Promoting Collaborative Systems Thinking Through the Alignment of Culture and Process:
Initial Results

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Agenda

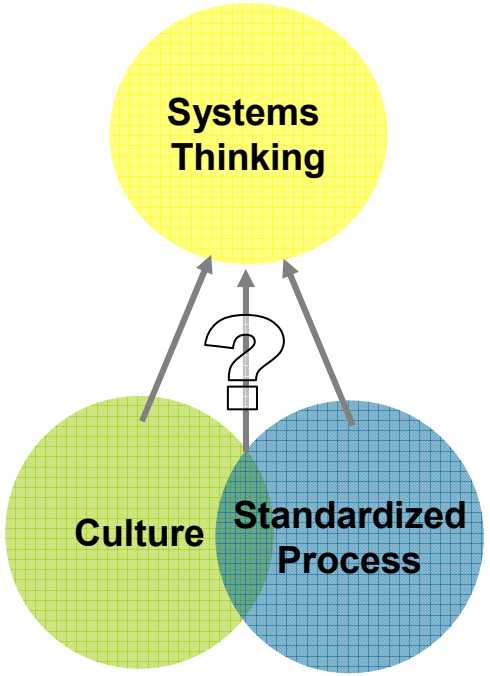
- Motivation
- Research Framework
- Key Constructs
- Objectives
- Research Methods
- Current Progress
- Conclusions and Next Steps

Motivation

- Aging demographics within engineering
  - Average age of engineer within US = 45 (NA Report, 2006)
  - Average age of engineer at NASA = 49 (Lemos, 2006)
- Increasing system complexity and development time (Murman, et.al, 2002)
  - 48 military aircraft program starts in 1950's
  - 7 program starts in 1990's
- Experiential learning best for systems thinking development (Davidz, 2006)
- Process certification increasingly contractually required
- Team is the primary working unit

Research Framework

- 3 key concepts
  - Standardized process
  - Culture
  - Systems thinking
- Desire to explore construct interactions
- Identify enablers and barriers to collaborative systems thinking



Standardized Process

Process: a logical sequence of tasks performed to achieve some objective. Process defines what is to be done without specifying how it is to be done.

--James Martin, 1997

- **Codify best practices and facilitate effective coordination and communication.**
- **Drive interactions within teams and between teams**
- **Reduce ambiguity and unpredictability (Schein, 2004)**
- **Process alone insufficient to guarantee success in product development (Dougherty, 1990; Spear and Bowen, 1999)**

Culture

Culture: a dynamic phenomenon and a set of structures, routines, and norms that guide and constraint behavior.

--Edgar Schein, 2004

- **Components of culture**
  - **Norms of behavior**
  - **Espoused beliefs**
  - **Basic underlying assumptions**
- **Norms most visible component of culture**
- **Effective team norms do not evolve naturally and must be fostered (Hackman, 2002)**
- **Team norms constitute unwritten set of standardized processes**

Systems Thinking

Systems thinking: the analysis, synthesis, and understanding of interconnections, interactions, and interdependencies that are technical, social, temporal, and multi-level.

--Heidi Davidz, 2006

- **Experientially developed skill that facilitates system design**
- **Five types of systems thinking (Roberts, 1999)**
  - **Open: flows and constraints**
  - **Social: relationships**
  - **Systems dynamics: causal loops**
  - **Process: ways in which information flows**
  - **Living: interactions**

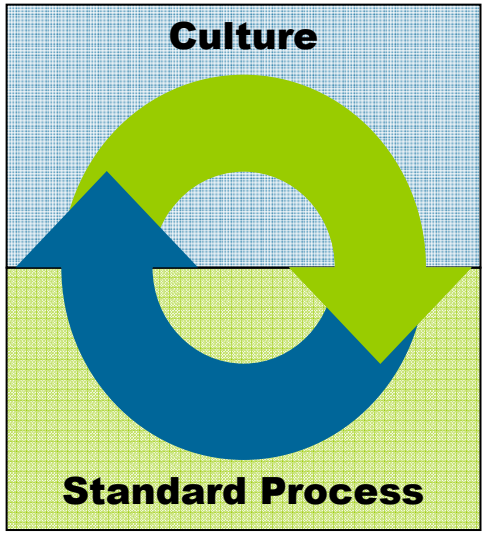
Collaborative Systems Thinking

Collaborative systems thinking: systems thinking as a property of an engineering team or organization.

- **Term coined to refer to higher-level systems thinking in engineering contexts**
- **Systems dynamics/organizational learning current context for most organizational systems thinking research**
- **How might collaborative systems thinking differ from individual systems thinking?**
  - **Teams and organizations produce products**
  - **Borrow ideas of value and efficiency from lean thinking**

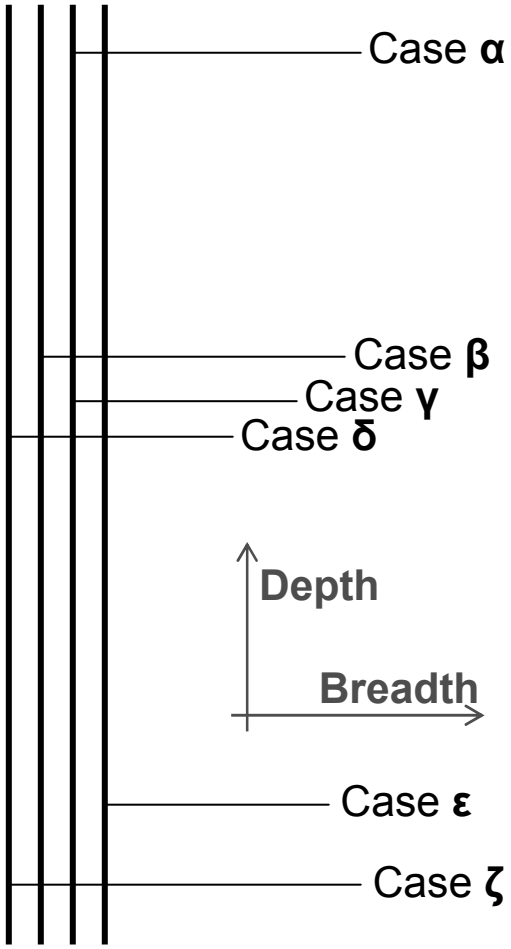
Research Objectives

- Operational definition of collaborative systems thinking (CST)
- Identify enablers and barriers to CST
  - Standardized process
  - Culture
- Explain how CST develops
- Identify best practices, heuristics for aligning culture and process
  - Ways to tailor process
  - Feedback mechanisms
  - Best practices



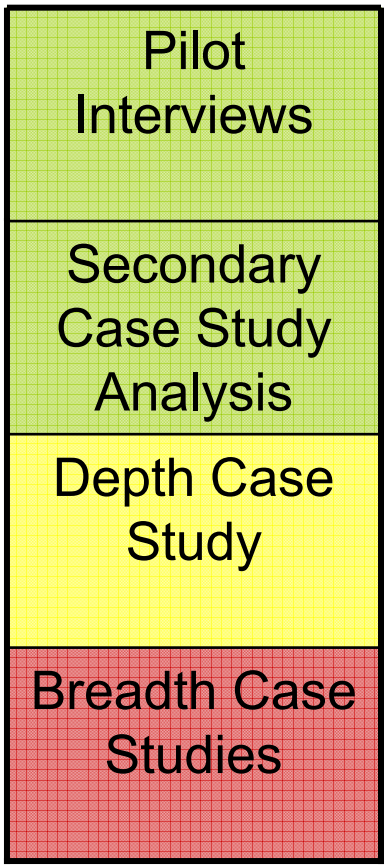
Research Methods

- Grounded theory based research
  - Characterized by concurrent and systematic data collection, analysis, and theory development (Glaser and Strauss, 1967)
- Pilot interviews
  - Identify and define key concepts
- Secondary case study analysis
  - Identify linkages between concepts
  - Drive interview and survey questions development
- Case studies
  - Interviews
  - Primary document
  - Focus groups (simulations)
  - Surveys



Progress to Date

- Wrapping up pilot interviews
- Completing secondary case study analysis
- Depth case study selected
  - Collecting background information
  - Will collect team-based data starting April/May
- Breadth case studies still to be identified



Preliminary Results

- Process tools (value stream mapping, process roadmaps) facilitate forming mental models of development process
- Process facilitates communication—necessary precursor for CST
- Identifying with product an enabler of CST
  - Startups
  - Black programs
- Leadership is key component of CST
  - Leader with systems thinking capabilities
  - Leader working closely with systems thinkers on team
- CST requires a critical mass of systems thinkers

Conclusions and Next Steps

- Links do exist between systems thinking and standard process
- Culture plays a mediating role in success of standard process
- Next steps
  - Complete pilot interview and secondary case study analysis stage
  - Design interview and survey tools for case studies
  - Complete case studies
  - Data coding and analysis

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