

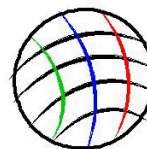
# A Systems Theoretic-Based Framework to Discover Pathologies in Acquisition System Governance

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April 26, 2017



**EMSE**  
Engineering Management and Systems Engineering



**NCSOSE**  
*National Centers for System of Systems Engineering*

# Old Dominion University



- Public university located in Norfolk, Virginia
- Carnegie Research Institution serving 26,000 students
- Home to the National Centers for System of Systems Engineering (NCSOSE) – *focused on system science based engineering of technologies to improve complex system performance*

# ***Topics***

## ***A Systems Theoretic-Based Framework to Discover Pathologies in Acquisition System Governance***



01

**Nature of the Research & Systems  
Perspective**



02

**Introduce Complex System  
Governance & Pathologies**



03

**Research Results and  
Directions**

# ***Paper Purpose***

**Exploiting and extending recent developments in Complex System Governance (CSG) to advance the acquisition field.**

## **A Systems Perspective of Defense Acquisition**



**1**

Systems theory based framework for Acquisition System Governance

**2**

CSG pathologies implications for acquisition practice

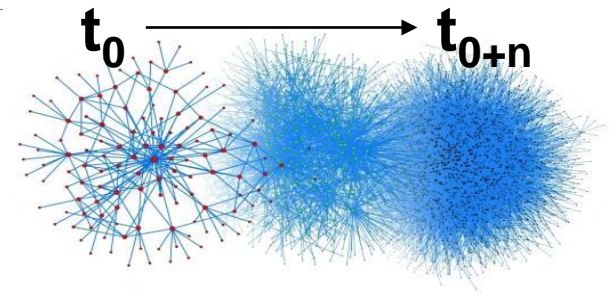
**3**

Moving CSG forward to improve acquisition practice

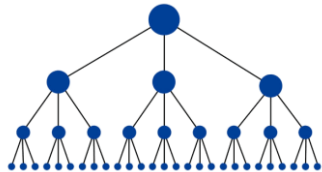


# A Systems Perspective of Defense Acquisition

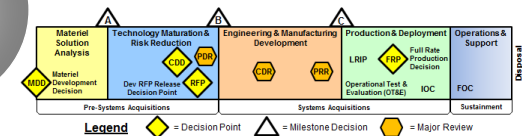
**Sprawling Complexity**



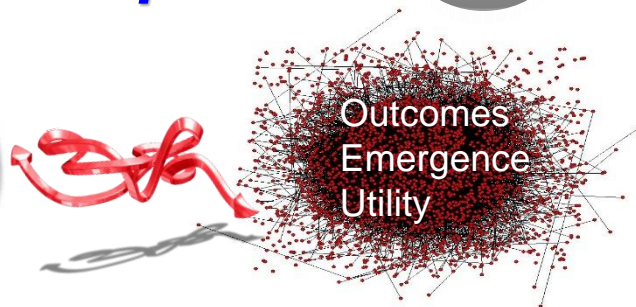
**Prominence of Global Control**



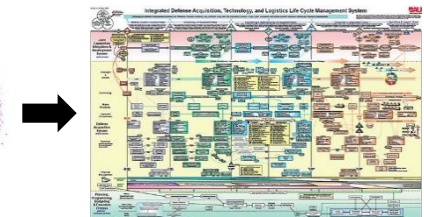
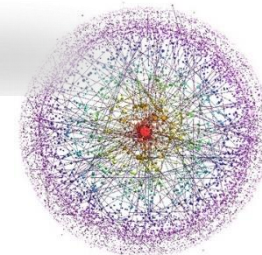
**Process & Event Centric**



**Paradigm Embedded in Output Emphasis**

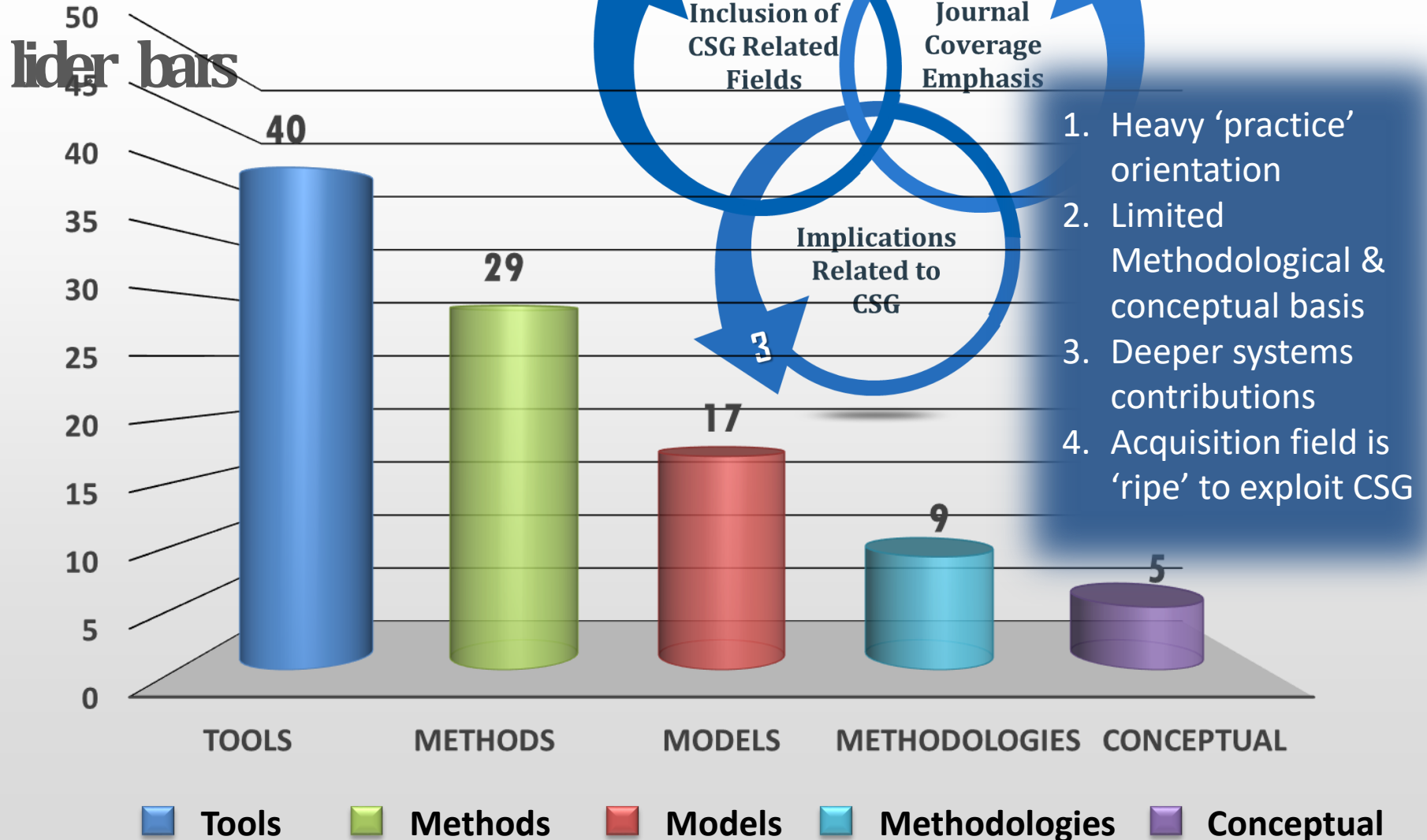


**Respond to Complexity with Complication**

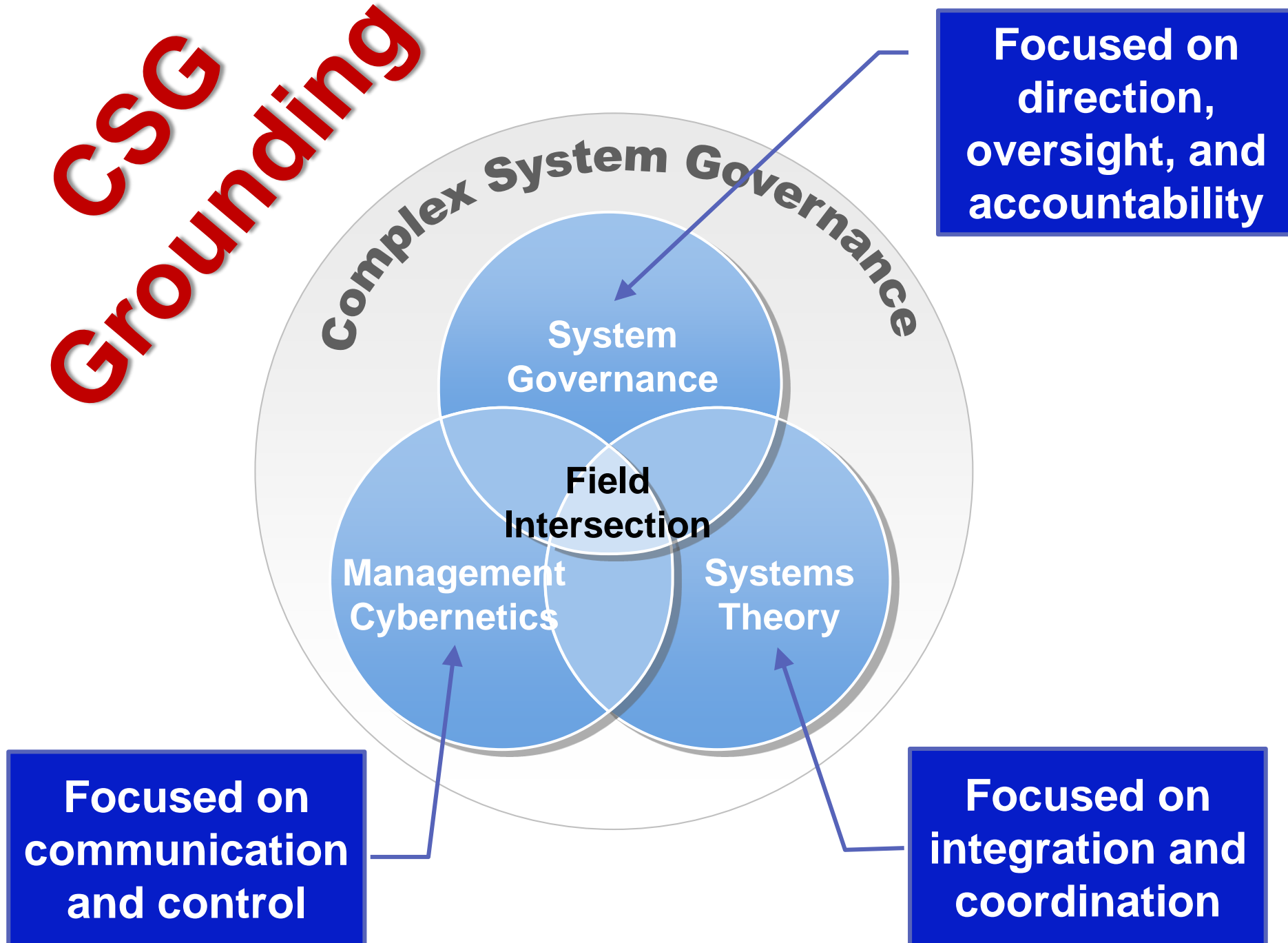


# A Glimpse of the Literature

Defense Acquisition Premier Journal  
Coverage Distribution % (2006 -2016)

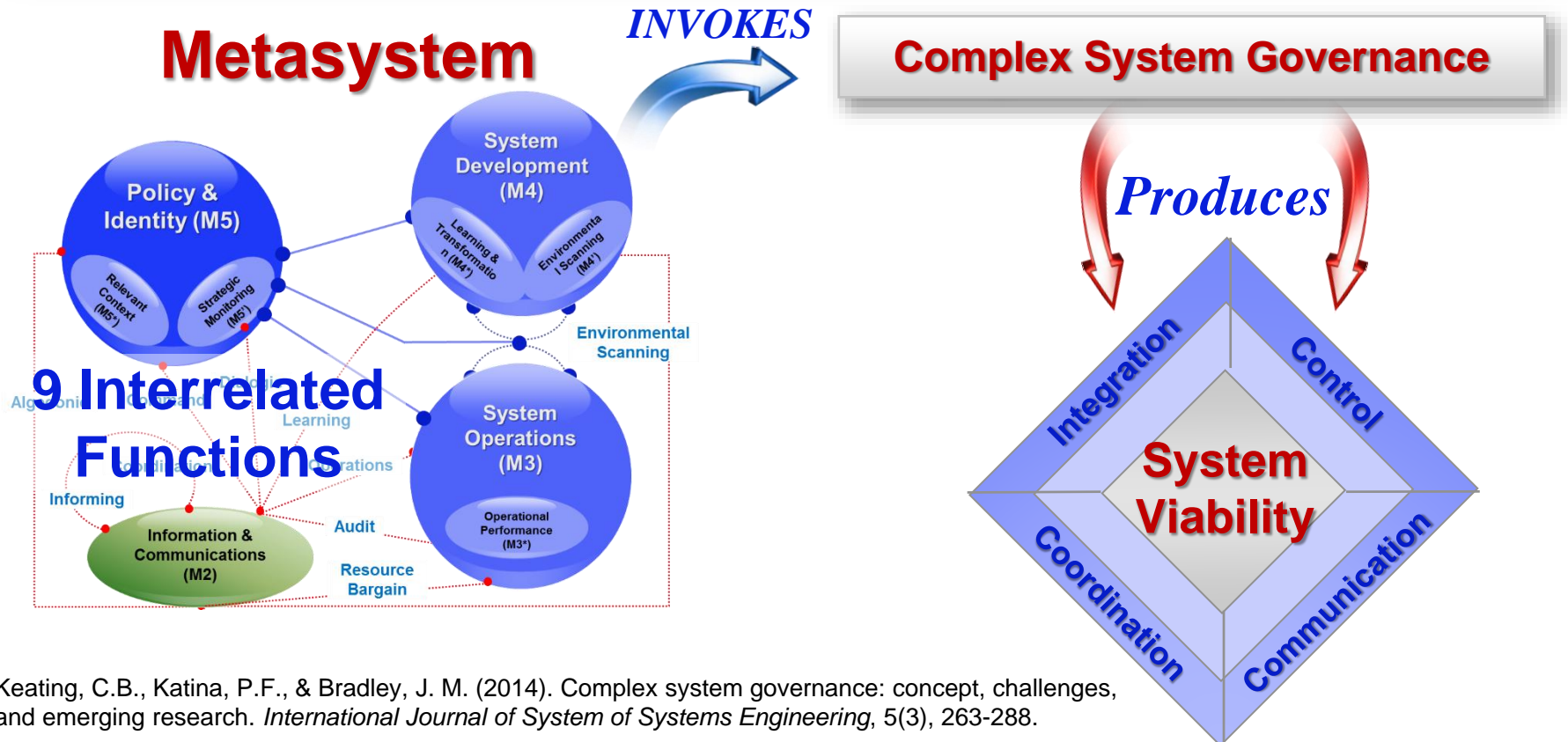


# CSG Grounding



# Complex System Governance & Pathologies

CSG is the design, execution, and evolution of the [nine] metasystem functions necessary to provide control, communication, coordination, and integration of a complex system  
(Keating, et al. 2014)



Keating, C.B., Katina, P.F., & Bradley, J. M. (2014). Complex system governance: concept, challenges, and emerging research. *International Journal of System of Systems Engineering*, 5(3), 263-288.



# Complex System Governance – in a nutshell of 5 fundamentals points



All systems are subject to the laws of systems



All systems perform essential governance functions that determine system performance.



Governance functions can experience pathologies in their performance.



Pathologies linked to ‘violation’ of one or more system principles



System performance can be enhanced through purposeful development of governance functions & addressing pathologies

## PATHOLOGY

“circumstance, condition, factor, or pattern that acts to limit system performance, or lessen system viability, such that the likelihood of a system achieving performance expectation is reduced”  
(Keating and Katina, 2012, p. 253)

## EXAMPLE

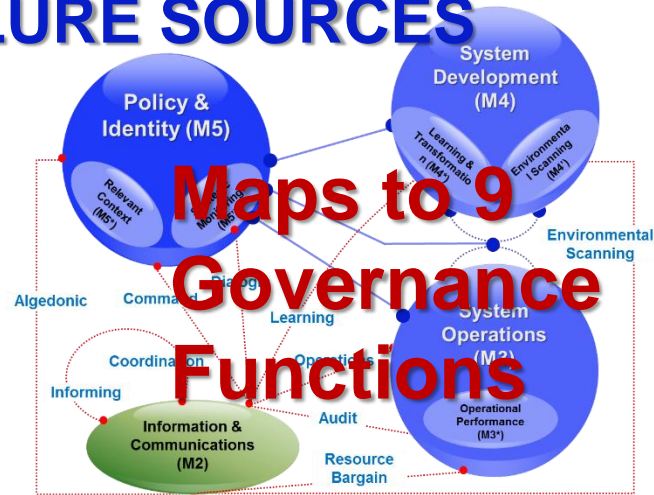
**M2.11. Introduction of uncoordinated system changes resulting in excessive oscillation.**

# OBSERVED FAILURE(s)



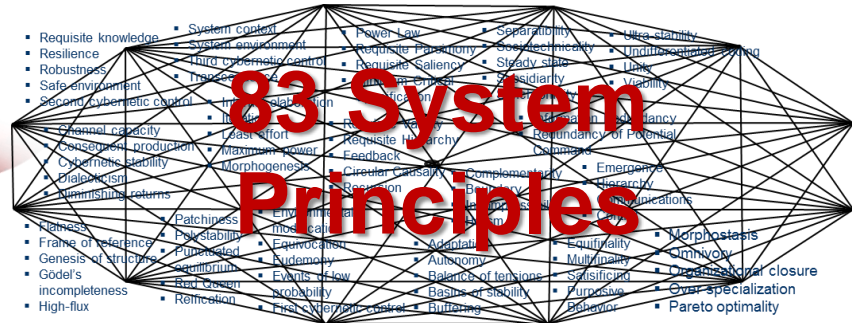
## UNOBSERVED FAILURE SOURCES

Same underlying system pathology appears as 'different' surface issues



|    |   |   |
|----|---|---|
| 36 | M3*1. Limited accessibility to data sources; to monitor performance.                                  | 3*1 We have access to sufficient information to monitor system performance. |
| 37 | M3*2. [SYSTEM OF INTEREST]-level operational performance indicators are absent.                       | 3*2 ...We have an effective set of operational performance indicators.      |
| 38 | M4.5. Strategic planning/thinking focuses on operations - limited time devoted to strategic analysis. | 4.4.2. The crises we encounter are for the most part inescapable.           |
| 39 | M4*1. Limited learning achieved related to operational level planning and improvement.                | 4.5 This is taken care of by 4.4.1 and 5.3                                  |
| 40 |   | 4*1 We effectively respond to shifts in the                                 |
| 41 |   |   |
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| 51 |   |   |

53 Complex System Pathologies

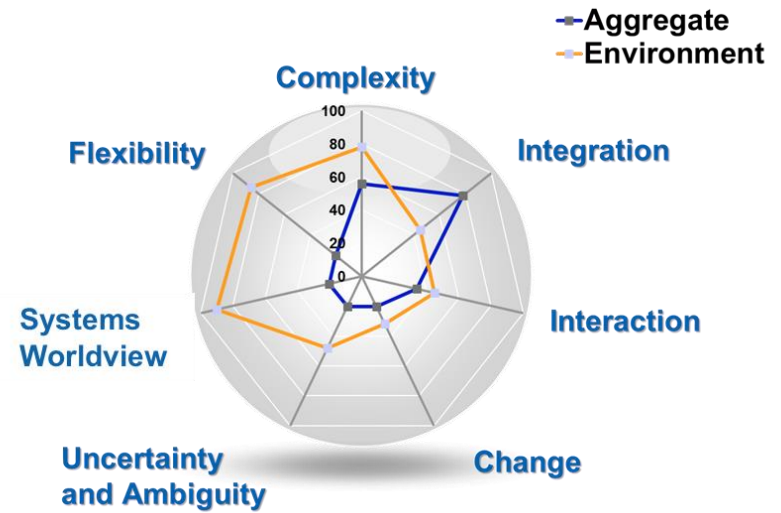


83 System Principles

# Results: What we have been able to do

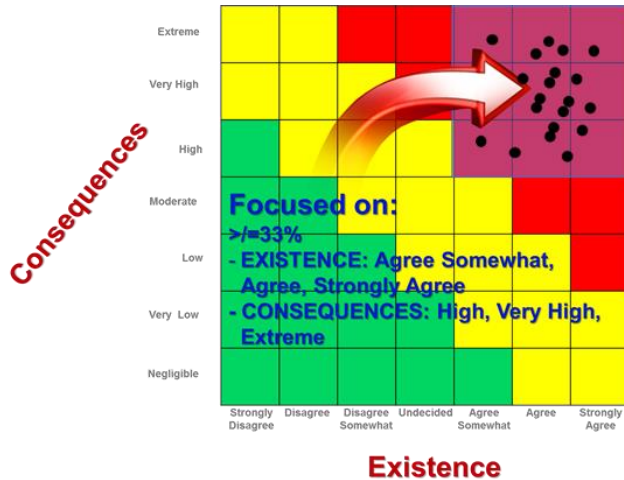
1

Identification of gaps between workforce systems thinking capacity and complexity demanded by the environment

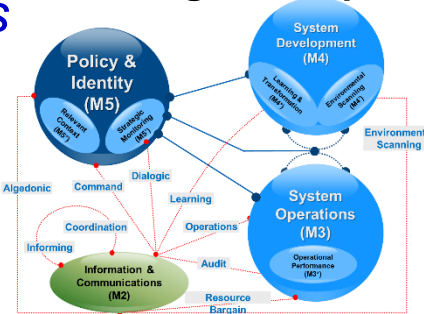


2

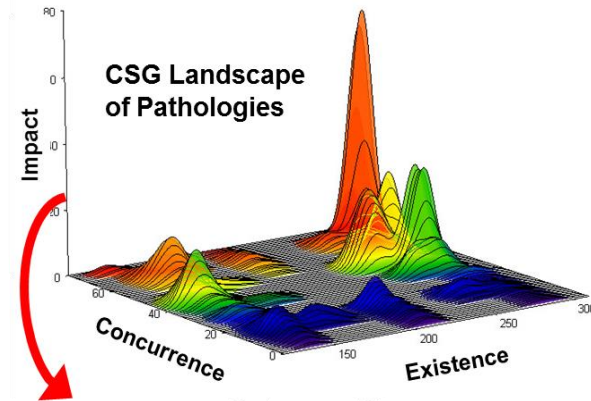
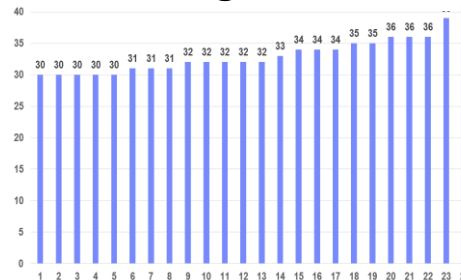
Identification, mapping, and prioritization of pathologies for CSG landscape



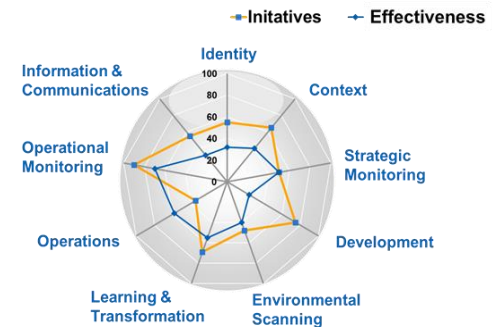
## Pathologies Mapped



## Pathologies Ranked



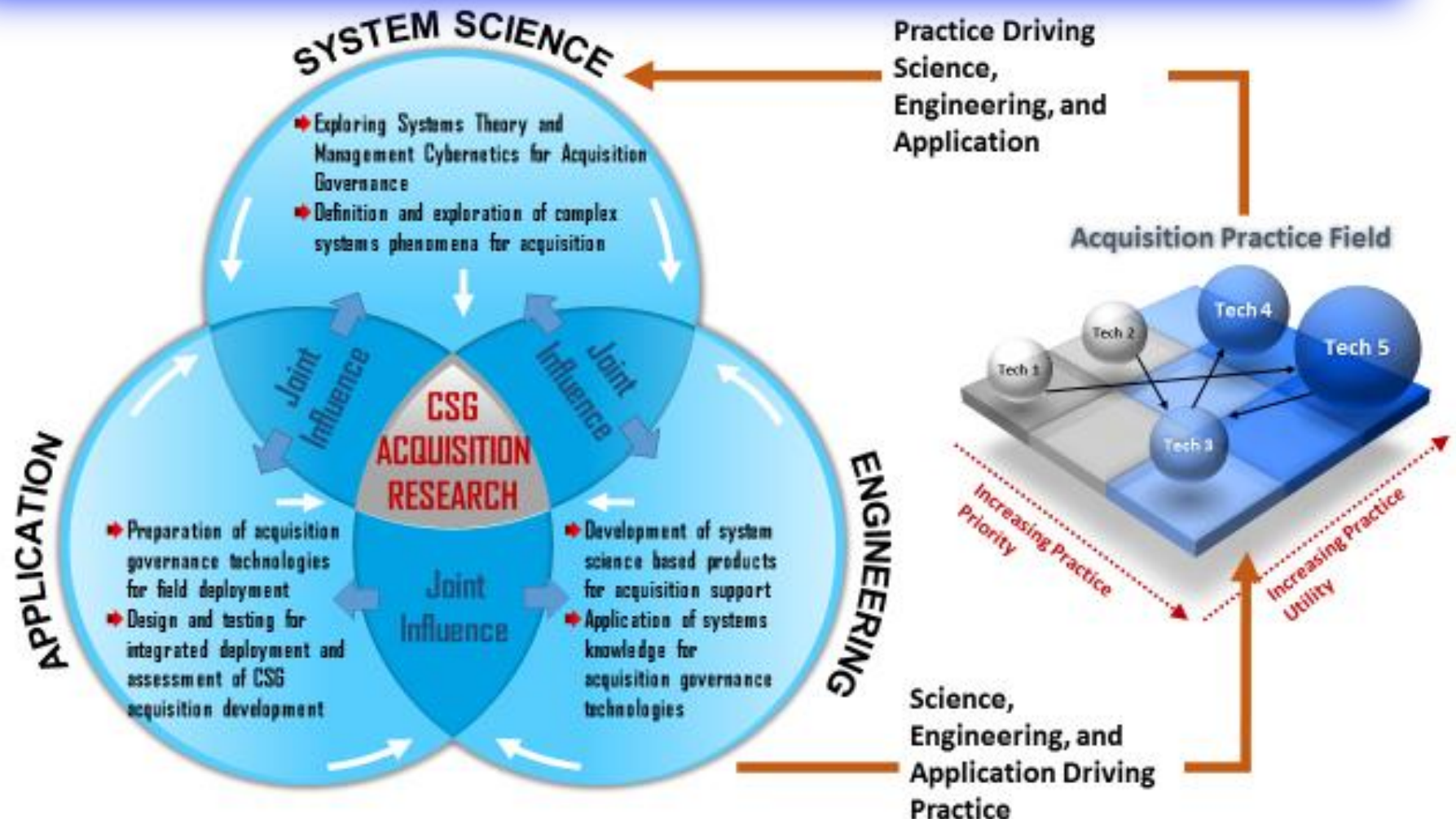
## Governance Check Aggregate Profile





# Research directions: Where we are going

‘The system-science based engineering of technologies to support application development that advances practices related to design, execution, and development of complex systems’.





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