By Any Other Name: Enabling Systems Engineering in an Unsupportive Environment

Eileen Arnold and Dorothy McKinney

www.incose.org/symp2022

Introduction

- System Engineers sometimes find themselves in an organization which
    - does not **understand** or **value** systems engineering, or
    - is **hostile** to systems engineering practices

How can an individual SysE improve the value proposition?

Examples: Cultural Support & Hindrance to SysE

SysE Cultural Supports	Cultural Hindrances
• Stakeholder involvement; frequent interactions • Learning from experience; using patterns • Effective risk management • Validating early and often • Baselining & configuration control • Effective processes and tools	• Developer knowing better than the customer • Leaping to point solutions • Lack of internal reviews • Fielding before testing • Ignoring interface concerns • Lack of resources • Lack of effective communication

Why a SysE Can Change an Organization

- We have both personally experienced SysE-led changes in organizations
- Brain research has now shown that it is possible to change attitudes
- Market forces dictate that organizations must change to meet rising customer expectations
- Organizations in desperate straits have been willing to change

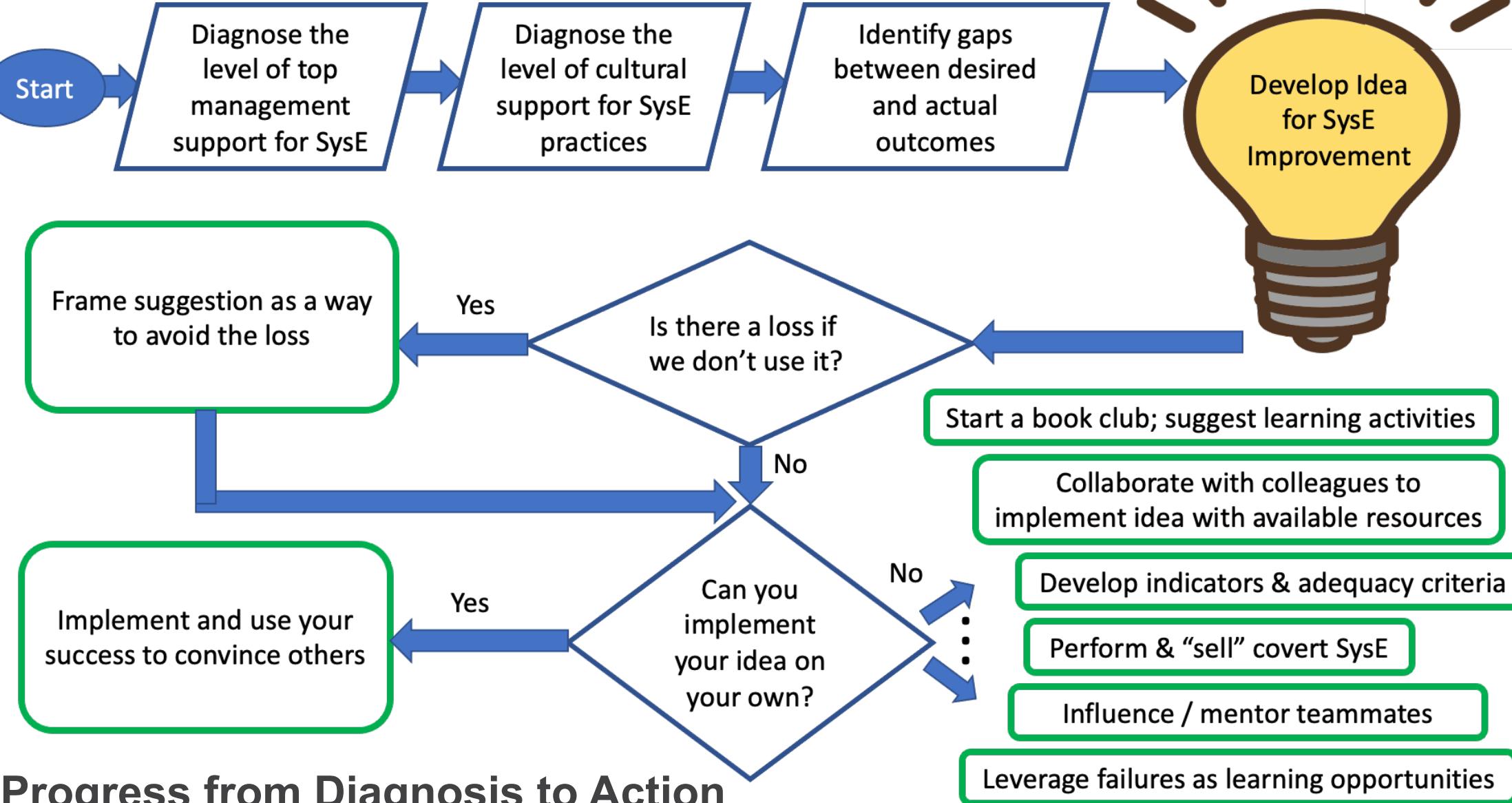# Diagnosing the Organizational Environment and Choosing Actions to Take

Characterize the environment on two axes:

1. Strength of top management belief in SysE
   - Strong belief
   - Empty words ("Lip service")
     - No belief
       - Counter belief

2. Supportiveness of cultural practices in the organization
   - Strong support
   - Weak support
     - No support
       - Oppositional to SysE approaches

Start → Diagnose the level of top management support for SysE → Diagnose the level of cultural support for SysE practices → Identify gaps between desired and actual outcomes → Develop Idea for SysE Improvement

Is there a loss if we don't use it?
- Yes → Frame suggestion as a way to avoid the loss
- No →

Can you implement your idea on your own?
- Yes → Implement and use your success to convince others
- No →
  - Start a book club; suggest learning activities
  - Collaborate with colleagues to implement idea with available resources
  - Develop indicators & adequacy criteria
  - Perform & "sell" covert SysE
  - Influence / mentor teammates
  - Leverage failures as learning opportunities

Progress from Diagnosis to Action

Effects: Organizational Environment on SysE

Top Management Belief in SysE	Cultural Support (by engineering practice) for SysE			
	Strong support	**Weak support**	**No support**	**Opposition**
Counter belief	only covert SysE is done	systems engineers do what comes to mind	systems engineers do what was done in the past	engineers celebrate speed over thoroughness
No belief	systems engineers perform SysE	engineers perform uncoordinated SysE	engineers perform haphazard SysE	engineers perform occasional SysE by accident
Empty words	systems engineers perform SysE	systems engineers perform occasionally coordinated SysE	engineers perform accidental SysE	systems engineers perform rework
Strong belief	systems engineers perform SysE	systems engineers do what was done in the past	engineers perform SysE without knowledge of SysE	engineers develop point solutions advertised as SysE

SysE Encouragement | Great | Good | Okay | Scanty | Poor | Lacking |

Case Studies ⭐

Top Management Belief in SysE	Cultural Support (by engineering practice) for SysE			
	Strong support	**Weak support**	**No support**	**Opposition**
Counter belief	only covert SysE is done	systems engineers do what comes to mind	systems engineers do what was done in the past	engineers celebrate speed over thoroughness
No belief	systems engineers perform SysE ⭐	engineers perform uncoordinated SysE ⭐	engineers perform haphazard SysE ⭐	engineers perform occasional SysE by accident
Empty words	systems engineers perform SysE	systems engineers perform occasionally coordinated SysE	engineers perform accidental SysE	systems engineers perform rework
Strong belief	systems engineers perform SysE	systems engineers do what was done in the past	engineers perform SysE without knowledge of SysE	engineers develop point solutions advertised as SysE

SysE Encouragement: Great | Good | Okay | Scanty | Poor | Lacking

Case Study: Impact of SysE Practices on a Seat-of-the-Pants Organization - Defense

Characterization:

A seat-of-the-pants organization with a history of building individual products without consideration for the business connection to the end system was acquired

(no top mgt belief; no cultural support)

Actions taken:

- SysE was sent to assess the company's culture and behaviors, identifying gaps that existed between the parent company culture and the acquired company culture
- A one-year roadmap was created, with the goal of doubling the profit in a year
- Training for lean manufacturing techniques, quality indicators and insight into the concept of products as a greater part of a system

Outcome:

- Profits more than doubled during the year of change

Case Study: Doing Systems Engineering Without Knowing It - Aerospace

Characterization:

Supplier (with excellent quality, cost and delivery record) was asked by prime contractor to be assessed for SysE maturity, but refused bluntly, saying they had no need to do SysE

(no top mgt belief; strong cultural support)

Actions taken:

- Systems engineer was sent from prime contractor, talked to both design and production personnel, then composed a table "translating" the company's activities into "systems engineering speak"

Outcome:

- Supplier rated "highly effective" on SysE maturity assessment

- Two years later, supplier's top management concluded there was marketing value in SysE, and implemented training so their people could "talk the talk" as well as continuing to "walk the walk" as they had been doing

Case Study: Fail Faster - Aerospace

Characterization:

Middle managers from across the corporation observed that projects with systematic processes were much more successful, but top management was unwilling to force processes on project managers, except after project failures (two divisions had implemented systematic processes across all their programs after major projects failures).

(no top mgt belief; weak cultural support)

Actions taken:

- Middle managers in other divisions looked for opportunities to "fail fast" – ideally in ways which illustrated the need for process implementation without bankrupting the division

- These failures were highlighted to division management, and parallels drawn to other division's lessons learned

Outcome:

- Within 3 years, all divisions had adopted systematic processes

What You Can Do

On Your Own (use your success to convince others)	With Colleagues
- Develop indicators and adequacy criteria - Perform covert SysE - Use models in your own work - Use tools in your own work - Use SysE methods in your own work, but don't call it that - Stay current on new technologies, SysE approaches and trends	- Start a book club - Suggest learning activities "Sell" indicators and adequacy criteria "Sell" covert SysE - Influence/mentor teammates - Leverage failures as learning opportunities

Conclusions

- Understanding top management's attitude toward SysE and how organizational culture affects SysE aids in choosing strategies for success

- An individual systems engineer can leverage effective SysE to improve success even in organizations actively hostile to SysE

Discussion Questions

- What other observations do you, the audience, have about being in an environment without strong support for SysE?

- What other actions have you found to be effective?

Other questions or comments?