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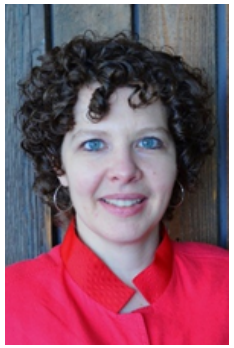
July 18 - 21, 2016

Selling Systems Engineering by Searching for the "Sweet Spot"



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- Organizational maturity in Systems Engineering
- Journey, not a “big bang”
- Conclusion / recommendation

1 Overall proposition

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- Systems Engineering has the potential to be a ubiquitous discipline, adding value to many domains
- Systems Engineering can appear rigid, process heavy with a strange language and a significant investment burden, preventing the realisation of value
- We suggest there is a “sweet spot” for System Engineering application – balancing the Systems Engineering response appropriate to problem **and** Systems Engineering capability level in the organisation

Organizational guidance needed – to establish appropriate capability to realise the value of Systems Engineering

2 Specifics of problem

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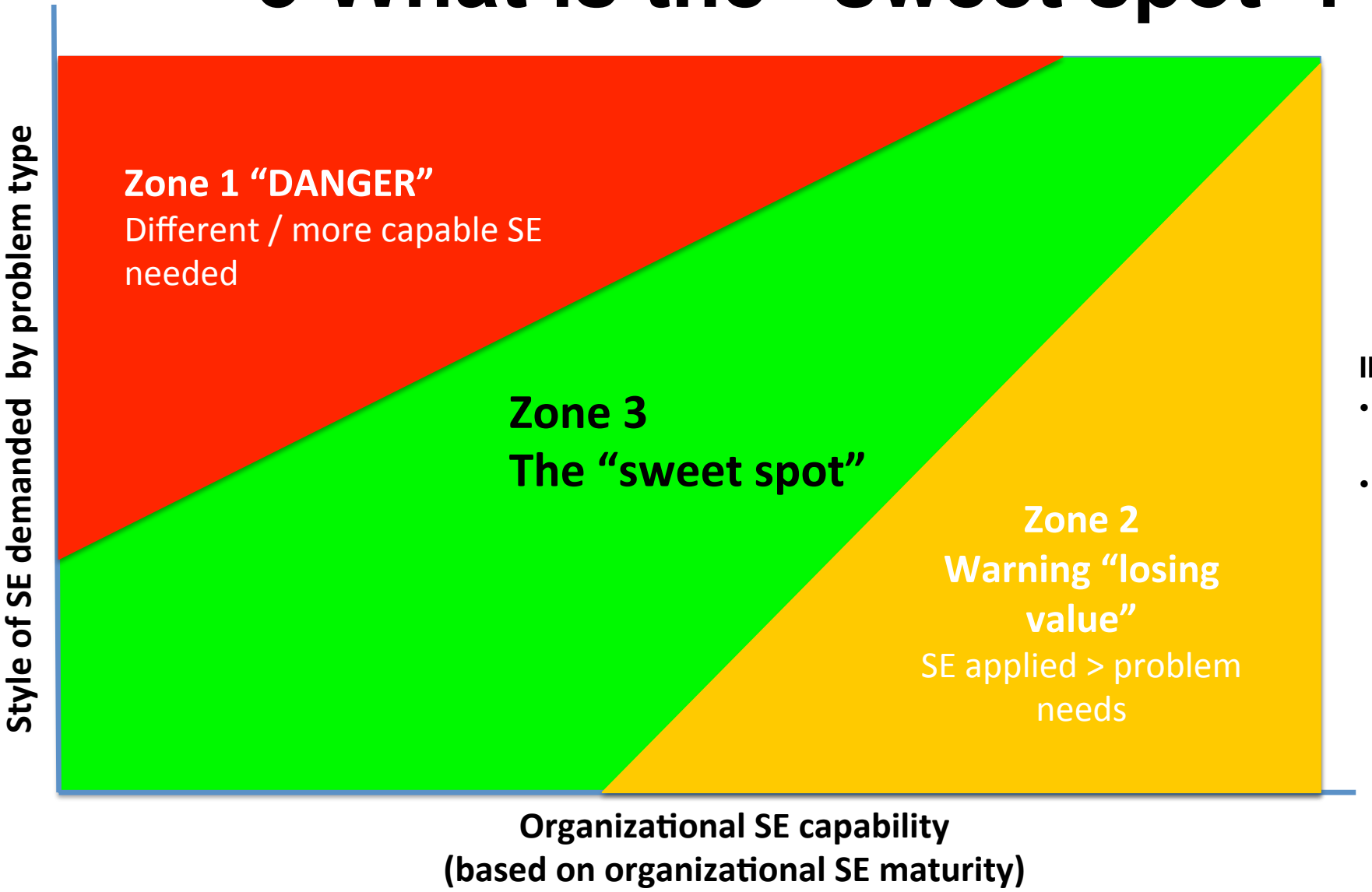
1. **Systems Engineering is a team sport**
   - Solo practitioners cannot deliver benefits of SE alone
2. **Organizational "brown field" challenge**
   - A SE advocate implementing SE needs to blend in with, leverage existing established responsibilities and culture
3. **SE reputation for adding overhead, not value**
   - Poses barrier to obtaining resource support from PMs, cultivating executive sponsors
4. **Terminology barrier**
   - "It's difficult to sell something if you do not use language intelligible to prospective customers"

Elliot, O'Neil, Roberts, Schmid and Shannon, 2011, Syst.Engin., 15, 203-212

2 Specifics of problem – cont'd

5. **Over-emphasizing process versus delivered value**
   - Can make process replacement for Systems Thinking, rather than enabler/ context for the powerful approach
6. **Inappropriate dependency on tools / methods**
   - Avoid "pursuit for perfection"
7. **Danger of creating another silo**
   - Do not perform SE for sake of "doing SE"

3 What is the “sweet spot”?



IMPORTANT note

- The axes are not linear; it’s a conceptual model
- Y axis is not simply “tailoring” – it’s the “style” of SE required

3 Explanation of zones

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Zone 1 – Situation demands certain rigour and style

- Typical of heavily regulated domain, and large / multi-layered complicated systems
- Failure to use right style, or deliver leads to significant project failure

Zone 2 Doing too much

- carrying on with SE when insights achieved
- Just takes too long to do SE
- “tick box” – doing SE that tells you nothing
- Too much rigour / detail

Zone 3 – the sweet spot

- “Just right” – not too much/ not too little, and the right style for situation

3 – “Sweet spot” key takeaways

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- Size of organisation must not be excuse for not adopting the SE approach and principles the situation demands
- Don’t jump to a standard approach or methodology solution!

Systems Engineer the appropriate SE approach to situation

4 Anecdotes / lessons learned from implementation journeys #1 – Establishing SE capability at MTA NYCT

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- **Created sense of Need**
  - ➢ **Understanding and communicating the need: capital project delivery issues**
  - ➢ **Then developed business case**

    Leveraged benchmarking data from industry peers

Network Rail
UK Rail

Land Transport Authority
Singapore Government

Dutch Rail
ProRail

BART
bart

RATP
Paris Metro

UNDERGROUND
London Underground

Charting the implementation journey for MTA NYCT

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Incremental, non-linear journey…

….flexibly aligned to agency, executive needs

- Didn't start at the beginning of lifecycle process
- Tailored activities, SE application to need – where we would demonstrate value.

Observing the problem space at MTA NYCT :
Generating organizational buy-in and awareness

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- Grew awareness for “systems issues”
- Allies generated, momentum and interest in other SE activities – to improve requirements definition, improve engagement with Operations stakeholders

At each incremental step to introduce further SE activities, emphasis remained on delivering value!

4 Anecdotes / lessons learnt from implementation journeys #2 – Making SE the way Rolls-Royce does engineering

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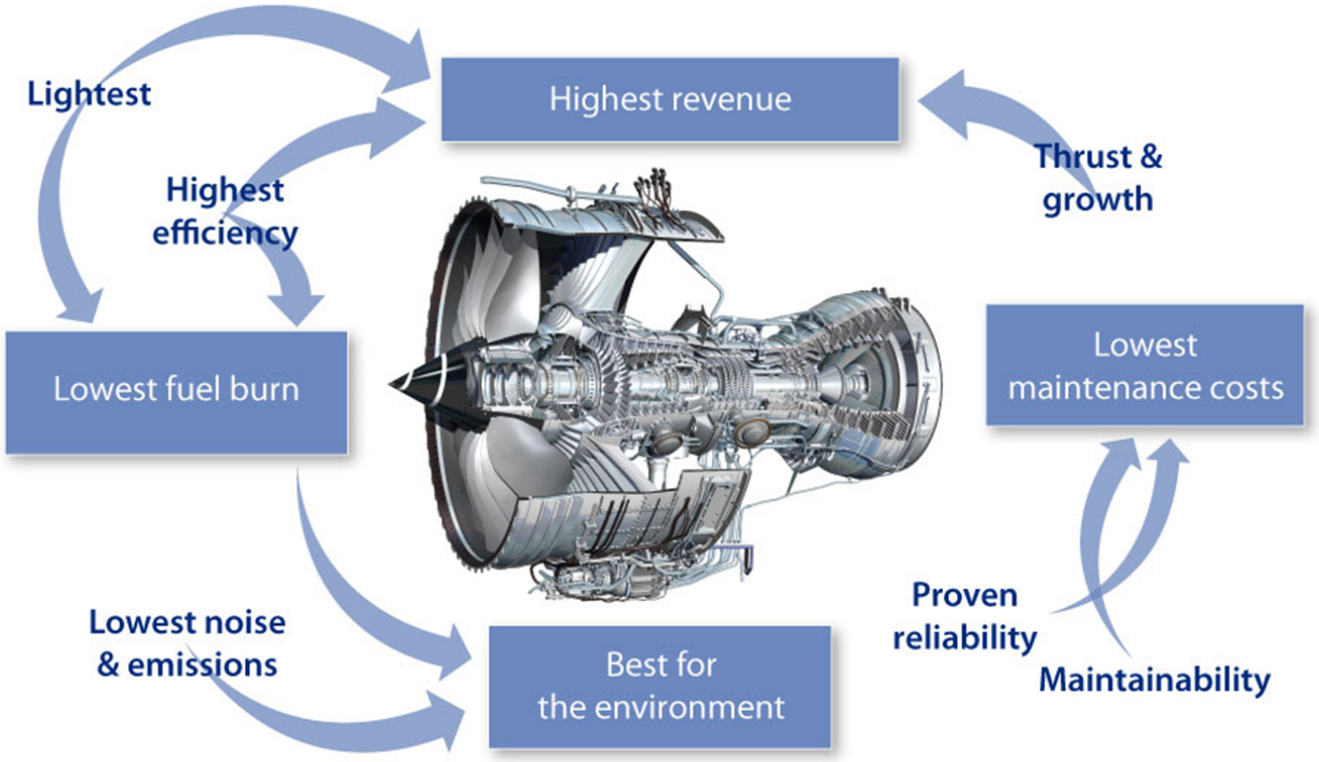
Multiple, challenging engine requirements



Complicated product – obvious for Systems Engineering as part of pre-work not re-work

4.2 How do you react to this introduction to Systems Engineering?

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"Basically Systems Engineering is good engineering with special areas of emphasis"

Blanchard and, Fabrycky Systems Engineering and Analysis, 4 edition 2006

Positive

"OK, its common sense, and not too great a stretch from what I do now"

Curious / interested

Negative

"Are you saying I'm not a good engineer?

#$%&** off"

Disengaged / negative

4.2 Model of improving quality of Systems practice

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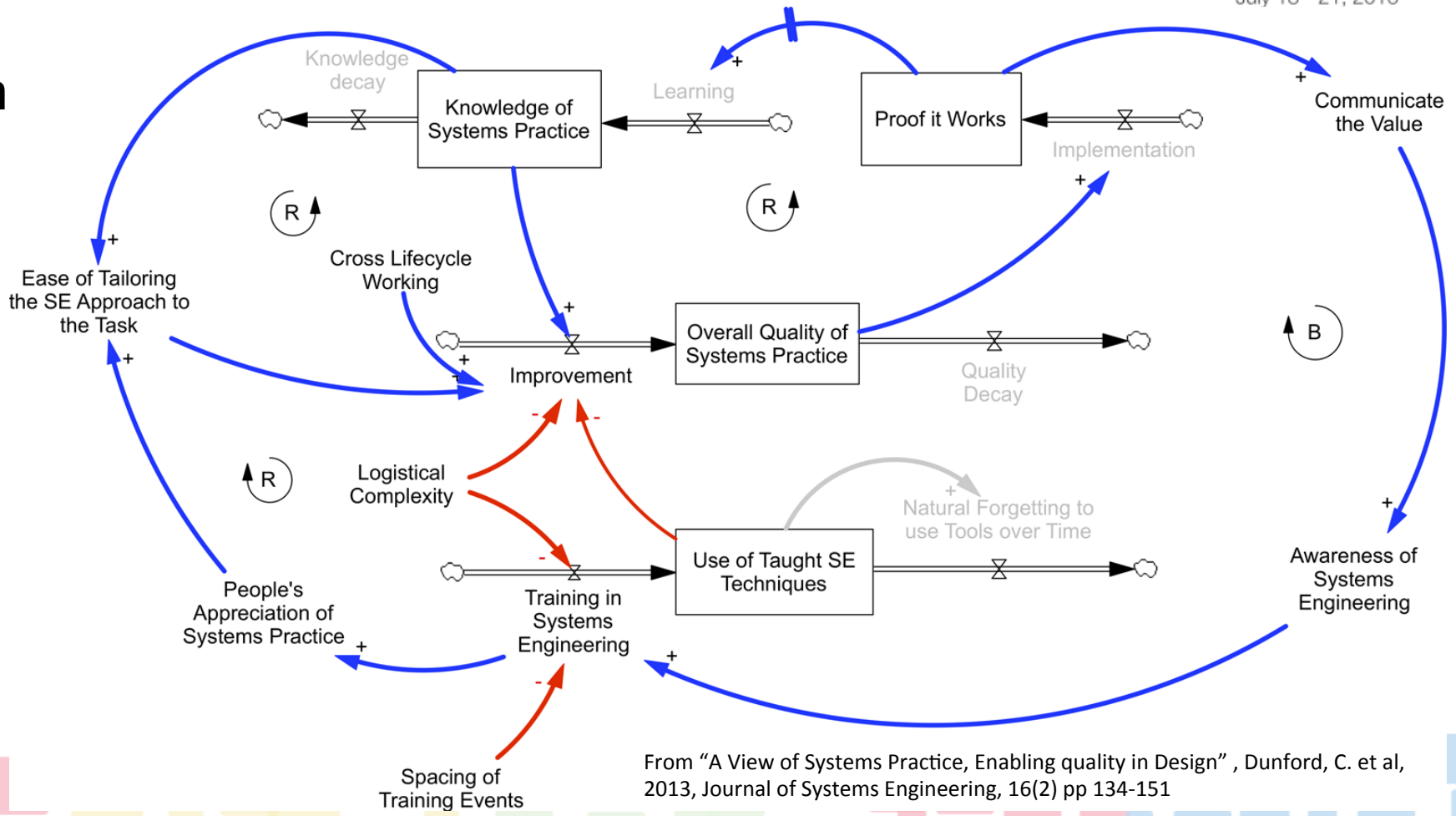
Quality of Systems Practice depends on:

- Working on **application** (real experience),
- Conscious effort to developing one's **expertise** in SE practice,
- **Communicating** both appreciation of value and generating enthusiasm



From "A View of Systems Practice, Enabling quality in Design" , Dunford, C. et al, 2013, Journal of Systems Engineering, 16(2) pp 134-151

4.2 Anecdotal experience: “It’s a journey”
Rolls Royce Experience

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- Phase 1
  - Recognition that some practice is “implicitly” Systems Engineering, and that it is not a revolution but evolution
- Phase 2
  - “What and Why” of Systems Engineering
  - Barrier – “that’s just good Engineering / common sense”
- Phase 3
  - Who does SE and how is it done
  - Challenge is keeping its application “standard”, and build on good practice (don’t keep reinventing)
- Phase 4 – Continuous Improvement
  - This will include moving to more Model Based
  - But could not move to full-on MBSE initially, until there was sufficient basic maturity of SE

Note – need to always be preparing for next phase while implementing current

5 Organizational maturity:

How to organize & How implement

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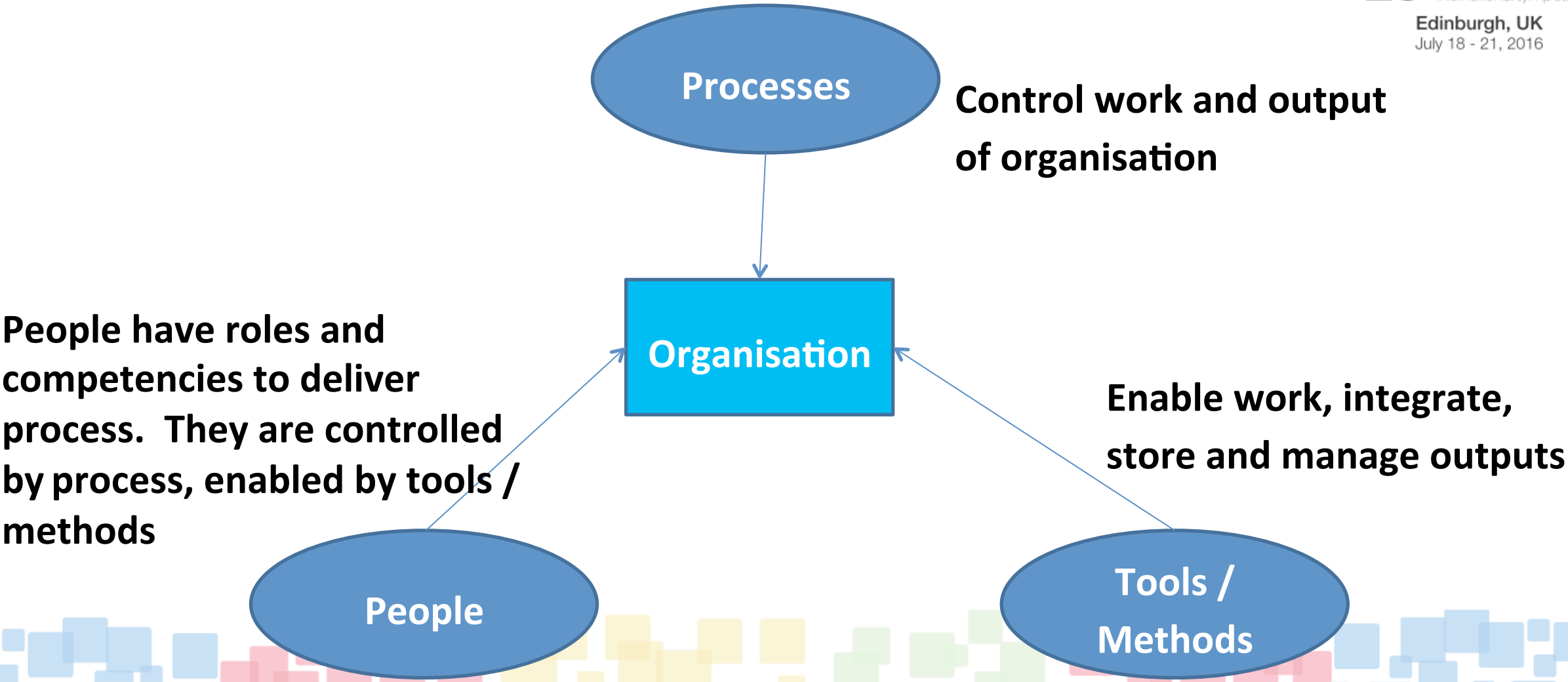

5 Organizational maturity to exploit SE

Key issues for integrated SE capability

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- SE as “glue” role
- SE **IS** a discipline
- Scope expands beyond Engineering to Executives, Operations and Project Management
- SE must make its business case

6 Recognize it's a journey, and plan the route

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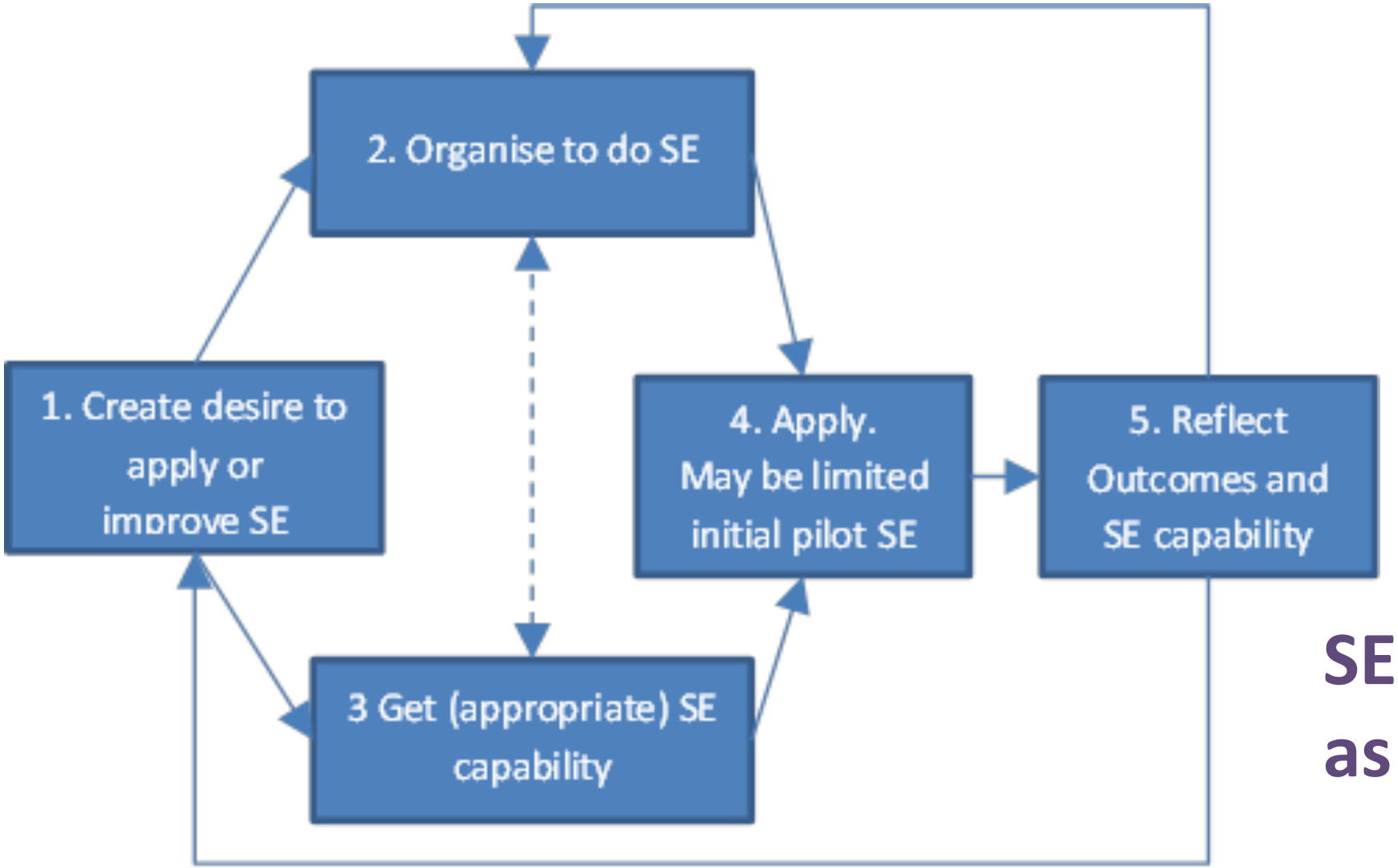

SE must be seen as a capability

6 Organizational maturity
Consider your organization when planning journey

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Step 1: Establish need for change or improvement

Steps 2, 3 :

- Determine what type of SE required – driven by problems the organization solves
- Appropriate leadership style and change approach
- Recognize existing organizational SE aptitude (strengths and weaknesses)
- Recognize existing culture of organization

Recognize it's a journey, plan the route

Roles of SE Champion and Advocate

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- Roles that define the Journey
- Core team guiding "Organizing to do SE"

Champion

– Accepts and pulls for SE application as business benefit

Advocate

– Responsible for planning the journey

– Ties SE capability needed to their understanding of 1) organization, 2) domain situation

Along journey approach must vary from "Prophet, to Pragmatist, to Perfectionist"

Kemp and Elphick, 2012

Conclusions:

Making SE truly universally applicable

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a) Create the desire for SE
b) Sustain desire: cultivate Advocates & Champions
c) Watch your language
d) More than tools & process, it's *Systems Thinking*!
e) SE seen as distinct discipline that is **additive** to the other engineering disciplines (as it integrates)
f) Tailor SE to specific needs of problem AND to existing capability of organization

Recommend: INCOSE produce "Guidance for Development of Organizational SE Capability"

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