ORDER TO UNORDER – THE THIRD AXIS OF DA (AND HOW IT APPLIES TO SUSTAINABLE ENERGY)

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DAAG 2011
The usual DA process

This approach to decision-making assumes a fairly high degree of order in the problem at hand
Order versus Unorder

- **Ordered systems**
  - The past is an indicator of the future
  - Uncertainties are “well behaved”
  - Modeling results are repeatable
    - Minor input differences => minor output differences
  - Expected values are meaningful

- **Unordered systems**
  - The future may not resemble the past at all
    - “Strange attractors”
  - Uncertainties are strongly interdependent
    - Feedback loops and tipping points
    - Minor input differences may lead to extremely different outcomes
  - The concept of the EV of a decision alternative may not be meaningful
## Decision-making amidst varying degrees of order

<table>
<thead>
<tr>
<th>Situation</th>
<th>Buzz phrase</th>
<th>Key inputs, tools</th>
<th>Decision process</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Stable</strong></td>
<td>“The past is key to the future”</td>
<td>Benchmarking, six-sigma</td>
<td>Determine best practices and adopt them; delegate</td>
</tr>
<tr>
<td><strong>Complicated</strong></td>
<td>“Known unknowns”</td>
<td>Expert inputs; stochastic modeling</td>
<td>Think creatively; push boundaries; use analysis to gain insight; weigh competing objectives</td>
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<tr>
<td><strong>Complex</strong></td>
<td>“Tipping points; butterfly effects”</td>
<td>Parallel efforts by multiple teams</td>
<td>Set boundaries, then experiment; multiple creative approaches; solutions emerge</td>
</tr>
<tr>
<td><strong>Chaotic</strong></td>
<td>“What the h*** is going on?”</td>
<td>None. Cope with situation and impose as much order as possible until chaos passes</td>
<td>Autocratic; take charge and give commands</td>
</tr>
</tbody>
</table>

Reference: Snowden and Boone
A third axis to the traditional DA 2x2

- Increasing ambiguity of and/or competition between objectives
- Simple deterministic approach
- Stochastic analysis
- Full probabilistic decision process

Increasing uncertainty

Stable

Ordered

Unordered
A third axis to the traditional DA 2x2

- Competing / ambiguous objectives
- Ordered / unordered
- Simple deterministic approach vs. Framing
- Increasing uncertainty vs. Full probabilistic decision process
- Stable vs. Chaotic
- Complicated vs. Complex
- Simple deterministic approach
- Stochastic analysis
Characteristics of complex systems:

- Large number of interacting elements (or agents)
- The agents and the system constrain each other
  - Contrast with ordered systems (system constrains agents)
- Interactions are non-linear
  - Minor changes can have major consequences
- The past is not the key to the future
  - Deterministic prediction is impossible
- System evolves
  - Elements evolve with one another and with environment
  - Evolution is irreversible

Reference: Snowden and Boone
But human complex systems may be different

- Humans play multiple roles and fluidly switch between them

- We make decisions based on:
  - Past patterns of success or failure and/or emotion
  - NOT on logical, definable rules

- Humans can consciously change systems

Reference: Snowden and Boone
So we have to model human behavior in a way that captures human attributes

=> Game Theory
The Order-to-Unorder spectrum bifurcated

Stable
- Deterministic Modeling

Complicated
- Basic Stochastic Modeling

Complex
- Small number of unique players
  - Game Theory
  - Complex Systems Analysis
- Large number of similar players

So & Stable
Basic & Complex
Stochastic & Systems
Modeling & Analysis

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Consider the issue of Sustainable Resources

- Competing objectives
- Uncertainties
  - Known
  - Unknown
  - Interdependencies
- Non-linear complex systems
- Multiple decision-makers
  - Governments, regulators
  - Resource providers (energy, food, water,...)
  - Resource consumers

A triple-integrated approach is needed
A modified DA process*

• Discovery
  – Understand the opportunity
  – Understand the system; learn the rules
  – Understand all players objectives, preferences and decisions

• Framing
  – Clarify our objectives
  – Raise issues
  – Determine focus
  – Create strategic themes
  – Understand influences between uncertainties
  – Establish reasonable boundaries for evaluation
  – Understand objectives, strengths, and influences of all players

*Acknowledgement to James Mitchell
A modified DA process*

• Evaluation (1)
  – Where known unknowns dominate:
    • Build stochastic model
    • Gather probabilistic inputs
    • Evaluate strategic themes
    • Gain insight
    • Create hybrid strategies
    • Optimize hybrid

• Evaluation (2)
  – Where “agent interactions” dominate:
    • Probe the situation; experiment within the bounds established during framing
    • Pilot several different potential solutions?
    • Observe changes and trends in the other players and in the system itself; learn what works
    • Plan for flexibility

• Evaluation (3)
  – To account for other major players and gain insight into likely outcomes:
    • Model the players’ interactions through a “sufficient” number of time periods
    • Include appropriate uncertainties
    • Run multiple simulations
    • Discover likely stable solutions

*Acknowledgement to James Mitchell
What this means for Sustainable Resources

• Research and/or analysis alone will not generate an answer

• Bounded experimentation is needed

• Game theory modeling of the behavior of the major players should be used

• Solutions will emerge
“...the values to which people cling most stubbornly under inappropriate conditions are those values that were previously the source of their greatest triumphs over adversity.”

Jared Diamond in *Collapse – How Societies Choose to Fail or Succeed*
TRADITION

JUST BECAUSE YOU'VE ALWAYS DONE IT THAT WAY
DOESN'T MEAN IT'S NOT INCREDIBLY STUPID.

www.despair.com
So there’s an element of Change Management needed, too.

(... but then again, there always is)


Questions?