, analysis of cliques, clustering coefficient.</td>
</tr>
<tr>
<td>Capacity to innovate</td>
<td>Number of ties, local edge connectivity, number of geodesics, types of ties, intensity of ties</td>
</tr>
<tr>
<td>Capacity to diffuse innovations</td>
<td>Analysis of ordered triples using a transitivity computation, analysis of bridges using a bicomponent computation, analysis of central nodes using a lambda set computation, analysis of structural holes.</td>
</tr>
<tr>
<td>Capacity to diversify strategies</td>
<td>Qualitative analysis of individuals acting as hubs and bridges</td>
</tr>
</tbody>
</table>
### RESULTS

<table>
<thead>
<tr>
<th></th>
<th>SN-FARM</th>
<th>SN-OTHER</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Capacity to build social memory</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Density</td>
<td>0.0449</td>
<td>0.0385</td>
</tr>
<tr>
<td>Geodesic distance</td>
<td>2.830</td>
<td>3.674</td>
</tr>
<tr>
<td>Mean network closeness centralization</td>
<td>13.001</td>
<td>9.614</td>
</tr>
<tr>
<td>Freeman mean degree centralization</td>
<td>3.634</td>
<td>3.157</td>
</tr>
<tr>
<td>Freeman network centralization</td>
<td>38.43%</td>
<td>21.05%</td>
</tr>
<tr>
<td>Freeman betweenness centralization index</td>
<td>43.78%</td>
<td>28.53%</td>
</tr>
<tr>
<td>Number 3 Cliques</td>
<td>35</td>
<td>15</td>
</tr>
<tr>
<td>Clustering coefficient</td>
<td>0.240</td>
<td>0.114</td>
</tr>
<tr>
<td><strong>Capacity to innovate</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of ties</td>
<td>154</td>
<td>138</td>
</tr>
<tr>
<td>Mean local edge connectivity</td>
<td>236.63</td>
<td>227.53</td>
</tr>
<tr>
<td>Mean number of geodesics</td>
<td>149.2</td>
<td>144.2</td>
</tr>
<tr>
<td>Types of ties</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kin</td>
<td>20.8%</td>
<td>27.5%</td>
</tr>
<tr>
<td>Friends</td>
<td>29.9%</td>
<td>37%</td>
</tr>
<tr>
<td>Acquaintances</td>
<td>49.4%</td>
<td>34.7%</td>
</tr>
<tr>
<td>Intensity of ties</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Once a week or more</td>
<td>60.4%</td>
<td>76.1%</td>
</tr>
<tr>
<td>Once a month or more</td>
<td>26%</td>
<td>16.7%</td>
</tr>
<tr>
<td>Once a year or more</td>
<td>13.6%</td>
<td>7.2%</td>
</tr>
<tr>
<td><strong>Capacity to diffuse innovations</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transitivity: number of transitive ordered triples</td>
<td>228</td>
<td>90</td>
</tr>
<tr>
<td>Transitivity: % of ordered triples that are transitive</td>
<td>9.28%</td>
<td>7.63%</td>
</tr>
<tr>
<td>Effective size of the network</td>
<td>2.45</td>
<td>2.46</td>
</tr>
<tr>
<td>Efficiency</td>
<td>0.82</td>
<td>0.91</td>
</tr>
<tr>
<td>Constraint</td>
<td>0.67</td>
<td>0.5</td>
</tr>
<tr>
<td>Hierarchy</td>
<td>0.2</td>
<td>0.16</td>
</tr>
<tr>
<td><strong>Capacity to diversify strategies</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bi-components, cut points number of cut points</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>Bi-components, cut points, nodes</td>
<td>10, 14, 16, 38, 43, 54, 64, 67, 72</td>
<td>2,16,29,32,38, 54,61,70,74</td>
</tr>
<tr>
<td>Bridges lambda sets</td>
<td>16 and 72</td>
<td>16 and 38</td>
</tr>
<tr>
<td>Nodes overlap in and across networks</td>
<td>3 (23%)</td>
<td>See next slide</td>
</tr>
<tr>
<td>Qualitative analysis of the individuals acting as bridges and central nodes</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Results (2/2)

Capacity to diversify strategies

SN-FARM

SN-OTHER
Discussion

• **SN-FARM and SN-OTHER performed differently** on the various layers of adaptive capacity.

• **Structural elements beyond** the strict centrality, diversity, and modular structure of a social network were instrumental.

• **In terms of overall adaptive capacity, Kambita benefits from** diverse social networks.
Conclusion

• Highlights complex relationships between the adaptive capacity of social systems and social networks’ structural features where bridges and hubs appear to be central.

• This work argues for mobilizing a multi-layered understanding of adaptation and a multi-faceted conception of social networks and social capital.
Acknowledgments

• Villagers of the Kambita (Mbeere) village
• Researchers and staff at International Livestock Research Institute
• Researchers and staff at Kenyan Agricultural Research Institute Embu
• The International Dissertation Field Research Fellowship Program of the Social Science Research Council with funds provided by the Andrew W. Mellon Foundation
• NSF SBE Doctoral Dissertation Research Improvement (DDRI) Grant in Geography and Regional Sciences
• Purdue’s Andrews Environmental Travel Grant
• Purdue’s Department of Forestry and Natural Resources
Using social network analysis to understand innovation and diffusion of sustainable agricultural water resource management in a changing climate

A Case Study in Northeast Thailand

Amanda Fencl

ICARUS II

May 7, 2011
About

- SEI
- NOVA funding (internal research innovation fund)
- Project Duration

SEI project team and partners

SEI Project team:
Monique Mikhail,
Amanda Fencl,
Sopon Naruchaikusol, &
Eric Kemp-Benedict

Project Partners: Earth Net Foundation & Green Net Cooperative

For more information:
amanda.fencl@sei-us.org
Outline

• Background and approach
• Case study location
• Methods
• Results
• Discussion
• Recommendations
• Questions?
Background and approach

• Study Objectives:
  – Understand smallholder farmer innovations
  – How AWM strategies are transferred between farmers
  – how that would enable widespread diffusion/adoption of CC adaptation strategies

• Comparative analysis of the spread of innovation in two “villages”
  – “Intervention Villages”
    • 2007-08 Earth Net Foundation/Oxfam pilot project
  – “Non-Intervention”
    • No explicit interventions
Case study location: NE Thailand
Methods

• Field work
  – 48 Farmers: structured questionnaire
  – 14 Institutions: semi-structured interviews

• Analysis
  – *Village social network analysis*: ORA, a social network analysis software
Structured questionnaire

- Individual attributes
- Types of AWM (agricultural water management) and water access
- Innovation discovery
- Name generators
  - Who do you talk to?
  - Who do they talk to?
- Small-world
- Innovation and resilience
Types of Farmers interviewed:

- **Innovator**: the originator of an on-farm strategy
- **Adopter**: successfully incorporated this strategy on his or her farm
- **Failure**: attempted but did not successfully incorporate the innovator’s strategy
- **Non-participants**: villagers not involved in the Oxfam/ENF pilot intervention
Types of on-farm innovations and strategies

Surface water-distribution systems
- Dams, reservoirs, tanks
- Bunded fields, other irrigation structures
- Spate, high-efficiency irrigation
- Gravity flow irrigation

Ground water management
- Shallow wells
- Pumps for deep wells
- Conservation tillage, intercropping
- Buckets

wind-turbine pump
### Institutions Interviewed

#### In Bangkok (National):
- **Non-profit**
  - Health Public Policy Foundation
  - Sustainable Agriculture Foundation
- **Research/think tank**
  - The Southeast Asia System for Analysis Research and Training (START-SEA)
  - Regional Adaptation Knowledge Platform (survey)
- **Government**
  - Hydro and Agro Informatics Institute of the Ministry of Science and Technology
  - ONEP liaison, GTZ

#### In Yasothon and Ubon Ratchathani (Local)
- **Non-profit**
  - the Organic Agriculture Centre, Yasothon Province, EarthNet Foundation
  - Bak Rua Organic Farmers Cooperative
  - Bak Rua Organic Farmers Cooperative Water Management sub-group
- **Financial**
  - Bank for Agriculture and Agriculture Cooperatives, Yasothon Province Office
- **Provincial Government**
  - Yasothon Province Department of Irrigation
  - Yasothon Provincial Office of Agriculture and Cooperation
- **District/Local Government**
  - Maha Chana Chai District Agriculture Office
  - Kahm Khuean Kaeo Sub-District Agriculture Office
  - Kannoi Sub-District Agriculture Officer, Department of Agriculture Extension
Results: Innovator attributes

- What makes an innovative farmer?
  - *Motivation*: constrained access to resources
  - *Support*: organizational membership, farmer connectedness
  - *Resources*: Mid-range wealth
    - Not about age, education, quantity of land-holding

### Irrigation

<table>
<thead>
<tr>
<th>Level</th>
<th>Non-Intervention</th>
<th>Intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.2</td>
<td>Innovator</td>
<td>Adopter</td>
</tr>
<tr>
<td>0.4</td>
<td>Innovator</td>
<td>Adopter</td>
</tr>
<tr>
<td>0.6</td>
<td>Innovator</td>
<td>Adopter</td>
</tr>
<tr>
<td>0.8</td>
<td>Innovator</td>
<td>Adopter</td>
</tr>
<tr>
<td>1.0</td>
<td>Innovator</td>
<td>Adopter</td>
</tr>
</tbody>
</table>

Innovators tend to be less likely to have irrigation than non-innovators in both villages, but especially in non-intervention village.

### Organizational membership

**Comparison of organization memberships**

- Organizational membership is important in both villages, but especially in non-intervention village.
Results: Innovator attributes

• How do innovators differ from others in their network(s)?
  – Authority-centrality
  – Gatekeepers of knowledge
  – Hubs of knowledge
Results: intervention village respondent network

Location of some respondents in their network
Results: intervention village combined network

↑ Connectedness

↓ Fragmentation

powered by ORA, CASC
Results: non-intervention villages respondent network
Results: non-intervention villages combined network

↓ Connectedness

↑ Fragmentation
Results: Institutional Interviews

- government structure undermines ability for integrated planning
- Widespread resource constraints
- Existence of policies that discourage change
- Current farm insurance scheme distorts perception of risk
- Farmers’ current coping strategies have limitations
Discussion: Innovation & Adaptation

Have the innovations/changes on your farm affected the way you decide what to plant next year?

- Intervention: 90% No, 7% Yes, 3% No Response
- Non-Intervention: 74% No, 16% Yes, 11% No Response

Have your current innovations made you better able (more flexible/adaptive) to respond to change?

- Intervention: 97% No, 3% Yes, 0% No Response
- Non-Intervention: 26% No, 26% Yes, 47% No Response
Discussion: key insights

- Innovative farmers can provide locally-appropriate adaptation responses to climate change.
- Innovators are significantly different from non-innovators in both intervention and non-intervention networks.
- Having some form of formal support is helpful for spreading innovations.
- Interventions such as the ENF’s climate adaptation project (our local partner) can be successful in strengthening innovator-adopter links and the capacity of adopters.
- It is necessary that the intervention take particular care to build on top of existing networks.
Recommendations for an enabling environment for adaptation in Thailand

• Critical need to bridge the disconnect between national and local adaptation efforts
  – Design your interventions to work within the existing fragmented government structure, to the extent possible

• Build national and local adaptive capacity
  – Change farm insurance schemes to discourage maladaptation

• Scale up indigenous innovation
THANKS!
ICARUS II Conference
University of Michigan, Ann Arbor
May 5 – 8, 2011

United We Stand: Coastal Communities and the Rise of the Community Federation

Kim Nong

Deputy Director General, and Research Team Leader
Ministry of Environment
Royal Government of Cambodia
Outline

• Introduction of the Research
• Research Methods
• Research Results and Findings
• Challenges
• Recommendations
Introduction

• Rational
  – The Community Federation was formed from the need for Village Management Committees to cooperate to stop illegal fishing.
  – The Community Federation does not strictly follow political and administrative boundaries.
  – The Community Federation offers a model of how better CBNRM leads to enhanced livelihoods.
FiA Problem Context:

Koh Kong Island (Navy)

MoE

PKWS

MoE

KSL

KKP

CHP
Goal

To understand the multiple roles of *boundaries* in decentralization as experienced by the community federation in mangrove, seagrass, and fishery resource management and livelihoods improvement in Chrouy Pros Bay and Peam Krasoap Wildlife Sanctuary, Kong Kong Province, Cambodia.
• Objectives

– To promote collaboration among communities in Community Federation, and with authorities at all levels in decentralization and de-concentration.

– To demonstrate the importance of cross-boundary and cross-sectoral collaboration in decentralization and de-concentration.

– To convince key stakeholders of the necessity of cross-boundary and cross-sectoral collaboration in decentralization and deconcentration.
1. Research Methods

The Action Research Cycle
2. Building Networks for Action Research

**IDRC**
- Technical & financial support
- Research documents support
- Capacity building for team

**Regional Partners**
- Short term training support
- Small grant support for community’s works
- Exchange of community development work
- Sharing global concept of sustainable community development

**Local CBNRM Partners**
- Sharing field experiences
- Documental sharing & learning
- Technical support for trainings and workshops
- Advocacy on CBNRM’s work

**PMCR Team**

**MoE**
- Policy of RGC support
- Technical advise
- Administration support
- Monitoring & Evaluation

**Local Communities**
- Improving natural environment
- Improving local livelihoods
- Understanding of long term benefit
- Enhancing local power and right on PNRM
- Equitable of benefit sharing
- Increasing sense of ownership

**National Institution Network**
- Providing policy & legal framework
- Helping local planning
- Learning & disseminating of CBNRM approaches
- Lobby to policy & decision makers

**Provincial Network**
- Technical advise
- Provide the policy from the line ministries
- Facilitation of local issues
- Learning and assisting with community
- Lesson learned sharing
3. Data collection and analysis

• Collect and analyze secondary data
• Collect primary data
  – Participatory Rural Appraisal (PRA) Tool
  – Community capacity building, i.e. community meetings/workshops/trainings/study tours
  – Field action (mangrove replanting, seagrass protection, patrolling, etc)
  – Focus group discussions and semi-structure interviews
• Document stakeholders’ perceptions
## Research Results and Findings

### Semi-Structure interview: number of respondents on community federation in Koh Kong based on occupation type

<table>
<thead>
<tr>
<th></th>
<th>Male</th>
<th>Female</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Villagers</td>
<td>23</td>
<td>34</td>
<td>57</td>
</tr>
<tr>
<td>Community representatives</td>
<td>26</td>
<td>12</td>
<td>38</td>
</tr>
<tr>
<td>District, commune and village officials</td>
<td>16</td>
<td>05</td>
<td>21</td>
</tr>
<tr>
<td>Village school teachers</td>
<td>22</td>
<td>03</td>
<td>25</td>
</tr>
<tr>
<td>Line department provincial offices</td>
<td>47</td>
<td>09</td>
<td>56</td>
</tr>
<tr>
<td>Local NGOs</td>
<td>07</td>
<td>03</td>
<td>10</td>
</tr>
<tr>
<td>National institutions</td>
<td>04</td>
<td>01</td>
<td>05</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>145</td>
<td>64</td>
<td>209</td>
</tr>
</tbody>
</table>
## Research Results and Findings

### Number of participants in focus group discussions on community federation in Koh Kong

<table>
<thead>
<tr>
<th></th>
<th>No. of FGDs</th>
<th>No. of participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Koh Sralao</td>
<td>3</td>
<td>35</td>
</tr>
<tr>
<td>Koh Kapic</td>
<td>3</td>
<td>34</td>
</tr>
<tr>
<td>Chrouy Pros</td>
<td>4</td>
<td>45</td>
</tr>
<tr>
<td>Peam Krasaop (sometime)</td>
<td>4</td>
<td>56</td>
</tr>
<tr>
<td>Village schools</td>
<td>4</td>
<td>25</td>
</tr>
<tr>
<td>District, commune and village officials</td>
<td>5</td>
<td>21</td>
</tr>
<tr>
<td>Line department provincial offices</td>
<td>4</td>
<td>56</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>27</strong></td>
<td><strong>272</strong></td>
</tr>
</tbody>
</table>
Research Results and Findings

• Cross-boundary collaboration means mainstreaming NRM and food security interventions.

• Short term success of cross-boundary collaboration in NRM and livelihood improvement is very difficult to define.

• Capacity building is more than concepts, guidelines and theories, it needs to be reinforced by **learning-by-doing** approaches.
Research Results and Findings

- Action research supports the work of a community federation and provides insights into the process.
- Cross-boundary NRM collaboration needs backstop support.
- Neutral small group facilitation is a very important catalyst for key issues stakeholder meetings and discussions.
Research Results and Findings

• More cross-sectoral approaches are needed to integrate environmental and food security issues into mainstream development planning and resource allocation processes.

• Horizontal and vertical cross boundary management approaches need better integration.
Key Challenges

• Low priority for NRM in the area.
• Coordinating diverse institutional agendas among stakeholders is difficult.
• Reluctance of government and local authorities to transfer power to communities makes cross-boundary work very difficult.
• Poor coordination is a lost opportunity for learning and knowledge sharing among stakeholders.
Recommendations

• Improve local governance.
• Enhance community assets.
• Improve management quality.
• Reform management structures, policies, and legal frameworks.
• Foster deeper commitment in coordinators or community development workers.
Thank You