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

The Lean Link

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Enterprise Transformation: Closing the Gap between Knowledge and Implementation

Agenda

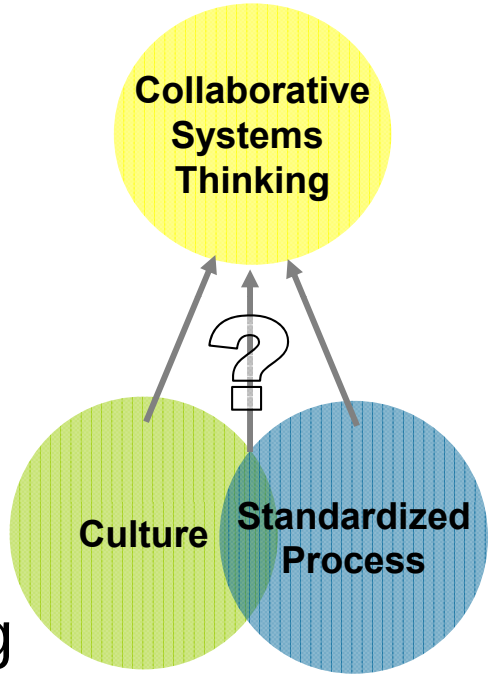
- Motivation
- Research Framework
- Key Constructs
- Objectives
- Research Methods
- Current Progress
- Next Steps

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
- Systems thinkers able to better cope with complexity
- 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
    - Within teams of engineers
    - Collaborative systems thinking
- Desire to explore construct interactions
- Identify enablers and barriers to collaborative systems thinking
- Borrowing ideas from lean thinking
  - Teamwork
  - Standardization
  - Recognition of individual, not just process



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)**
- **TPS based on strict standardization**
- **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**
- **Effective team norms do not evolve naturally and must be fostered (Hackman, 2002)**
- **Team norms constitute unwritten set of standardized processes**
- **Culture a differentiator between successful and unsuccessful organizations**

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 (Davidz, 2006)**
  - **Improved ability do handle complexity**
  - **Saves development time**
  - **May promote process optimization**
- **Evaluating systems thinking of group more important than individual**
  - **Teams design systems**
  - **Teams responsible for managing and maintaining systems**

Collaborative Systems Thinking

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

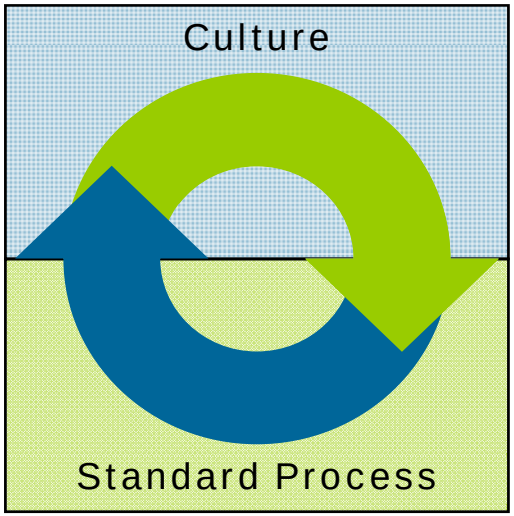
- **Term coined to refer to higher-level systems thinking in engineering contexts**
- **Systems thinking likely linked to context**
  - **Necessitates looking at team and organizational levels**
- **How might collaborative systems thinking differ from individual systems thinking?**
  - **Teams and organizations 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

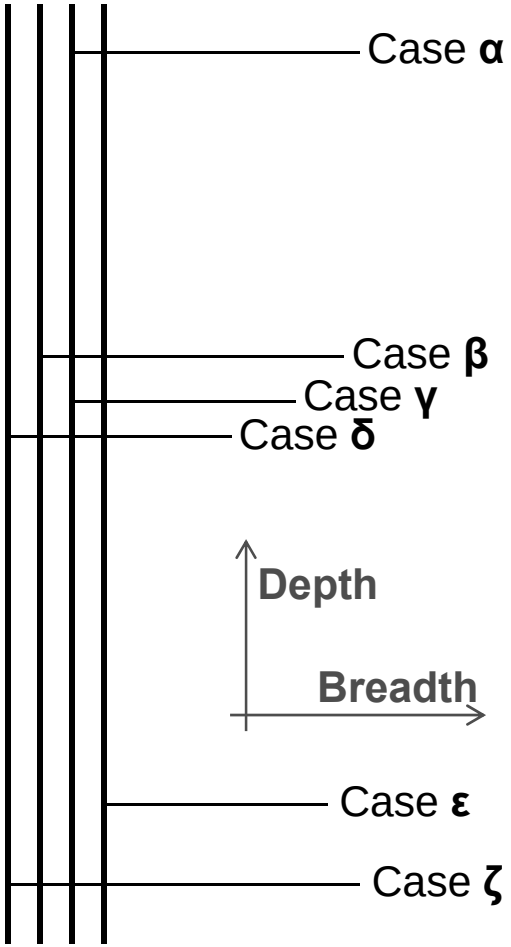
The *Lean Link*

- Lean as way to link culture and process
- Recognizes importance of teams and people, not just processes
- Concepts of value and efficiency
- Continual improvement fits model



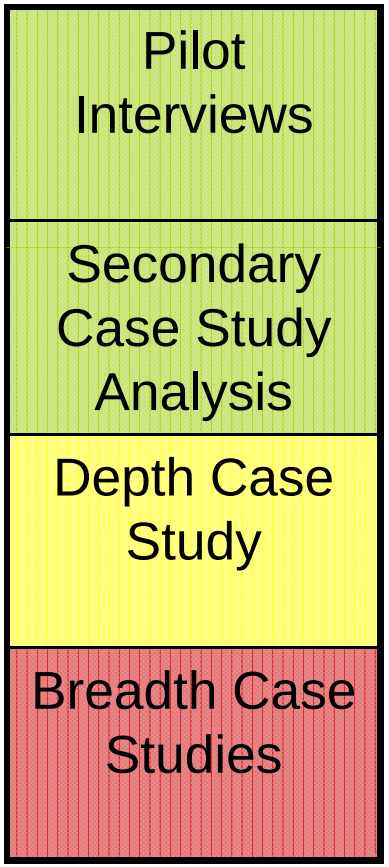
Research Methods

- 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



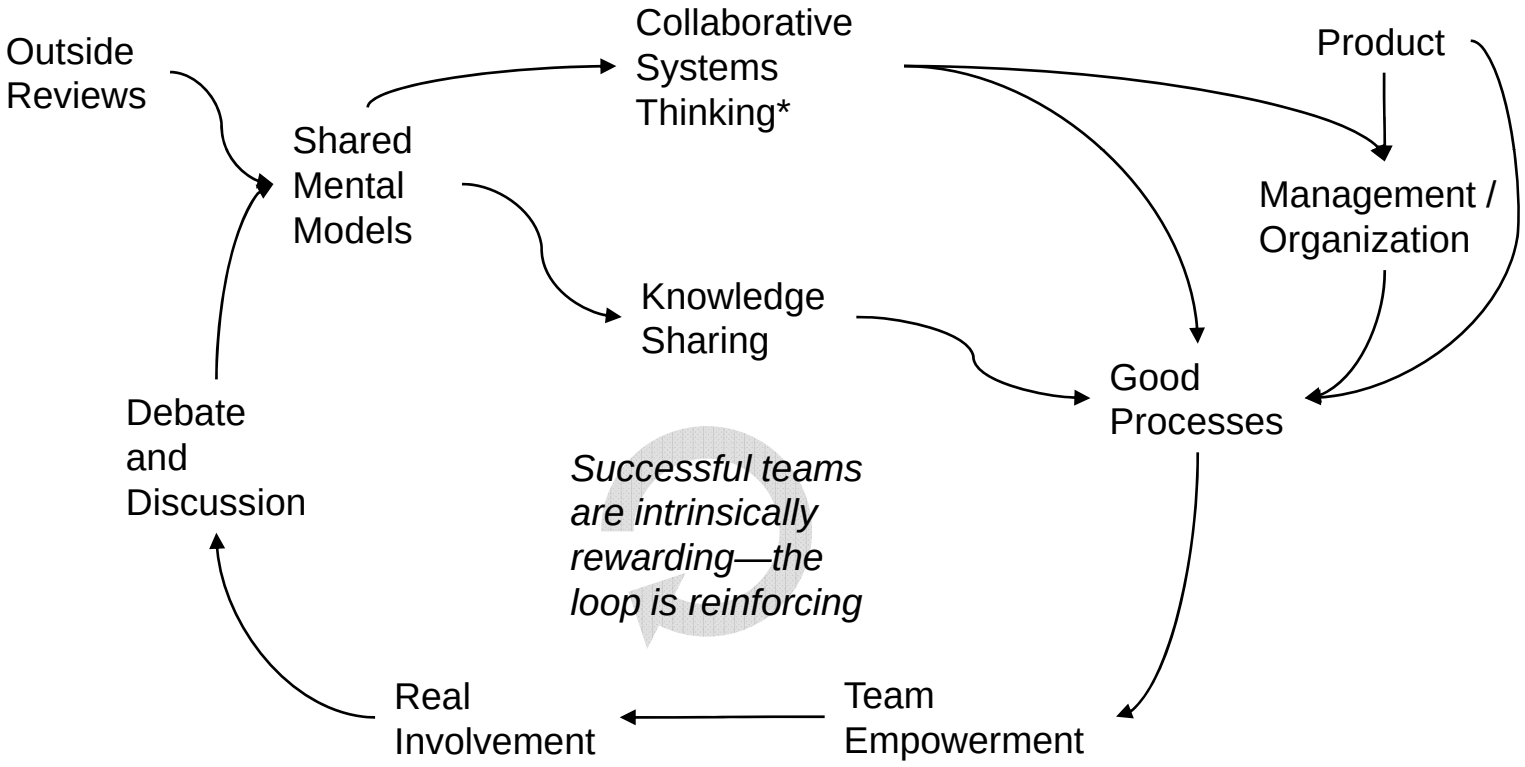
Progress to Date

- 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



Secondary Case Study Analysis

- Based on 12+ cases published through AIAA, IEEE and LAI looking at 'non-technical' aspects of complex product design



* Successful, multidisciplinary teams demonstrating meaningful exchanges of information were used a proxy for CST

Secondary Case Study Analysis

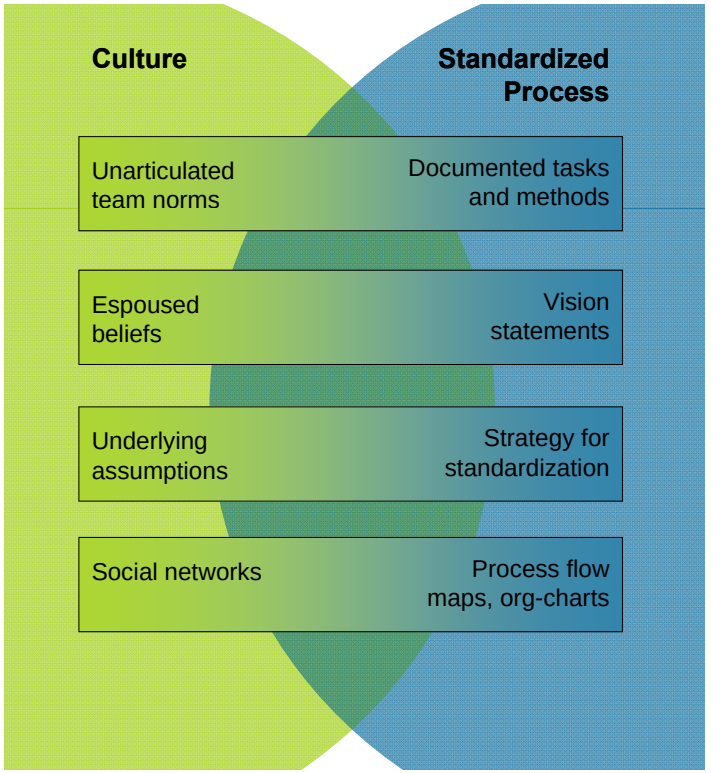
- General Observations
  - Systems thinking enables change
  - Team design important (selecting correct people)
  - Richness and completeness of communication important
  - Must allow and expect participation from all team members (real involvement)
  - Team membership improves knowledge and skill of participants
  - Communication must serve the problem
  - Well designed processes empower the user
- ENABLERS
  - LEADERSHIP
  - Identification with product enabler
  - Empowerment—freedom and ability to make meaningful decisions
  - Real and meaningful responsibility
  - Separating ideas from individuals—allowing for debate and critical analysis
  - Articulating team norms (beyond SP)
- BARRIERS
  - Complexity of product is a barrier to change in methods
  - Identification with function is barrier
  - Hero-based culture a barrier
  - Visionary leader encapsulating tacit knowledge of project
  - Failure to align team involvement with career advancement

Pilot Interview Analysis

- Defining Collaborative Systems Thinking (CST)
  - Teams deliver completed products
  - CST should include idea of delivering product/value
- Strong agreement that standardized process an enabler of CST
- Culture can be either an enabler or barrier
  - Enablers
    - Willing to ask and answer questions
    - Identifying with product (startups, black programs)
  - Barriers
    - 'Hero' culture
    - Failure to consider social dimensions when forming teams
    - Identifying with function
    - Resistance to change
- Leadership is key component of CST
  - Leader with systems thinking capabilities
  - Leader working closely with systems thinkers on team
- Standards and conventions may play even larger role than standard process (culture-process boundary)

Next Steps

- Next steps
  - Identify ‘breadth’ case studies
  - Design survey and interview for case studies



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