**Research Design**

This research is conducted with an iterative concurrent process using qualitative and quantitative methods.

![Flowchart illustrating research design and methods](chart.png)

**Key Questions**

1. What are the dominant enterprise & product variables that give rise to dynamic coupling and emergent behavior?
2. What are the dominant contextual factors (i.e., political, market, etc.) that influence architectural co-evolution?
3. How can the dynamic relationships between the enterprise-product architectures and contextual factors be managed?

**Candidate Methods**

- **Qualitative Methods**
  - Enterprise Architecting
  - Enterprise Value Stream Mapping Analysis
  - Complex, Large-scale, Interconnected, Open, Socio-technical (CLIOS) Process
  - Case studies & analysis
  - Field interviews & ethnography

- **Quantitative Methods**
  - Dynamic Multi-Attribute Tradespace Exploration (MATE)
  - Statistical inference from empirical datasets
  - System Dynamics
  - Complexity methods championed at the Santa Fe Institute, including non-equilibrium statistical physics and network & scaling theories

**Expected Contributions**

Advancement of enterprise and product architecting core theory
- Extension of dynamic tradespace exploration to include enterprise architecture and contextual factors
- Development of dynamic complexity metrics
- Systematic Observation and Documentation
- Collection of a robust empirical dataset through case studies, field work, probabilistic modeling and statistical analysis
- Innovative modeling and analysis
- New engineering system representation and visualization schemas
- Impact to policy and practice
- Enable more effective enterprise and technology strategic planning and governance

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**Motivation / Problem Statement**

Enterprise Architecting is the proactive process of designing and evolving the desired future state of the enterprise. It encompasses choices about the fundamental business models employed and the strategic responses available to dynamic changes in context. Similarly, product architectures govern the design and evolution of products.

Product development enterprises experience dynamic coupling between their enterprise and product architectures that leads to emergent behaviors often manifested as "ility" properties (flexibility, rigidity, etc.), for better or worse. Better understanding of enterprise-product architectural coupling and interactions with the dynamic context in which they are embedded will allow the design of symbiotic enterprise-product architectures that deliver sustainable stakeholder value.

The goals of this research are to develop core theory & methodology, create a robust dataset, apply innovative modeling & analysis, and impact the policy & practice of enterprise and product architecting in dynamic contexts.

**Literature Review**

- **Technology**
  - Engineering Systems Fundamentals & Research Publications
  - Lean Enterprises & Enterprise Architecting
  - Dynamics of Innovation

- **Management**
  - Product Development & Systems Architecture
  - Product Planning & Acquisition Strategy

- **Policy**
  - Complex, Large-scale, Interconnected, Open, Socio-technical (CLIOS) Process
  - Case studies & analysis
  - Field interviews & ethnography

**Timeline**

- **Program Start, Coursework, Definition, Data Collection**
  - Fall 2007
- **Coursework, Research, Substantiation, Proposal Development**
  - Spring 2008
- **Coursework, Research, Substantiation, Proposal Development**
  - Fall 2008
- **Data Gathering, Synthesis & Refinement, Case Applications**
  - Fall 2009
- **Computer Experiments, Simulations, Validations & Outreach Activities**
  - Spring 2010
- **Dissertation, Synthesis & Refinement, Impact & Outreach Activities**
  - Fall 2010
- **Outreach & Publications**
  - Spring 2011