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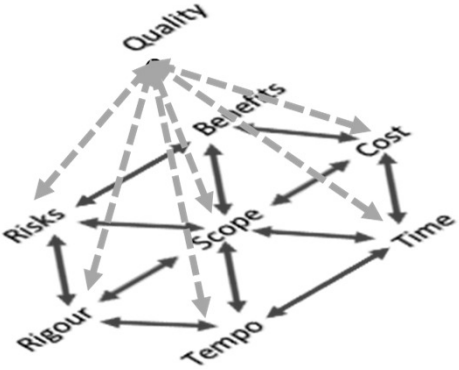
Solving tensions of overlapping PM & SE with elegance of complex systems governance approach

Dr Rani Yesudas & Dr Keith Joiner

Never Stand Still | UNSW Cyber & Capability Systems Centre



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Reviews | Overlay Efforts | Agility Drivers | Fusing Governance | Pathological Adoption | Conclusions

- *"strong incentives & weak disincentives for cost underestimation and thus for cost overrun may have taught project promoters what there is to learn, namely that **cost underestimation and overrun pay off**. If this is the case, cost overrun must be expected & it must be expected to be **intentional**."*

- *Cost underestimation & overrun have not decreased over the past seventy years. No learning seems to take place; cost underestimation & overrun cannot be explained by error and seem to be best explained by strategic misrepresentation, namely **lying**, with a view to getting projects started."*

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2003 Bent Flyvbjerg, Megaprojects & Risk

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"Witnesses have presented numerous cases whereby the expectation that a procurement activity is OTS (off the shelf) has led Defence to believe that a product is more mature or an outcome more predictable than experience (or an experienced review) would indicate. The ***conspiracy of optimism****, referred to by a number of witnesses, appears to have led Defence to undervalue the role that* ***developmental test & evaluation can play in the early stages of the acquisition cycle to identify & analyse risk in a quantifiable & defensible manner****…The committee notes that this conspiracy of optimism may have tended to crowd out or* ***ignore dissenting voices*** *that could alert Defence to the true extent of capability, technology, integration and certification (hence cost & schedule) risk represented by a proposed project"*

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- *risk…inadequately described during the capability definition & planning phase…*
- *risk identified by domain or subject matter experts but downplayed, misinterpreted, or* ***ignored*** *by more senior non-experts…*
- *failure to appreciate the challenge of being a customer of a first-of-type program;*
- *under-estimation or understatement of the level of technical maturity with programs proceeding without the requisite level of knowledge – numerous examples where developmental projects were deemed incorrectly to be MOTS;….*
- *Under-estimation of complexity of integration;*
- *Inadequate specifications;…*
- *Poor understanding of overseas certification standards & Australia's requirements;…*
- *Inadequate planning of testing & acceptance;…*
- *Inadequate testing of contractors' claims with a "****shallow****" understanding of industry's capacity to deliver"*

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Series of Government Policy implementation disasters where Royal Commissions found:

- *… program design and implementation compromised by … failing to provide robust advice*
- *… did not draw sufficiently on external views and expertise*
- *… unable to exert influence through its advice to ministers*
- *… failure to provide sufficiently frank and forthright advice to ministers on important elements of policy design and risk*
- *… significant gap between the inadequate levels of candour displayed in written advice and that reportedly conveyed in oral briefing*
- *… failed to keep detailed records of key decisions and how they were arrived at*

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Conclusions

- *F.23 The default position that new policies proceed straight to large-scale roll-out should be reversed & instead new policy proposals should include a trial or demonstration stage, allowing new approaches to be developed fast & **evaluated early**.*
- *F.24 Staged decision-making for large projects should incorporate the allocation of **seed funding to agencies to develop a business case & proof-of-concept**, which can be tested before the project moves to a further stage.*

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In scoping projects, questions usually

answered well *vs* ***poorly***

- *What equipment do I have to buy?*
- *Who sells such equipment?*
- *What do I have to build?*
- *When do I want the equipment?*
- *What will it cost me to buy/build?*
- *What are the risks to success?*
- *Who are the stakeholders?*
- *Who pays & when?*
- *What written plans are needed?*

- *What does success look like for each stakeholder?*
- *What are the critical operational issues (benefits to be realised)?*
- *What are the measures of effectiveness?*
- *What are the practical activities to de-risk the project early?*
- *Can this be trialled?*

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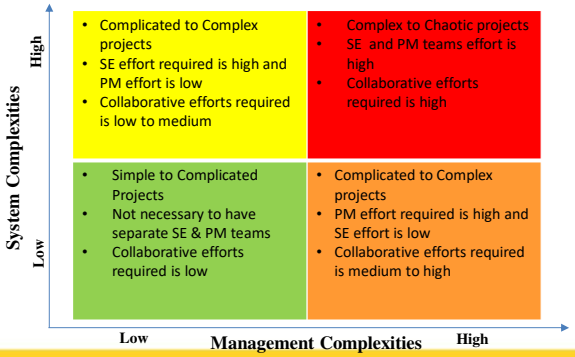
Complexity Categories

- **Management Complexities** Requires Efficient Management Capabilities (Project/ Product/ Portfolio)
- **System Complexities** Requires Efficient Systems Engineering Capabilities



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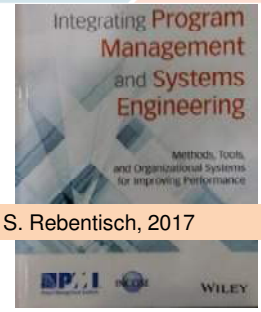
- PMs focus on cost & schedule
- SEs focus on capability & rigour
- Add preconceptions and mis-communications
- overlaps or gaps in responsibilities
- over-elaboration in requirement setting
- over-elaboration in project planning
- lack of mutual understanding and respect



E. S. Rebentisch, 2017

- Process issues are exacerbated by the 'tension fields' in project environments
- Both SE & PM practitioners must recognise and understand how their perspectives and actions both affect, & are affected by, these tensions.

Gray, et al., 2017, "Foundations for improved integration …", INCOSE Conference, Adelaide

Xue, 2016, "Improving Cooperation between SE & PM in …," Dissertation

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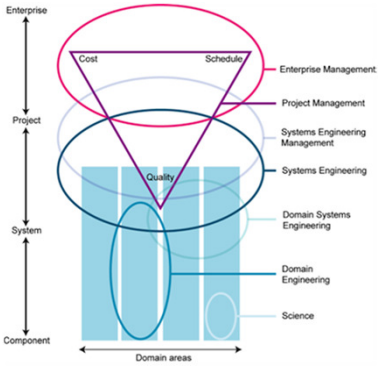

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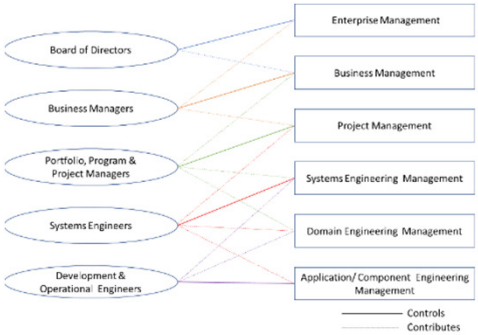

1. UCL, 'Defining Systems Engineering' https://www.ucl.ac.uk/systems-engineering/research/defining-systems-engineering

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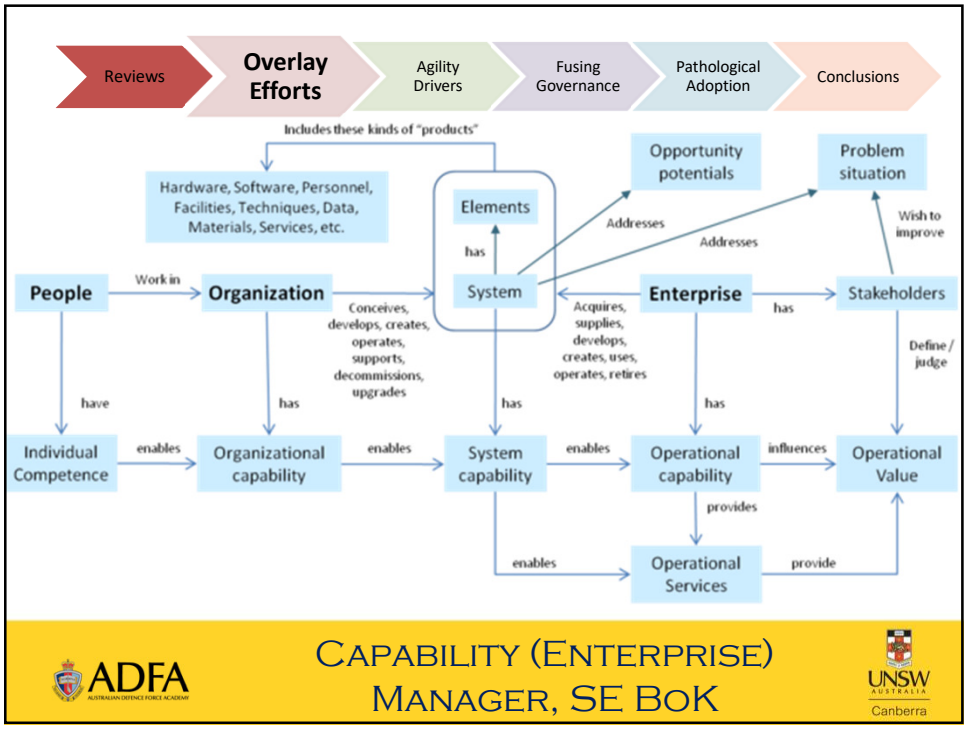
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Includes these kinds of "products"
Hardware, Software, Personnel, Facilities, Techniques, Data, Materials, Services, etc.
Elements
has
Opportunity potentials
Problem situation
Addresses
Addresses
Wish to improve
People
Work in
Organization
System
Enterprise
has
Stakeholders
Conceives, develops, creates, operates, supports, decommissions, upgrades
Acquires, supplies, develops, creates, uses, operates, retires
Define / judge
have
has
has
has
Individual Competence
enables
Organizational capability
enables
System capability
enables
Operational capability
influences
Operational Value
provides
enables
Operational Services
provide
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CAPABILITY (ENTERPRISE) MANAGER, SE BOK
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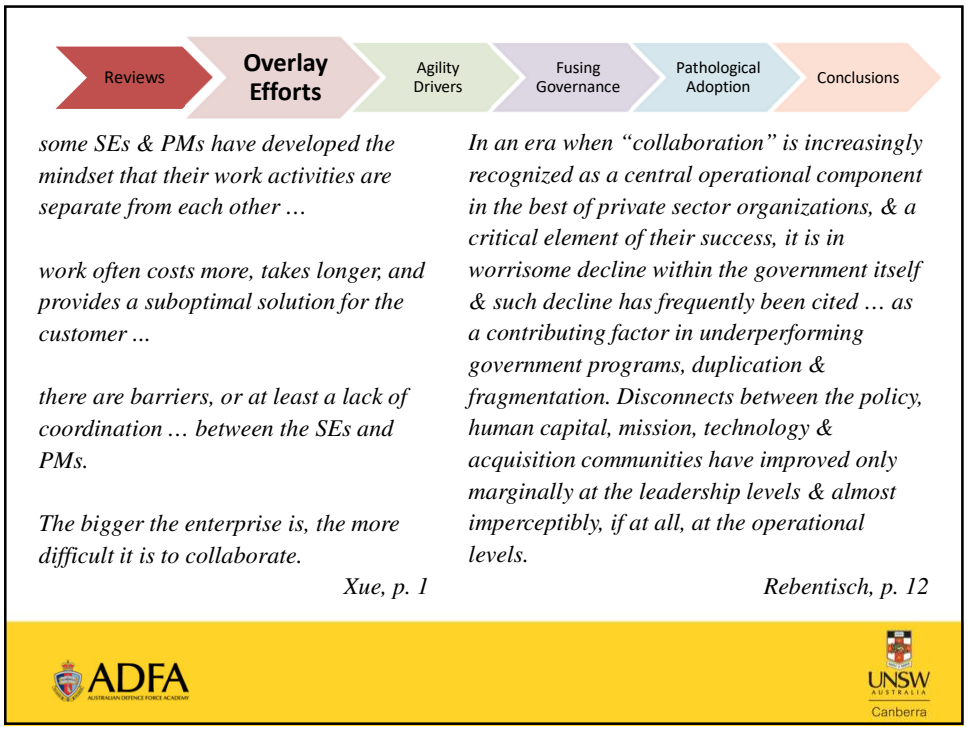
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some SEs & PMs have developed the mindset that their work activities are separate from each other …
work often costs more, takes longer, and provides a suboptimal solution for the customer …
there are barriers, or at least a lack of coordination … between the SEs and PMs.
The bigger the enterprise is, the more difficult it is to collaborate.
Xue, p. 1
In an era when "collaboration" is increasingly recognized as a central operational component in the best of private sector organizations, & a critical element of their success, it is in worrisome decline within the government itself & such decline has frequently been cited … as a contributing factor in underperforming government programs, duplication & fragmentation. Disconnects between the policy, human capital, mission, technology & acquisition communities have improved only marginally at the leadership levels & almost imperceptibly, if at all, at the operational levels.
Rebentisch, p. 12
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- Xue finds SE standard has a tendency towards progressive processes whereas the project management standard tends towards addressing processes in parallel: complex systems obviously require iterative & adaptive processes.
- *"The group of programs with greater integration is significantly more likely than programs with lesser integration to have better performance in schedule and budget performance, as well as client requirements and satisfaction,"* with orders of difference between 14 & 21% [Rebentisch, p. 245-246].

Integration factors that correlated significantly with higher success were:

- *"rapid and effective decision-making"*
- *"effective collaborative work' &*
- *"effective information sharing"*

Sources of unproductive tension were:

- *"lack of integrated planning"*
- *"authority not clearly defined"*
- *"conflicting practices"*
- *"job positions not clearly defined"*
- *"unclear expectations from executive sponsor"*
- *"authority not clearly understood"*

Rebentisch

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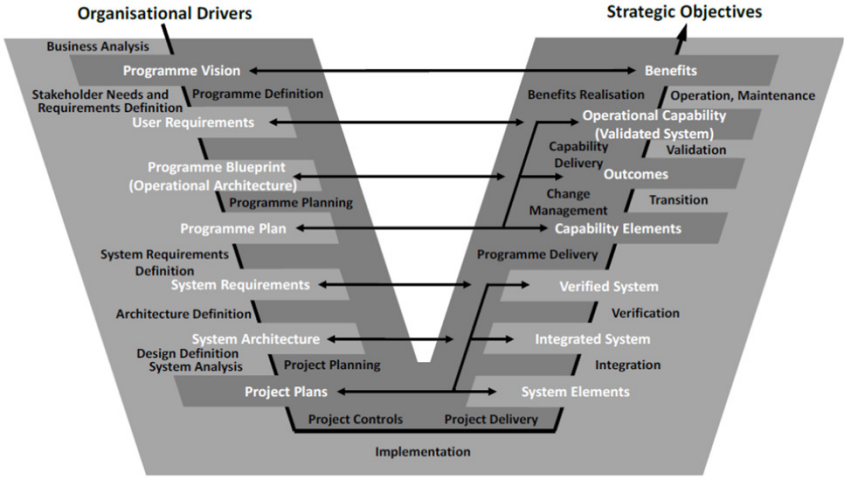
- Gray et al. (2017) developed a highly promising '*combined Vee-model which highlights areas of overlap* [between SE & PM] *& where the two views complement or enhance each other ('touch points').*'.



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Gray et al. (2017) recommends 11 fusion points for integrating SE & PM:

- Employing SE techniques in project product-based planning
- Adopting a system-of-systems approach to programme definition and management
- Utilising architectural modelling in defining programmes and projects
- Verification and validation in benefits management
- Identifying and managing project-to-project interdependencies
- Applying soft systems methods to stakeholder management
- Using SE to improve the governance of complex projects
- Requirements definitions in contract management
- Transition definition and management
- Managing change across the supply chain-based product delivery system
- Integrating review gates throughout project delivery phases

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Summary is anything to promote:
- Teaming
- Collaboration
- Communication
- Alignment

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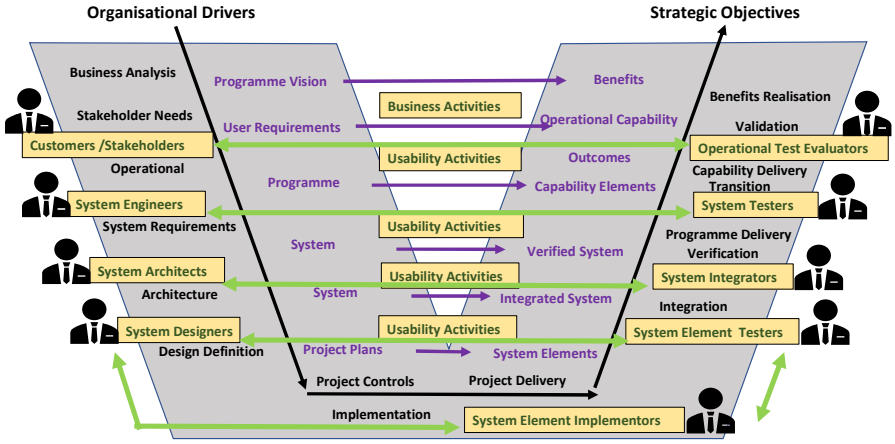

Illustration of PM & SE integration using Vee Model & usability activities to reinforce key communications (adapted from Gray et al. (2017), Hoehne (2017) & Joiner et al. (2018))

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Summary is anything to promote:
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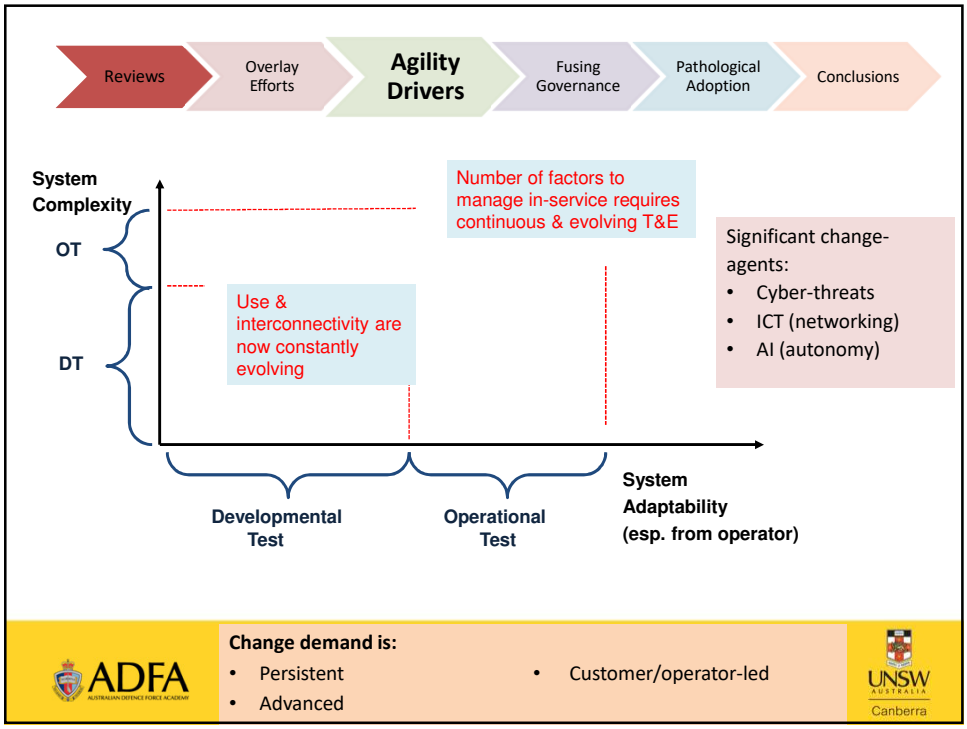
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System Complexity
OT
DT
Number of factors to manage in-service requires continuous & evolving T&E
Use & interconnectivity are now constantly evolving
Significant change-agents:
• Cyber-threats
• ICT (networking)
• AI (autonomy)
Developmental Test
Operational Test
System Adaptability (esp. from operator)
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Change demand is:
• Persistent
• Advanced
• Customer/operator-led
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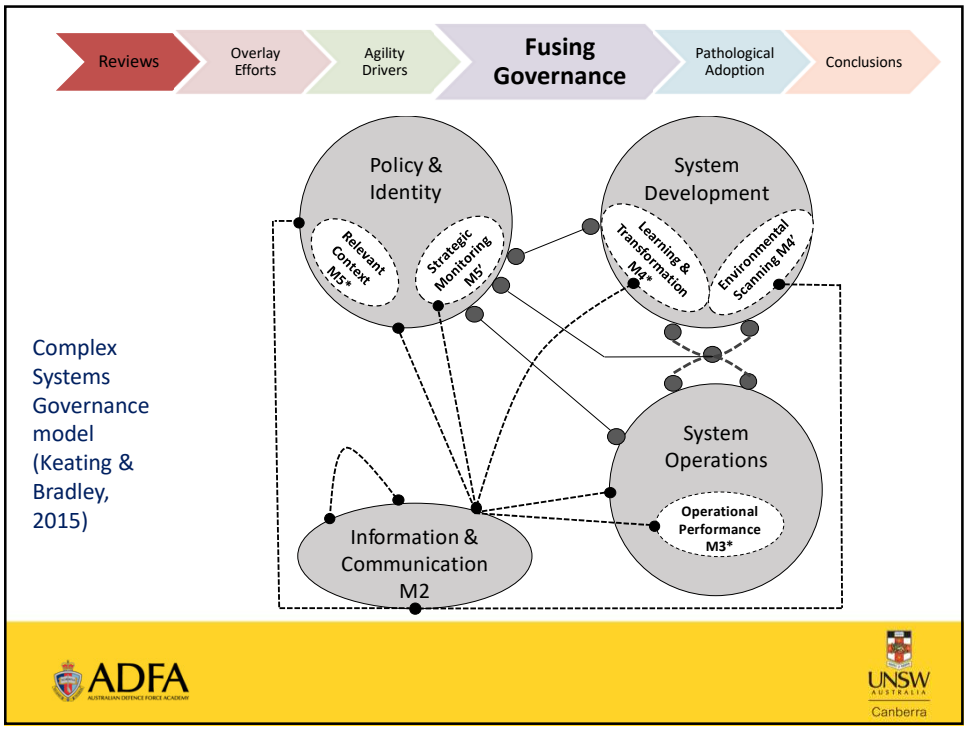
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Complex Systems Governance model (Keating & Bradley, 2015)
Policy & Identity
Relevant Context M5*
Strategic Monitoring M5
System Development
Learning & Transformation M4*
Environmental Scanning M4*
System Operations
Operational Performance M3*
Information & Communication M2
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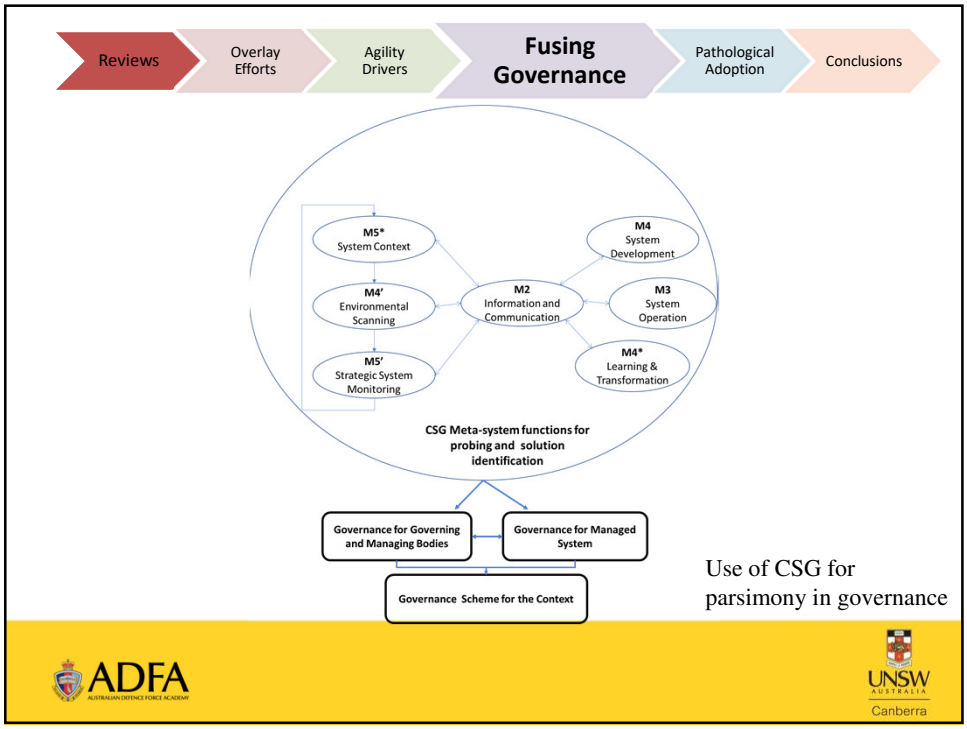
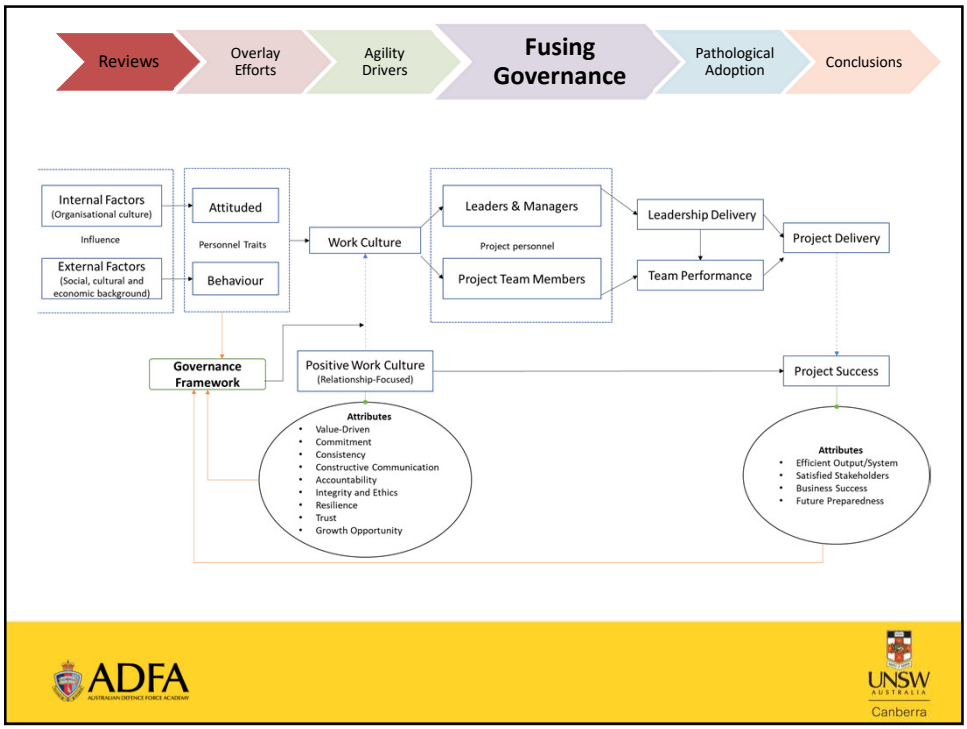


Use of CSG for parsimony in governance



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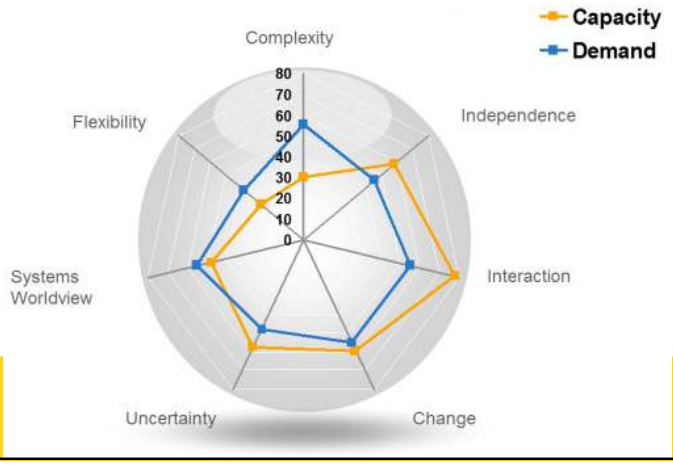
An associated pathological approach has been developed for CSG implementation that provides an accretional path of least resistance for the greatest benefits, in part, leveraging survey of the milieu inhabitants of capability governance irrespective of their discipline (Keating et al., 2019)



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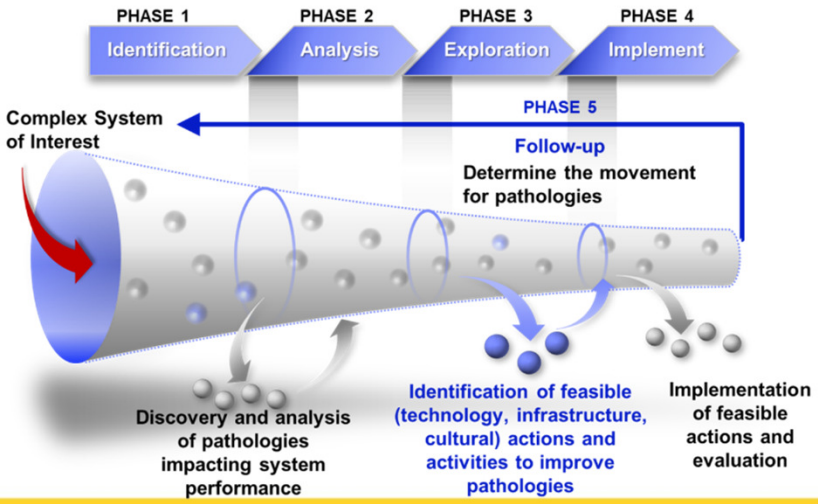

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Real difficulties in PM & SE from:

- Project scoping over-optimism,
- Illusion of off-the-shelf vice mixed-maturity
- Constant change agents of cyber-threats, ICT, user adaptation & now AI
- Lack of infrastructure & processes to evolve (insufficient agility)
- Stove-piped PM & SE governance & structure causing tensions & inefficiency

Current overlays focus on anything to create:

- Teaming
- Collaboration (Communication)
- Alignment
- Early preview or trial risk-discovery
- Rejuvenated focus on usability & iteration

Efficient governance structure needed based on organismic (evolutionary) approach:

- Policy & Identity
- System Development
- System Operations
- Communications fusing these three

Pathological CSG approach offers change that is:

- Inhabitant-led
- Focused on greatest need
- Discerns efficient trade-off
- Accretional improvement
- Efficient
- Evolutionary

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Thank You

Questions & Comments

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