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A case for using new Complex Systems Governance

Evaluating Australia's most complex system-of-systems, the future submarine

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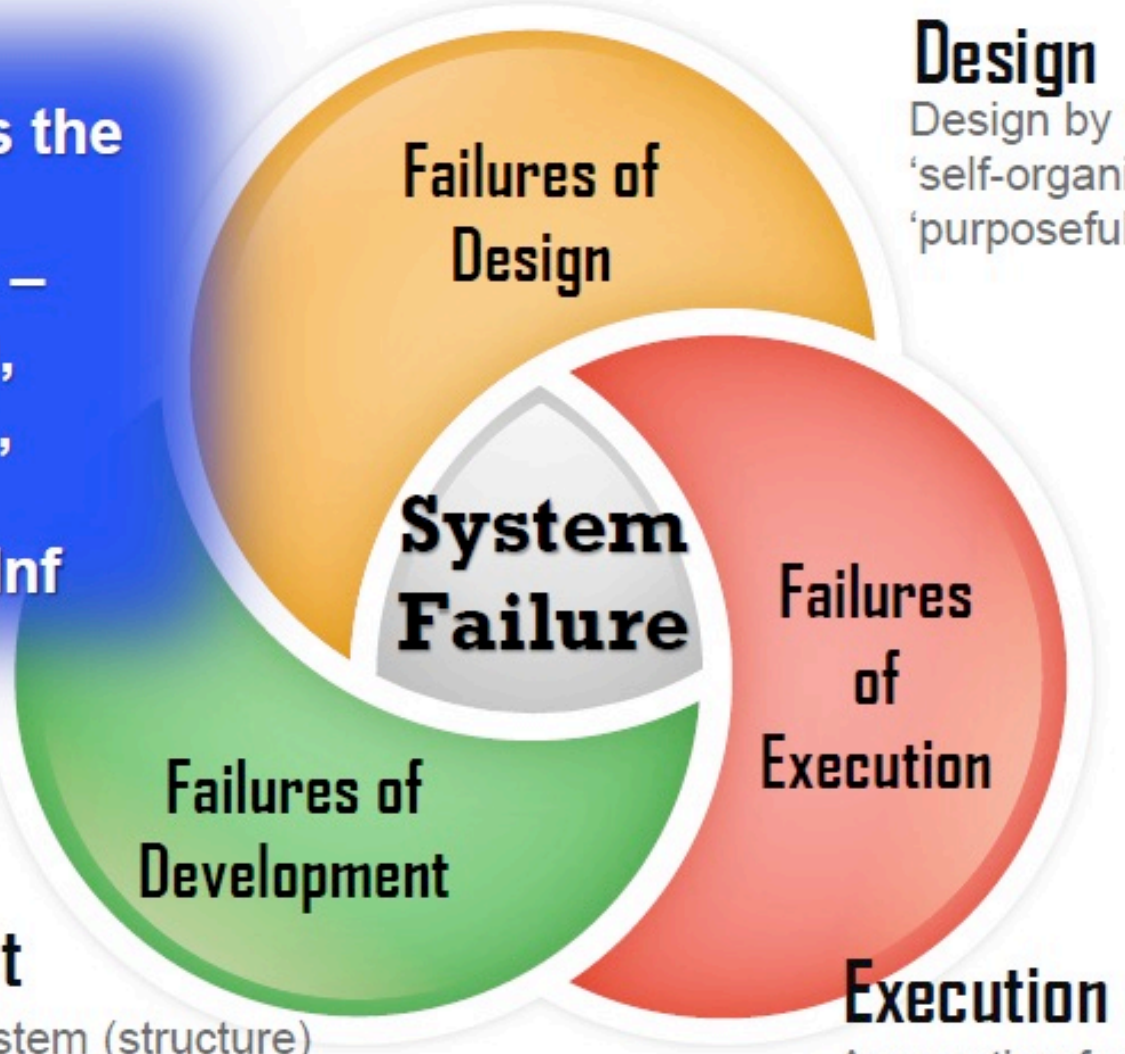
The world grows more complex

Our systems of systems grow more complex

Can cross the 'holistic' spectrum – Tech, Org, Mgt, Hum, Soc, Pol, Political, Inf



Design
Design by 'accretion', 'self-organization', or 'purposeful'

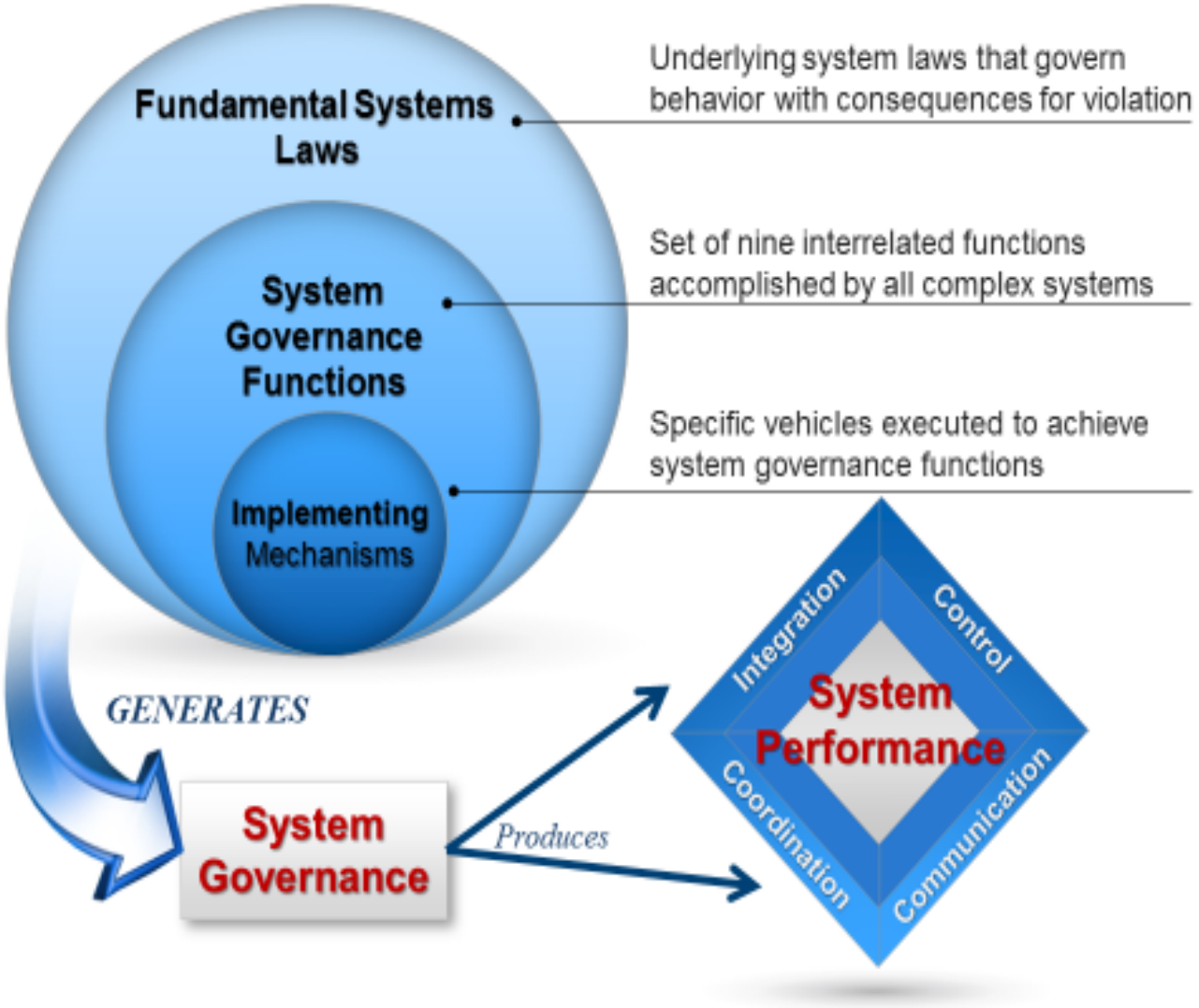
Development
Modifying the system (structure) to accommodate shifts in systems, context, or environment

Execution
Accounting for 'emergence' and 'increasing system knowledge incorporation'

Three areas we fail systems

Yet, successes do exist

- US Submarine Warfare Federated Tactical System
  - Evolutionary developed
  - Break from previous model
  - Active Governance system

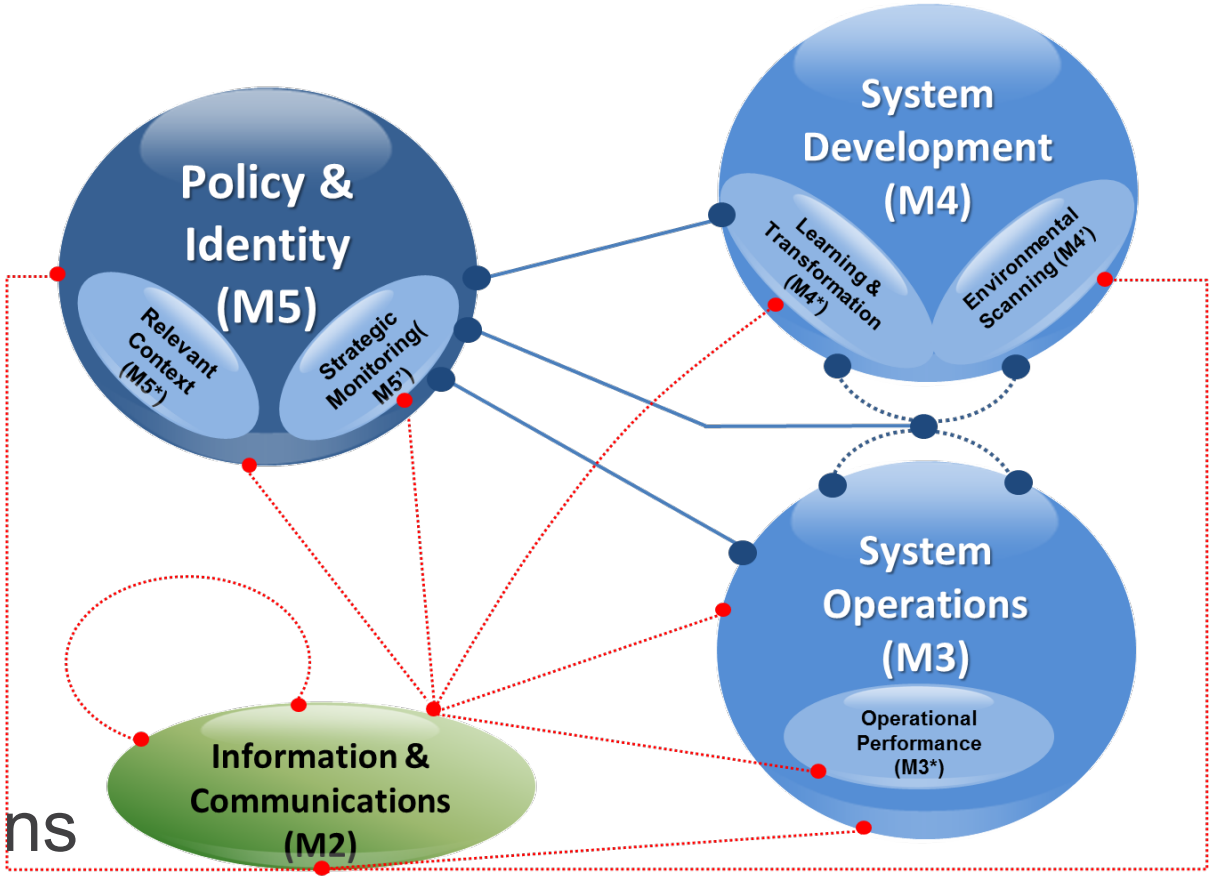


- *Control* establishes constraints necessary to ensure consistent performance and future trajectory.
- *Communications* provides for flow and processing of information necessary to support consistent decision, action, and interpretation throughout the system.
- *Coordination* provides for effective interaction to prevent unnecessary instabilities within and external to the system.
- *Integration* maintains system unity through common purpose, designed accountability, and maintenance of balance between system and constituent interests.

Complex System Governance

9 essential meta-functions

- (1) policy and identity,
- (2) system context,
- (3) strategic system monitoring,
- (4) system development,
- (5) environmental scanning,
- (6) learning and transformation,
- (7) system operations,
- (8) operational monitoring, and
- (9) information and communications



Four Tenets of CSG

- ***All systems are subject to the laws of systems.***
- ***All systems perform essential governance functions that determine system performance.***
- ***Violations of systems laws in performance of governance functions carry consequences.***
- ***System performance can be enhanced through development of governance functions.***

How and what must each meta-function perform? What must each deliver?

- CSG Reference Model
  - Common Grounding Reference Point
  - Set of Common Functions and Requirements
  - Multiple Utility serving researchers and practitioners
  - Foundation for Field Related Development

Collins Governance

- On Collins, public, Government & even some military confidence was lost in the turmoil of 1998-2002.
- Rush to build, four boats before first was properly evaluated
- Technical & operational problems could not be rectified or even evaluated properly in appropriate LBTS = problems at sea
- Pathways for correcting and evolving the design were not adequately anticipated & were therefore unconvincing for investors & management
- Remains a lack of the design-level capacity & T&E infrastructure to do the RDT&E necessary for:
  - obsolescence, l
  - evolve the submarine to meet new threats, or
  - be a viable alternative as the FSM.
- FSM needs to do better if Australia is to avoid importing another foreign design with another boom-bust cycle

Application to Future Submarine Program

- High-level aim for FSM:

  "*To maintain political, military and public trust that the FSM capability is continually evolving to meet the maritime threat with adequate efficiency*"

- FSM complexity thus comes from:
  - political,
  - cultural (French-U.S.-Australian),
  - evolving strategic threat,
  - extremely iterative new design,
  - cyber threats &
  - creating an evolutionary (RDT&E) design & build capability.

- Adjusting for inflation, FSM is three times the Snowy Mountains Hydroelectric Scheme
- Good governance is a structure that:
  - works to both advise Government & implement its goals
  - adroit to elections & contract milestones, but also focused on 30-year objective

A few vignettes

Industry cyber-security (2018)

- Australian industry being sounded for participation
- US cybersecurity specialists advise supply chain of critically-sovereign software-intensive componentry (i.e. nuclear, satellite, C4ISR etc) to be 5-eyes to meet threat 5-10 years hence
- After submissions, governance team recommends targeted cyber-resilient Australian industry be mandated as supply chain

Election (2019)

- Partisan differences emerge around production speed of 12 boats
- Public confusion about “rolling design & build” concept
- After review, governance team recommend non-political awareness campaign on 13th boat - an F-model
- Explains early lifing of systems due changing threats (esp. cyber)
- Includes hypothetical allied export sale of B-model to a SE-Asian nation

Harbour acceptance (2028)

- 5 LBTSs have representative mature system parts & initial software load on test
- If pass = final install in structural modules that are in first build in docks
- LBTS not meeting governance goal of 30% of LBTS time for future designs (boats 2-3).
- After submissions, governance team recommends boat 1 delay to balance LBTS use for long-term goal

First OT&E (2033)

- Boat 1 in 2nd year OT&E, boats 2-3 in build
- LBTS under-utilized (75%) due no funding release on block of boats 4-6
- After review, governance team recommends funding release for LBTS capacity to focus on:
- (1) generic weight, space and power reduction activities to recover margins eroded in boats 1-3
- (2) counter-measure efficacy & capacity work to address deficiencies found in the ultra DWTR & SWTR

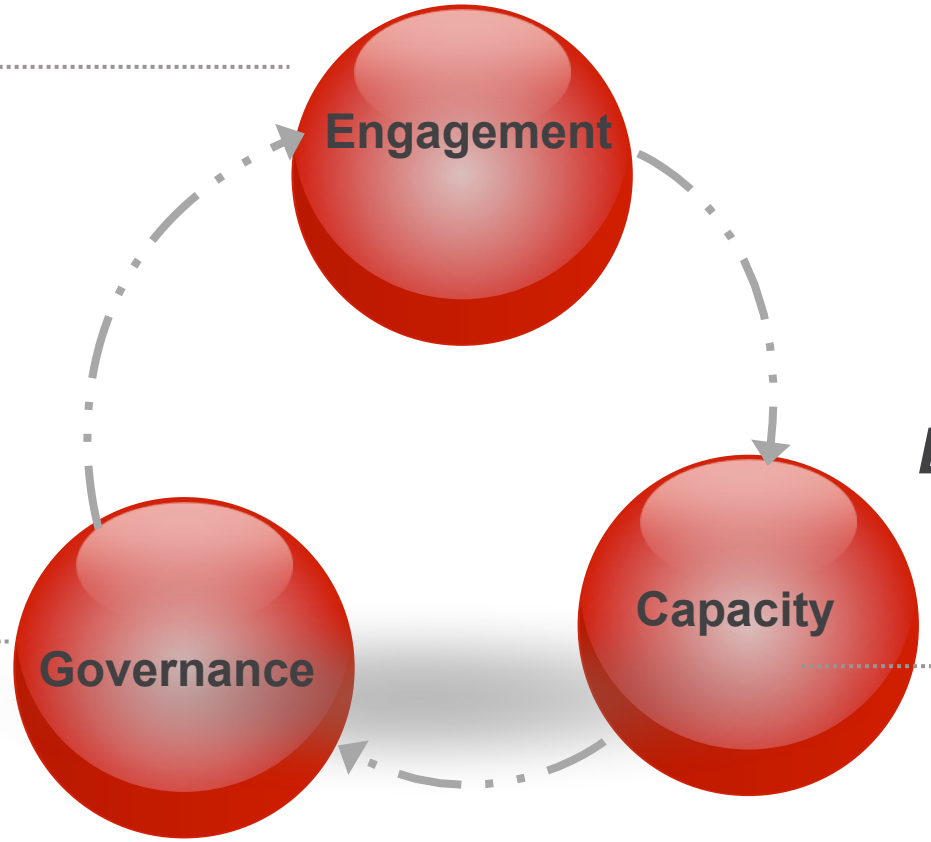
CSG Entry & Diagnosis

- Entry level survey measures actual current governance versus preferred or needed governance
- Looks at mismatch on 9 dimensions
- Survey is from the team, for the complexity they are working in
- Hence tailored governance, not utopian or over-governance

Three Questions to Answer?

What development strategy and priorities can feasibly be engaged for purposeful CSG evolution?

How the system governance is currently designed and executed?



Does the organization have the capacity to deal with the level of complexity in the subject environment?

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