First Four Years: A Case Study of Starting a Social System Design Lab

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• **Mission**
  – To develop the science and application of system dynamics in human services and communities

• **Research**
  – System dynamics computer modeling and simulation
  – Group model building
  – Social determinants of health
    • Obesity, cancer, early child and maternal health, domestic violence, mental health, child abuse and neglect, natural environment

• **Teaching**
  – System dynamics, group model building, field based summer and winter institutes for graduate students
  – High school internships, MSW/MPH practicums, & doctoral and post-doctoral fellowships

• **Professional development and training**
  – Topic specific design workshops and training institutes
  – Annual Systems Thinking in Schools
  – NIH Institute on Systems Science and Health 2011
Motivation

• “When might we expect to have universities of social system design?” (Forrester, 2007)

• Design matters (Sterman 2000)

• Relatively few accounts on how organizational units focused on using system dynamics were developed. Exceptions include reflections on:
  – MIT System Dynamics Group at MIT (e.g., Forrester 2007, 2007, 1968)
  – Internal consulting group at Shell (Lane 1992)
  – Work at PA Consulting (Lyneis, Cooper, and Els 2001).
  – Conference presentations by Ed Roberts, Jack Pugh, and David Packer in 2007, and Barry Richmond’s accounts of the use of system dynamics at High Performance Systems.
Trends noted in 2009

- From “what is system dynamics” to “how to do system dynamics”

- New paradigms of collaboration
  - Understanding systems is about “collaborating out” vs. “collaborating in” (Scott Page, 2009, ISSH Ann Arbor, MI)

- More funding and push to support:
  - Transdisciplinary collaborations
  - Develop human capital
  - Address disparities
Systems thinking is also logically related to knowledge and computing infrastructures necessary to link networks of researchers in their collaborative work. …A wide variety of methodologies are encompassed under systems science…some examples of the methodologies being sought under this PAR: agent based modeling, system dynamics simulation, network analysis…(2009 NIH PAR-07-379)

Need for New University Structures

“Now, think of some future time when students come to colleges already having 12 years of exposure to systems. They will be advanced far beyond what is now taught in the universities. What then are the universities to do in building on that foundation? I do not see universities preparing for that day. Nor do I see the universities even planning 4- or 6-year systems programs for students who have not had an earlier exposure to systems.”

“When might we expect to have universities of social system design? What public background must be established to make a system dynamics profession possible? Who might be the people to lead creation of a powerful systems education?” (Forrester, 2007, 367)
Organizing Genius
The Secrets of Creative Collaboration

Warren Bennis
Patricia Ward Biederman

Foreword by Charles Handy

Tektronix®
Strategic problem

Desired modeling
Desired quality
Feared modeling
Feared quality

Time
Impact on human system

Impact on natural system

Community action

SD models

New models
Impact on human system

Impact on natural system

Community action

Quality of SD models

New models

SD models

Quality of new models

Impact on human system
Impact on human system

Impact on natural system

Community action

SD models

New models

Quality of SD models

Modeling

Quality of new models

New models

Quality of new models

Modeling

Quality of SD models

Community action

Impact on human system

Impact on natural system
Traditional strategies

1. Hire expert modelers as consultants
2. Limit demand
3. Limit modeling
Impact on human system

Impact on natural system

Community action

Technical experts

Emperical data

Stakeholder participants

New modelers

Novice modelers

Expert modelers

+ Total modelers

- Experience

Hire consultants

Modeling

SD models

New models

Quality of SD models

Quality of new models

Demand for modeling

Demand limit

Modeling limit

Total modelers

Modeling experts per model

New modelers

 total impact

Total impact

Experience

New modelers

+ Shortage in modelers

Modeling

B1

R1

Demand limit

Demand for modeling

- Total impact

- Total modelers

Hire consultants

Expert modelers

Modeling

+ New models

+ SD models

- Quality of SD models

- Quality of new models

- Community action

+ Impact on human system

+ Impact on natural system

- Total impact

Modeling

Modeling

- Expert modelers

Modeling

Modeling

Modeling

Modeling

Modeling

Modeling

Modeling
Traditional strategies

1. Hire expert modelers as consultants
   *Limited experts, too expensive*

2. Limit demand
   *Limits new modelers*

3. Limit modeling
   *Limits developing internal capacity*

*Need to restructure the system and/or expand the model boundary!*
Three stages of modeling

• Scoping models:
  – “High-generality, low-resolution scoping and consensus building model involving broad representation of stakeholder groups affected by the problem” (Costanza and Ruth, 1998, p. 187)
  – Maximize perceived representativeness of model

• Research models:
  – “More detailed and realistic attempts to replicate the dynamics of the particular system of interest” (p. 187)
  – Maximize quality of analytic insights

• Management models
  – “Producing scenarios and management options in this context of adaptive feedback and monitoring and is based on the earlier scoping and research models” (p. 188)
  – Maximize perceived effectiveness of intervention
  – Implementation stage

Impact on human system

- Quality of SD models
- Expert modelers
- Expert modelers
- Quality of new models
- Stakeholder participants
- Technical experts

impact on natural system

- Expert modelers
- Expert modelers
- Quality of new models
- Stakeholder participants
- Technical experts

Demand for modeling

Total impact

- Modeling
- Expert modelers
- Expert modelers
- Quality of new models
- Stakeholder participants
- Technical experts

Impact on natural system

- Expert modelers
- Expert modelers
- Quality of new models
- Stakeholder participants
- Technical experts

Total modelers

Demand for modeling

Modeling experts

New models

Selecting scoping models

Best scoping models

Research models

Management models

Experience

Modeling

New modelers

Shortage in modelers

Total modelers
Health Services Research and Development (HRSD) Center Model

Measures of growth from 2009 to 2012

<table>
<thead>
<tr>
<th>Measure</th>
<th>2009</th>
<th>2012</th>
<th>2012:2009</th>
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<tbody>
<tr>
<td>Full time staff</td>
<td>3.25</td>
<td>3.5</td>
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<tr>
<td>Students per year</td>
<td>30</td>
<td>70</td>
<td>2.3</td>
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<tr>
<td>Active GMB projects</td>
<td>3</td>
<td>15</td>
<td>5.0</td>
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<tr>
<td>Research assistants</td>
<td>4</td>
<td>25</td>
<td>6.3</td>
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<tr>
<td>Annual budget</td>
<td>$85,000</td>
<td>$750,000</td>
<td>8.8</td>
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<tr>
<td>Office space</td>
<td>350 SF</td>
<td>2,700 SF</td>
<td>10.8</td>
</tr>
</tbody>
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SSDL space in the Brown School in August 2009 (top), May 2010 (bottom), and July 2010 (right)
“If they keep doing this, the program is sure to work”
Closing reflections

**What we resisted...**
- Strategic focus on getting started
- Continuous growth
- Marketing
- Making system dynamics easier for people to understand
- Grants
- “Low hanging fruit”
- Expanding into new methods

**What we fought for...**
- Strategic focus on “limits to growth”
- Staying small
- No marketing
- Helping people learn system dynamics and how to apply it appropriately
- Educating across the lifespan
- Hardest situations we could find
- Doing system dynamics better