

Systems Engineering Cultural Transformation

Facilitator: Dr. Heidi Hahn, Los Alamos National Laboratory, ESAP. xxx



Heidi is the Director of the Engineering Capability Development Office at Los Alamos National Laboratory, where her responsibilities include developing and implementing strategies for establishing enterprise systems engineering processes and practices. Just prior to joining the Engineering Directorate, she was Deputy Project Director for Change Management for the Enterprise Project, with responsibility for stakeholder development, communications, reengineering and organizational transition, and end user training - to ensure that the implemented system was accepted and used.

She has also been acting division leader of the Human Resources division, subsequent to an assignment as group leader of HR's Workforce Data and Analysis Group, where her responsibilities involved the development of systems for the collection, analysis, and interpretation of data to support decision-making related to workforce and workforce management issues.

Heidi served for eight years as group leader for the Human Factors Group, where she conducted and oversaw research and development activities in the following areas: safety analyses and program design, in both the nuclear weapons and the nuclear power arenas; systems analyses; knowledge acquisition and transfer; human performance requirements analyses as inputs to system design and evaluation; and the development of methods for human performance evaluation and the evaluation of human reliability.

Day-2 Workshop Participants

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Day-1 Intro and Results Poster

What are the organizational challenges and opportunities for transforming to a systems



Socorro Systems Summit October 6, 2017

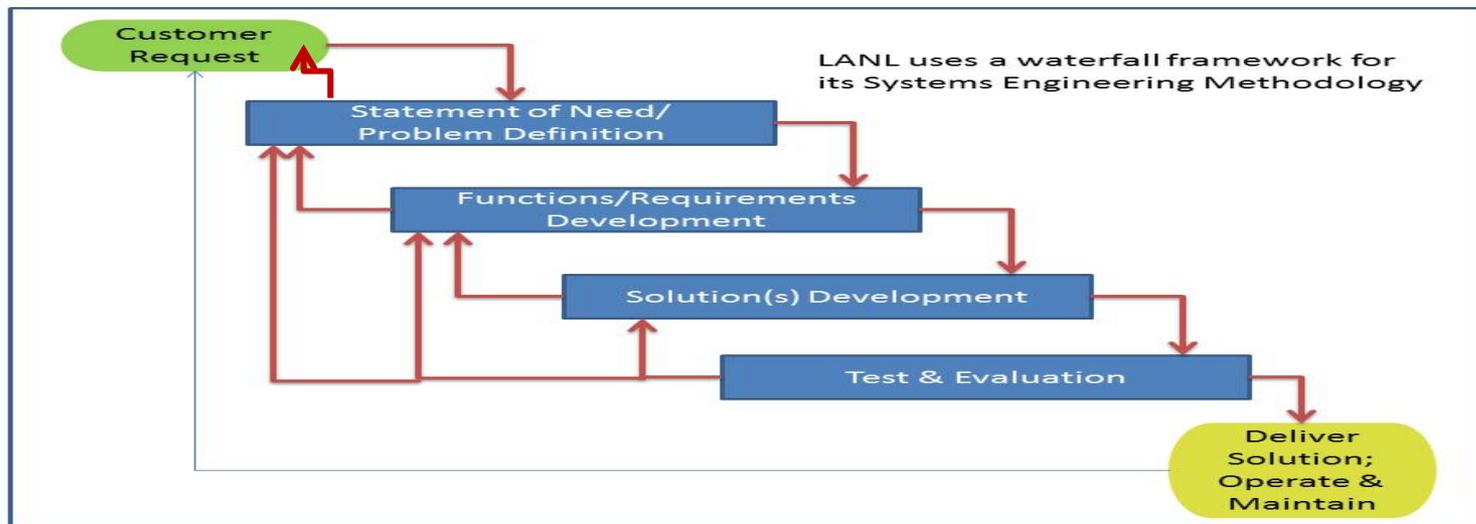
Dr. Heidi Ann Hahn, ESEP, PMP



Operated by Los Alamos National Security, LLC for the U.S. Department of Energy's NNSA

Conduct of Engineering for R&D is the governance document that defines “how we do R&D Engineering @ LANL.”

- Is a systems engineering methodology that has been tailored for LANL
- Based on ISO/IEC 15288, *Systems engineering – systems lifecycle processes*
- Initial issue date: 11/28/12



Three organizational factors influenced the development and implementation of the SE Program for R&D.

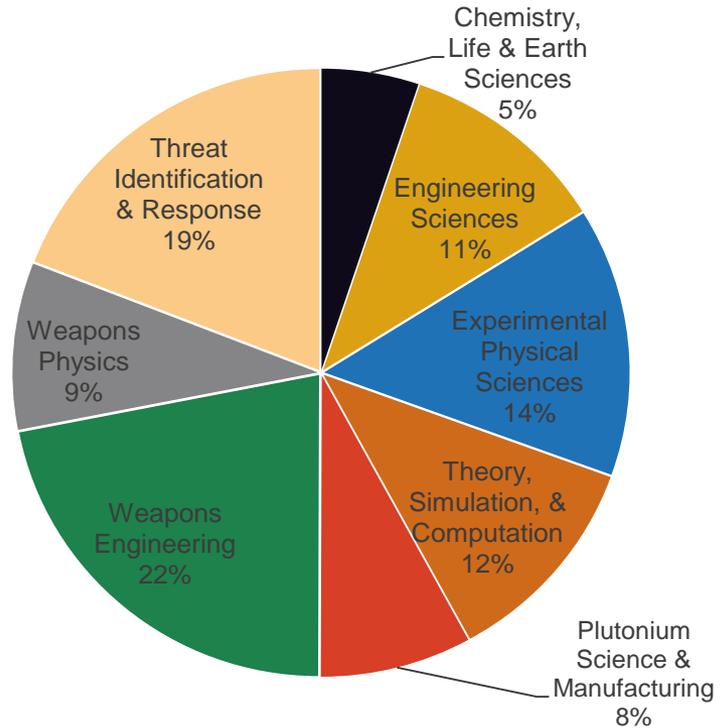
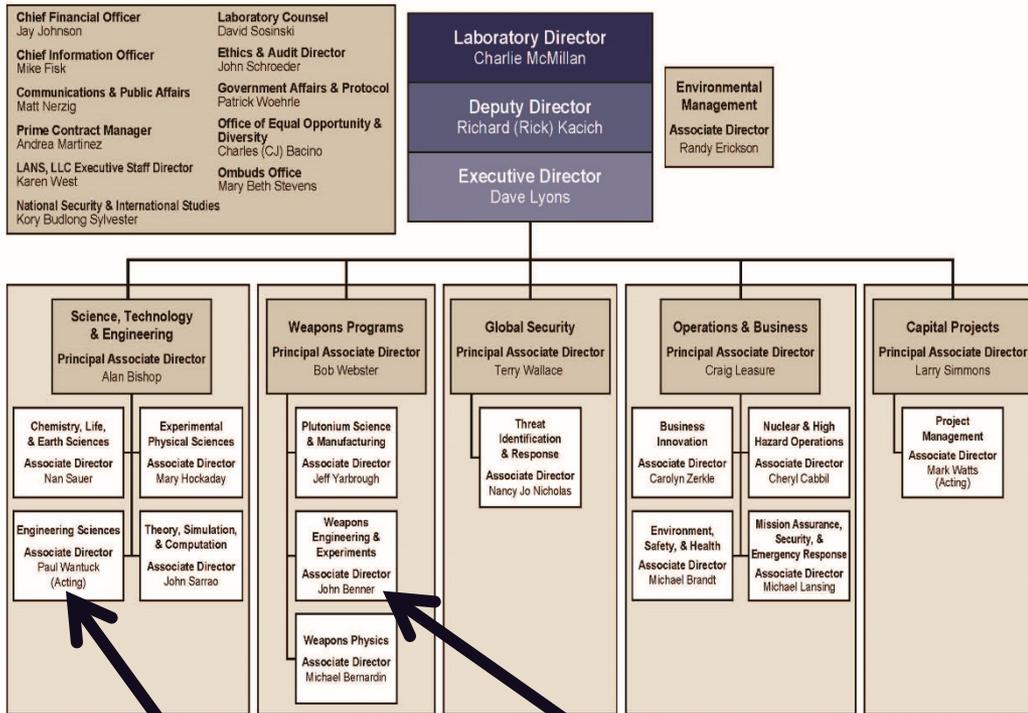
- **Broad mission space**
- **Distributed R&D Engineering capability**
- **Large campus with diverse, often remote, facilities**

Los Alamos delivers national nuclear and global security mission solutions.

- **Has an enduring nuclear weapons mission**
 - Provide a safe, secure, effective nuclear deterrent
- **Has broader national and global security missions**
 - Protect against the nuclear threat
 - Counter emerging threats
 - Provide solutions to strengthen energy security



LANL's R&D Engineering capability and workforce is highly distributed.

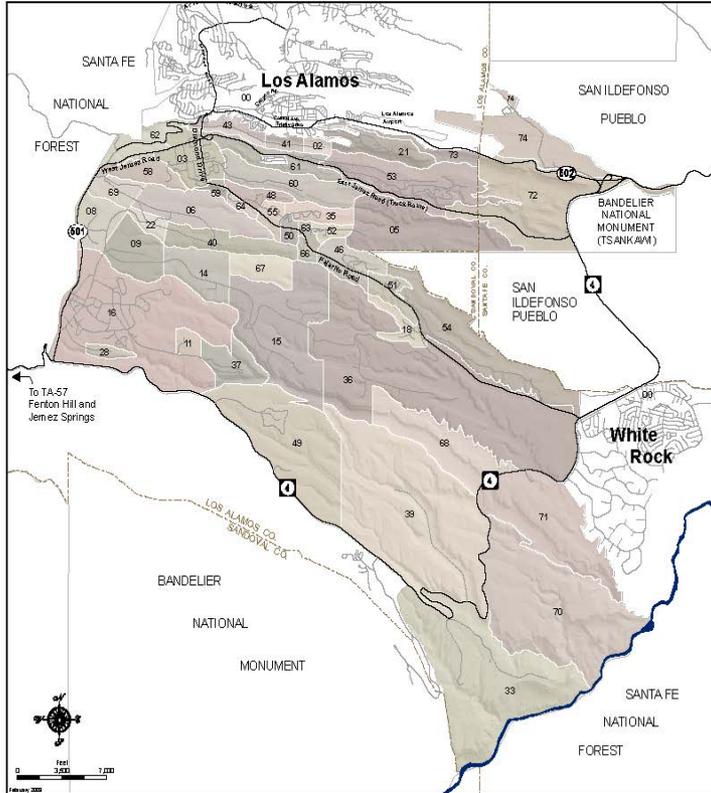


Distribution of R&D Engineers by Directorate
N=1003 (Staff, PDs, GRAs)

Two dedicated R&D engineering directorates

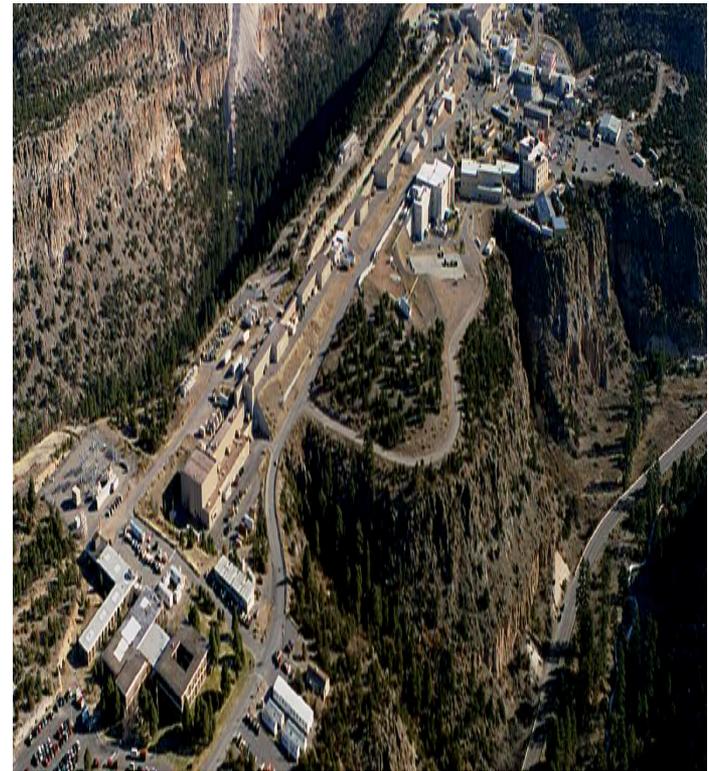


LANL facilities span a 40 square mile campus.



Technical Areas

- 1A00 01F SITE
- 1A02 0M EDA SITE
- 1A03 30 UTH MESA SITE
- 1A04 30TH SITE
- 1A06 TWO MILE BEND SOUTH SITE
- 1A07 ANCOCK HARBOR SITE
- 1A08 ANCOCK HARBOR SITE
- 1A11 0 SITE
- 1A14 0 SITE
- 1A16 0 SITE
- 1A18 0 SITE
- 1A19 PALMARTO LAB RADIOLY
- 1A21 0 SITE
- 1A23 70 SITE
- 1A25 MACHO W E HED A
- 1A26 0 SITE
- 1A28 70A SITE
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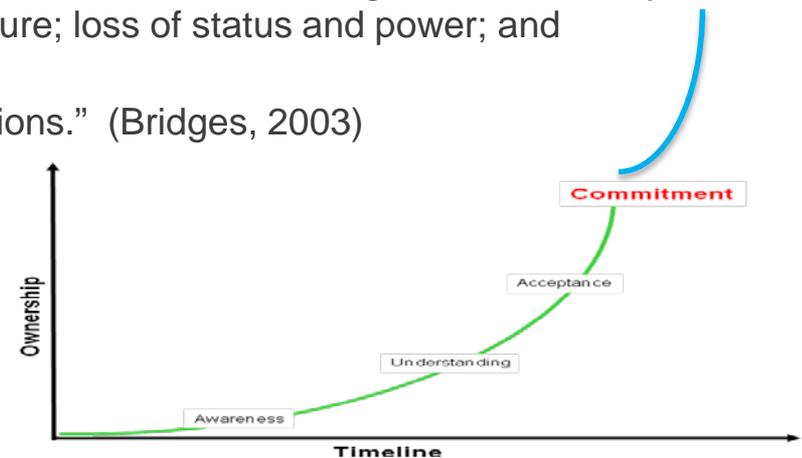
Evolution of the SE Methodology presents both opportunities and challenges.

• Opportunities

- Greater efficiency and effectiveness
- Higher satisfaction → increased compliance
- Potential for business development

• Challenges

- Change, even change for the good, is hard!
 - Difficulty accepting change may stem from: lack of trust; belief that change is unnecessary or not feasible; economic threats; fear of personal failure; loss of status and power; and resentment of interference (Connor, 1995)
 - “It’s not the change that does you in, it’s the transitions.” (Bridges, 2003)



Organizational environment can support or inhibit implementation efforts.

Organizational environment includes factors such as culture, mechanisms for “collective consciousness,” leadership, and interdisciplinary teaming

- **Communication (about the implementation) is critical**
- **Need a business case to start/sustain implementation**
- **Focal points are integrated schedules and planning, regular meetings**
- **Internal and external stakeholders influence adoption and sustainment**
 - Motivations that support: Efficiency/effectiveness; reputation (individual or organizational) – loss of reputation due to poor customer satisfaction; accomplishment; money
 - Motivations that inhibit: Resistance to change (ex., loss of control, “It has always been done this way”), unawareness; cost/schedule impediments
- **Leaders need to be knowledgeable about SE (“believers”) and be able to manage relationships**

Success and failure factors are two sides of the same coin.

- **Good communication (or the lack thereof)**
- **Stakeholder management, including managing the project team as stakeholders (on internal projects, especially)**
- **Accountability**
- **Strong leadership**
- **Use of a systems approach**

Rebentish (2017) provides a number of tips for effecting sustainable cultural transformation.

- **Successful transformational change requires:**
 - A systems approach to implementing change
 - An understanding of common sources of change failure
 - A holistic approach that considers the current state, articulates a future state, and executes the transformation to achieve the future-state vision
 - A committed and engaged leadership team, that understands the need for metrics, ensures information flow, and promotes organizational learning
 - Understanding and incorporating stakeholder value propositions, hearing what they want and honoring what they contribute
 - Focusing on doing the right thing
 - Understanding both internal and external interdependencies

We have a lot of information about why cultural transformation is hard, so why can't we crack the nut?

- **We're not here to solve the problem BUT**
- **Can we get a better (systems) understanding of how the factors that contribute to success or failure of cultural transformation efforts interrelate?**
- **Dream for tomorrow: A systems dynamics model (even a notional one) of successful SE culture adoption and sustainment**

Reference

Rebentish, E. (Ed.). 2017). Integrating Program Management and Systems Engineering: Methods, Tools, and Organizational Systems for Improving Performance. John Wiley & Sons, Inc. Hoboken, NJ.

What are the organizational challenges and opportunities for transforming to a systems engineering culture?

Day-1 Brief Out Poster

Need:

- We need the ability to manage increasingly complex systems across the life cycle (research to deployment)

Customers:

- Discipline engineers, business managers, executives, program managers, customers/sponsors, operations, entry-level SEs, users

Impediments to Focus On:

1. Ability to articulate and deliver on the value proposition, different value proposition for different audiences
2. Tailoring processes and vocabulary to scale to the problems (“Stealth” SE)
3. Interdisciplinary/cross-disciplinary communication, teaming
4. Perception of SE as bureaucratic
5. Lack of metrics to determine SE impact

Day-2 Workshop

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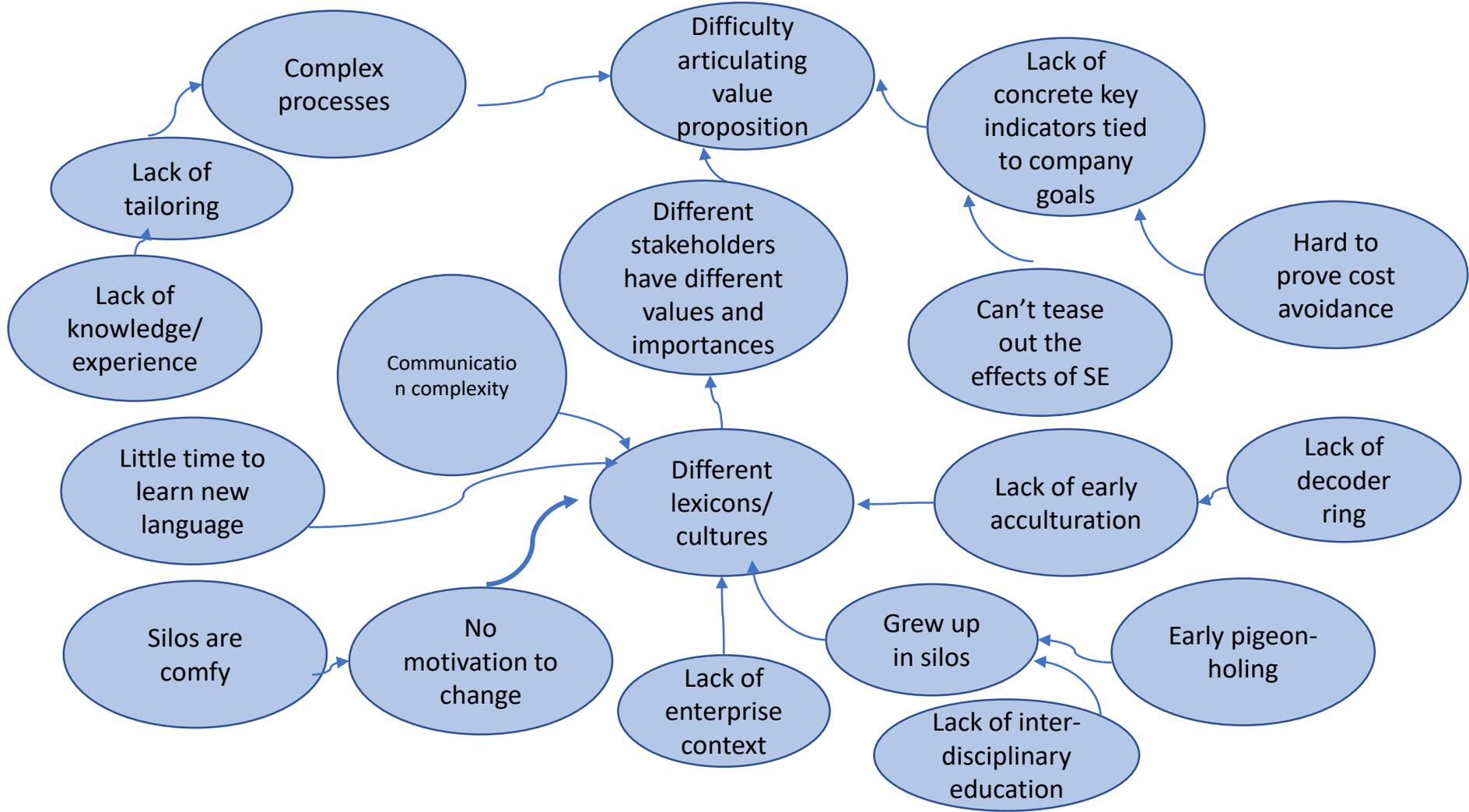
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Why aren't we able to articulate and deliver on the value proposition?
Why do we need different value propositions for different audiences?

- Different stakeholders have different views of the values of SE and their relative importance
 - Some seasoned engineers and managers point to past heroics – don't need SE
 - Different stakeholders have different lexicons
 - Grew up in silos
 - Don't have time
- Lack of concrete key indicators tied to company goals

Tailoring processes and vocabulary to scale to the problems (“Stealth” SE) – Why don’t we have a common language?

- Lack of exposure to alternatives
 - Get pigeonholed early
- Lack of interdisciplinary enterprise awareness
 - Grew up in silos
 - Work overload – no time for systems thinking



Element	Link	Element
Early pigeon holing	Can lead to	Growing up in silos
Lack of interdisciplinary education	Can lead to	Growing up in silos
Lack of interdisciplinary education	Can lead to	Lack of knowledge/ experience
Growing up in silos	Promotes	Different lexicons/cultures
Different lexicons/cultures	Leads to	Different stakeholders have different values and assign different importance
Lack of enterprise context	Reinforces	Different lexicons/cultures
Lack of motivation to change	Supports	Different lexicons/cultures
Comfy silos	Leads to	Lack of motivation to change
Little time to learn new language	Reinforces	Different lexicons/cultures
Communication complexity	Leads to	Different lexicons/cultures
Lack of knowledge/ experience	Results in	Lack of tailoring
Lack of tailoring	Leads to	Complex processes
Complex process	Make it	Difficult to articulate the value proposition
Different stakeholders have different values/importances	Lead to	Difficult to articulate the value proposition
Lack of early acculturation	Leads to	Different lexicons/cultures
Lack of a decoder ring	Leads to	Lack of acculturation
Lack of concrete key indicators	Leads to	Difficulty articulating value proposition
Difficulty proving cost avoidance	Leads to	Lack of key indicators
Difficulty teasing out effects of SE	Leads to	Lack of key indicators

A solution must:

- Create a motivation to change
- Provide a methodology to understand enterprise context
- Provide inter-disciplinary education/experience with systems early
- Characterize SE for the customer
- Express key indicators in business terms
- Identify trans-disciplinary SE practices