Advancing **System of Systems Dynamics (SoSD)** in the **Cyber Intelligence (CYBINT)** domain

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Introduction #1

- Offer response to contemporary **CYBINT challenge(s)**
- Further develop **frameworks + related concepts** = for advancing **System of Systems Dynamics (SoSD)** in Cyber Intelligence (CYBINT) domain in **globalised circs**.
- Build on **'System of Systems Analysis' (SoSA)** approaches >>> offer a **joined-up comprehensive systems-based approach**
- Help subsequent **'System of Systems Engineering' - (SoSE)** efforts - i.e. 'mission accomplishment' thru transforming devs + to better capture enterprise-relevant characteristics, notably the **SoSD** involved.
- Aim = for realising greater **contextualisation potential** relating to CYBINT missions + in closely assoc. areas beyond.

Introduction #2

- Throughout **maintain focus** on:

  ➡ **sustained delivery of intelligence reqs of '3Rs'** = *'getting the **right intelligence/information**, to the **right person/people**, at the **right time**'* +

  ➡ Continuing to **simultaneously better meet + consistently sustain over time in cyber enterprises** >>> all of highly-pressing customer/end-user intelligence delivery criteria of **'STARC'** = *'Specificity, Timeliness, Accuracy, Relevance and Clarity'*

- **Esp. pressing reqs** to realise during **contemporary 'Big Data' + 'Cyber' age** - esp. where areas, e.g. **'attribution' in cyber contexts = remain difficult**.

Introduction #3

- **Conclusions = designed to offer overall suggestions** >>> potential viable utility in CYBINT work - however precisely configured/ calibrated/scaled (spatially/temporally).

- Esp. while **wide-range of practitioners** strive to navigate several **multi-functional operations (MFOs)** ranging from 'war' to 'peace' + **cover full-spectrum of diverse concerns**, e.g.:

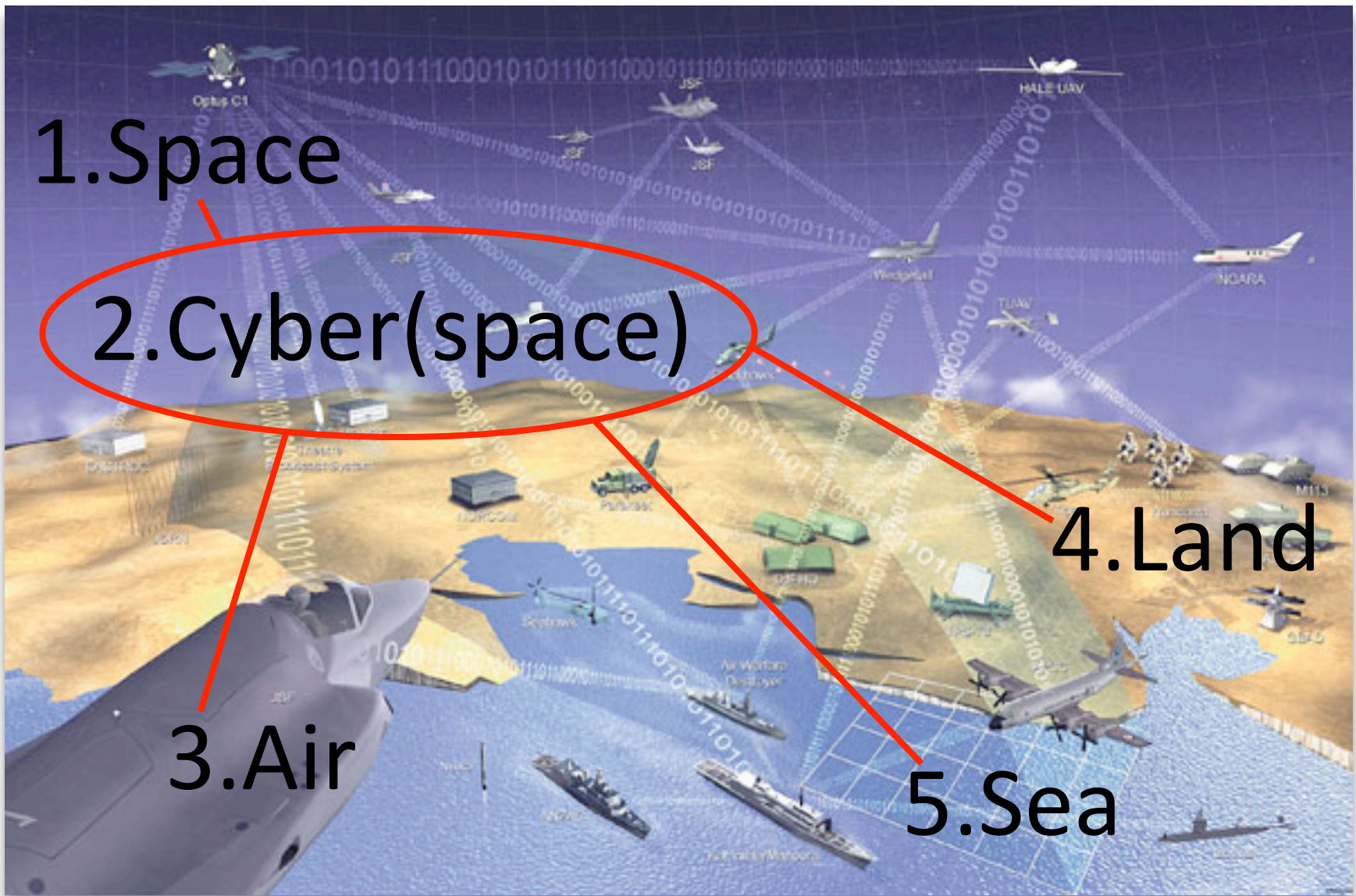
  ➡ crisis management, peacekeeping and humanitarian operations, counter-insurgency (COIN), counter-terrorism (CT), counter-proliferation, and the countering of transnational organised crimes, etc.

- Simult. as all above MFOs = occurring in **both virtual (cyber) + physical (sea, air, land, space) domains** during **overall era of globalised strategic risk (GSR)** + unfolding in **'complex co-existence plurality' (CCP) environments**.

- Ultimately, a **constant feedback process of *'context appreciation'* + *'solution fashioning'*** = important.

Current positions #1

5x domains of activity, with cyber(space) linking:



Source: http://www.defence.gov.au/news/raafnews/editions/4802/images/10-P12-Main-graphic.jpg

Current positions #2

- **Recap/summary:** Currently **use/rely on SoSA** approaches, breaking-down 'problems' in op. spaces into readily graspable different dimensions of, e.g.:
  - **'PMESII'** ('Political, Military, Economic, Social, Informational and Infrastructural'), e.g. used by NATO;
  - **'PESTLE'** (Political, Economic, Sociological/Social, Technological/Technology, Legal/Legislative, Environmental), e.g. used by EUROPOL;
  - **'DIME'** (Diplomatic, Information, Military, Economic);
  - **'HSCB'** (Human, Social, Cultural, Behavioural), e.g. as both used by US Military;
  - **'STEEP(L)'** (Social, Technology, Economic, Environmental, Political, [Legal]), e.g. as used in commercial/business intelligence contexts, etc.
- \+ rather than **subsumed singly *within one*** of these categories >>> CYBINT domain **involves *all* different dimensions collectively + needs to** for best capture + tackling of problems, challenges, etc.

Current positions #3

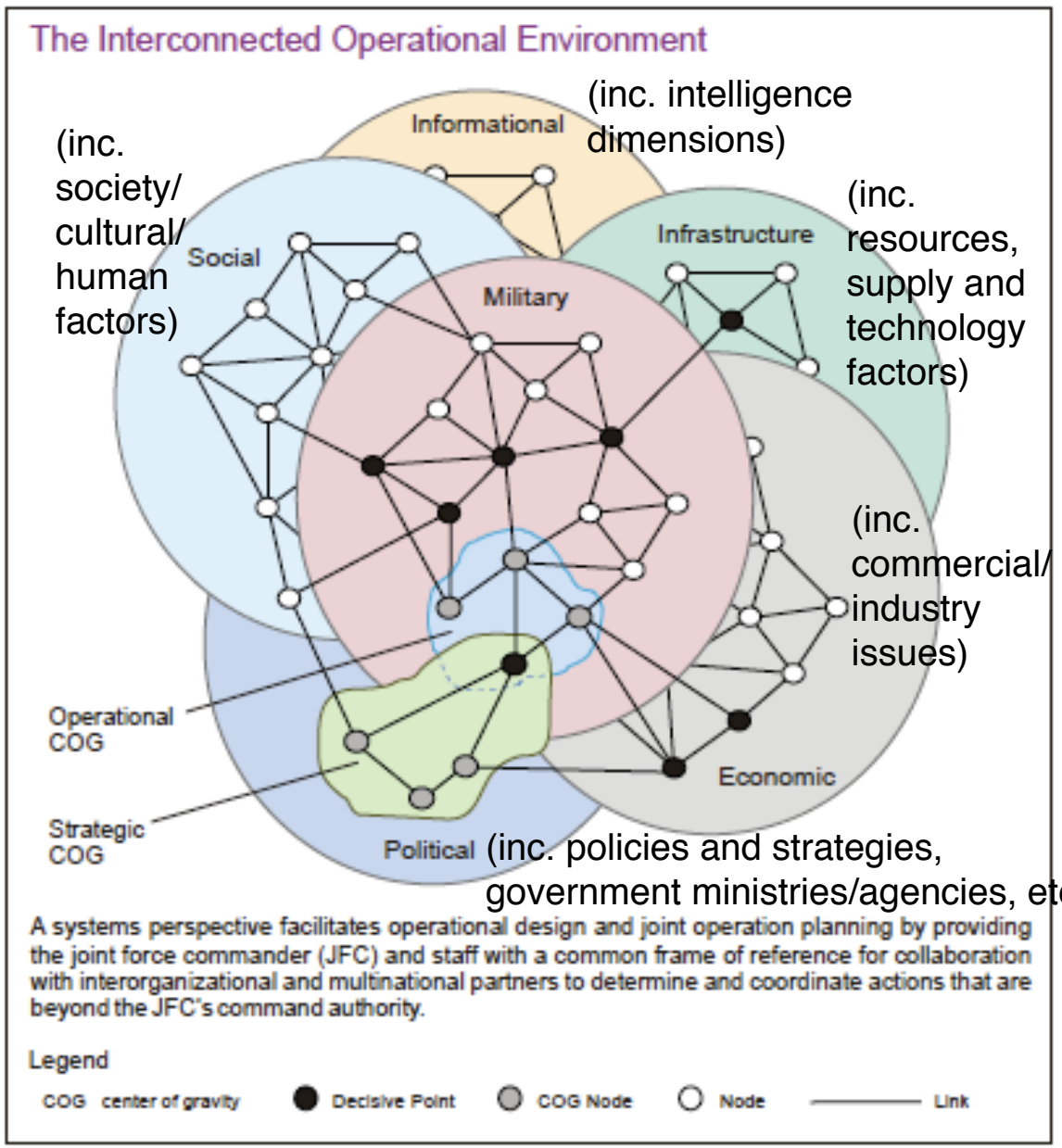


Figure IV-2. The Interconnected Operational Environment

Depiction of System of Systems Analysis (SoSA) - *figure IV-2* from US Joint Chiefs of Staff, *J-P 3.0* (Aug. 2011), p.IV-5 *(my additions)*

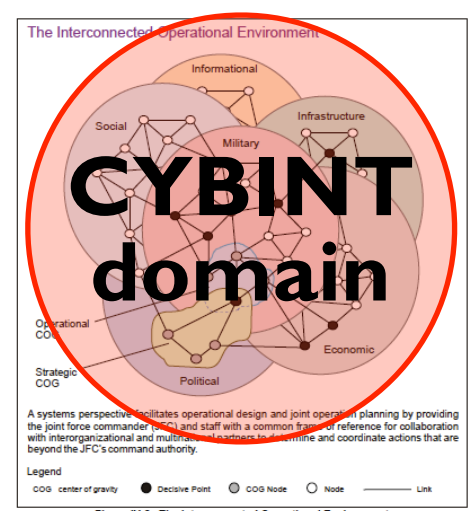


Figure IV-2. The Interconnected Operational Environment

Pathways forward #1

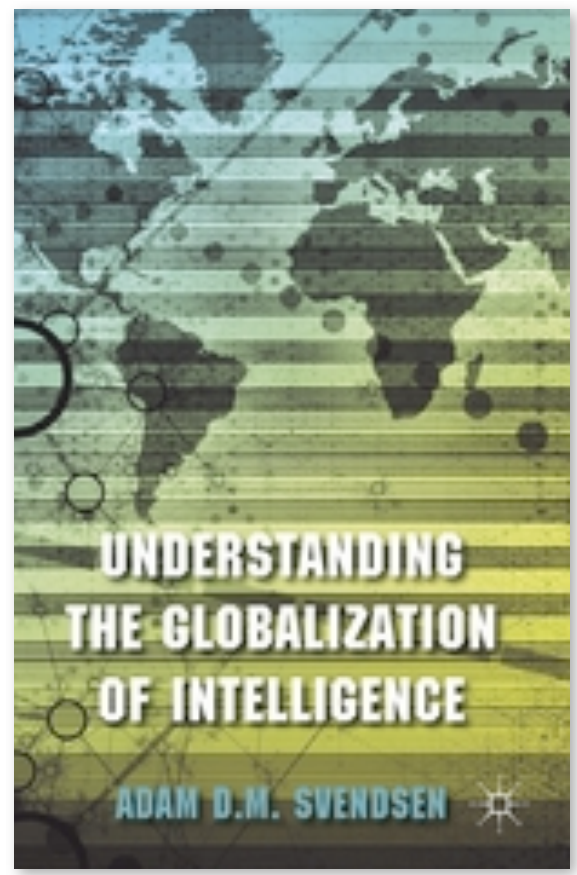
- **Found: SoSA approaches *alone* = not adequate**
- Many different approaches = instead proposed.
- Most viable = **Build on SoSA** approaches + ***better harness* SoSE** approaches in CYBINT domain.
  - e.g. Use **'target-centric' intelligence analysis** approach - cf. Robert M. Clark
  - Got to **keep qualitative + 'human factors'** well inside the overall CYBINT loop.
- Advance **interconnected, joined-up 'systemic' model** = helpful for subsequent **SoSE** + synthesis + sense-making efforts.
- Namely, advance a ***'SoSA+SoSE'* (SoSD) approach**

Pathways forward #2

- That last **SoSD model** inc. covering **8x systemic attributes or variables**:

CHECKLIST

1. internal influences/factors;
2. rationale;
3. types + forms;
4. conditions + terms;
5. trends;
6. functions;
7. external influences/factors; +
8. effects + outcomes.



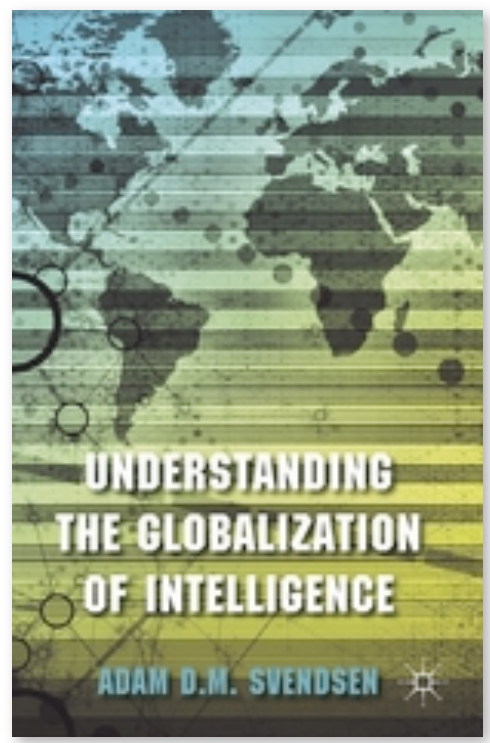
- (cf. A.D.M. Svendsen (2012), *Understanding the Globalization of Intelligence*, pp.99-107)

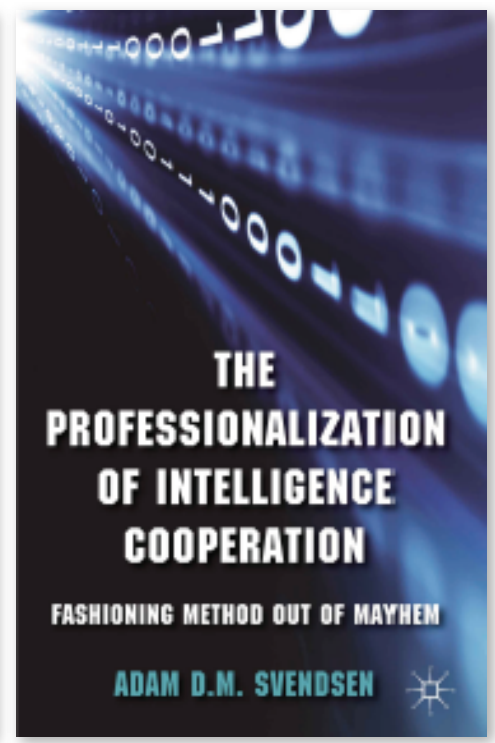
Pathways forward #3

- + inc. covering **8x levels of (inter-)activity/implementation**:

CHECKLIST

1. Ideological
2. Theoretical
3. Strategic
4. Policy
5. Operational
6. Tactical
7. Individual (as 'professional')
8. Personal





- + ack. **'Reach' concepts >>> 'under-reach' + 'over-reach'**
- Need realise **'optimised reach balance(s)'** in CYBINT enterprises

(cf. A.D.M. Svendsen (2012), *Understanding the Globalization of Intelligence*, e.g. p.12, etc. + A.D.M. Svendsen (2012), *The Professionalization of Intelligence Cooperation*.)

Pathways forward #4

Figure 3.2
Geospatially Oriented Aspects of the Information Domain of the Operating Environment

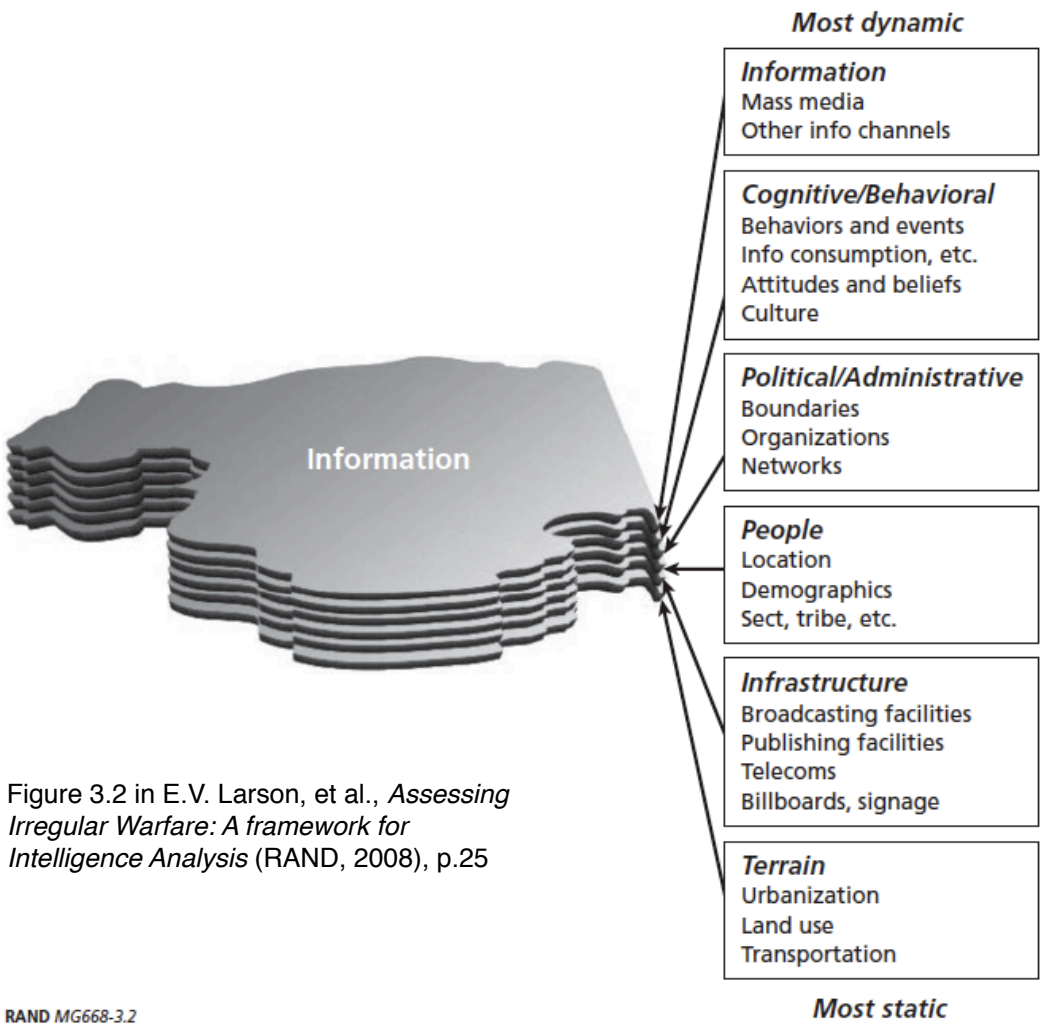


Figure 3.2 in E.V. Larson, et al., *Assessing Irregular Warfare: A framework for Intelligence Analysis* (RAND, 2008), p.25

- \+ inc. covering **geo-spatial = physical, not just virtual dimensions** of cyber - e.g. as given in this figure.

Context appreciation

- **Captures '*M4IS2*:** *multiagency, multinational, multidisciplinary, multidomain information sharing and sense making*', which **ranges across '*eight entities*** *[of] commerce, academic, government, civil society, media, law enforcement, military and non-government/non-profit.*' (Segell, 2012)
- **Shows importance of + doing RESINT + COLINT** in CYBINT.

Fusion approach #1

Overall '**Situational Awareness**' Evaluation (**SoSA/G-J2**)

CONTEXT APPRECIATION - Observe + Orient

System attributes/ variables > e.g. inc. captures + covers...? > ---------- **SoSA units (e.g. PMESII):**	**Internal influences / factors** 'Who?' / 'Which?'	**Rationale** 'Why?'	**Types + Forms** 'What?'	**Conditions + Terms** 'When?'	**Trends** (+ dynamics/ flows) 'Where?'	**Functions** 'How?'	**External influences / factors** 'Who?' / 'Which?'	**Effects + Outcomes** 'What?' / 'S.W.O.T.'
Political (inc. law/legislation)								
Military								
Economic								
Social (inc. sociological + cultural)								
Informational/ Intelligence (inc. technological)								
Infrastructural (inc. environment[al])								

This matrix is designed to provide an analytic framework with **core - even checkbox - criteria or variables to consider** into which evaluators can record as holistically as possible - e.g., through mapping - what they observe from, e.g., a selected case/issue/ problem, etc.

This approach enables the **comprehensive capturing** of - if not all - at least several different aspects of an event/episode, issue, etc., in its **varying key dimensions**.

CYBINT ANALYSIS INSIGHTS

FUSION EXAMPLE: ISIS

Overall 'Situational Awareness' Evaluation (SoSA/G-J2)

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Political (inc. law/legislation)	Sharia law / alternative hierarchies	Unrep. elsewhere/ power-play	Strong leadership	Fill governance vacuum	Exploiting Iraq/Syria weaknesses	Ruthless / kill off opposition	Sympathisers	Imposing regime
Military	Tight, well-disciplined C2	Got weapons / tactics	e.g. Heavy +automatic weaponry	Succeed vs. weaker/ disorg. oppo	Good at capturing; less so at holding?	Agile / flexible / fast-lightfoot	Ex-military personnel	Competent committed adversary
Economic	Profitable/ employed	Make profit - e.g. oil	Steady supply funding	Exploit existing/new markets	Exploiting oil-refineries	Able to sell, e.g. oil	Resp to consumer demands	Self-sustaining/ autarky?
Social (inc. sociological + cultural)	Camarad-erie/ purpose	Romance	Bonding/ band-bros/ marriage	Links/ties - e.g. friends/ passions	Native + Foreign fighters	Quasi-religious/ smashing activities	'Call of the wild'/ share adventurism	Soft + not just hard factors
Informational/ Intelligence (inc. technological)	Good / soc media / BYOD	Able to influence	Social media/ propaganda	INFO/ PSYOPS = work	Use internet - e.g. Twitter	Access to electronic devices	Acquiescence support thru intimidation	Shifting frames of reference
Infrastructural (inc. environment[al])	Good networks/ comms	Can seize/ control/ trade/nego	Training camps/bases	Using what is there - e.g. roads...	Urban/settled/ travel-able areas	Travel on roads / oil refinery use	Unwitting(?) private service prov	Too depend on what have already?

N.B.: main CYBINT concerns **not isolated from the other aspects** encounter + need to consider more widely

Fusion approach #2

Overall '**Mission Accomplishment**' Guide (**SoSE/G-J3**)
SOLUTION FASHIONING - Decide + Act

SoSA units (e.g. PMESII) > ---------- **'Levels' (of interactivity/ implementation/ engineering)**:	**Political** (inc. law/ legislation)	**Military**	**Economic**	**Social** (inc. sociological + cultural)	**Informational/ Intelligence** (inc. technological)	**Infrastructural** (inc. environment[al])
Ideological (e.g. Ideas/Why realise?)						
Theoretical (e.g. Aspirations/Why do?)						
Strategic (e.g. Directions/How go?)						
Policy (e.g. Aims/Where go?)						
Operational (e.g. How/What realise?)						
Tactical (e.g. How/What do?)						
Individual (as 'professional') (e.g. What/Which realise?)						
Personal (e.g. Who do?)						

Deliverable work filling/completing this matrix (+ the one given on prev. slide) can be **done 'live'** - e.g. in a real battlespace/ operational context ('pre-flight' style); or equally can be **done more 'off-line' + in the abstract** - e.g. during a simulation/training/ exercise in the classroom.

Overall, these **matrices form useful analytical frameworks + educational teaching tools**, also helping to advance **standards + best practices** in approaches towards situation evaluations + subsequent transformation.

Also suggests **where 'to draw the line'** in relation to issues, e.g. privacy, etc.

Privacy buffer

Fusion approach #3

Fusion grid = mapping System Attributes/Variables + Levels
for each specified SoS unit of analysis* - e.g. using PMESII model: Political; Military; Economic; Social; Informational/Intelligence; Infrastructural (*show which is selected for focus)

System Attributes/ Variables> ---------- **'Levels' (of interactivity/ implementation/ engineering)**:	**Internal influences / factors** 'Who?' / 'Which?'	**Rationale** 'Why?'	**Types + Forms** 'What?'	**Conditions + Terms** 'When?'	**Trends** (+ dynamics/ flows) 'Where?'	**Functions** 'How?'	**External influences / factors** 'Who?' / 'Which?'	**Effects + Outcomes** 'What?' / 'S.W.O.T.'
Ideological (e.g. Ideas/Why realise?)								
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This third chart (table) for mapping allows for **'triangulation'** to be undertaken, e.g. with the results from the other two previous charts, during overall 'fusion' activities.

Privacy buffer

Fusion approach #4

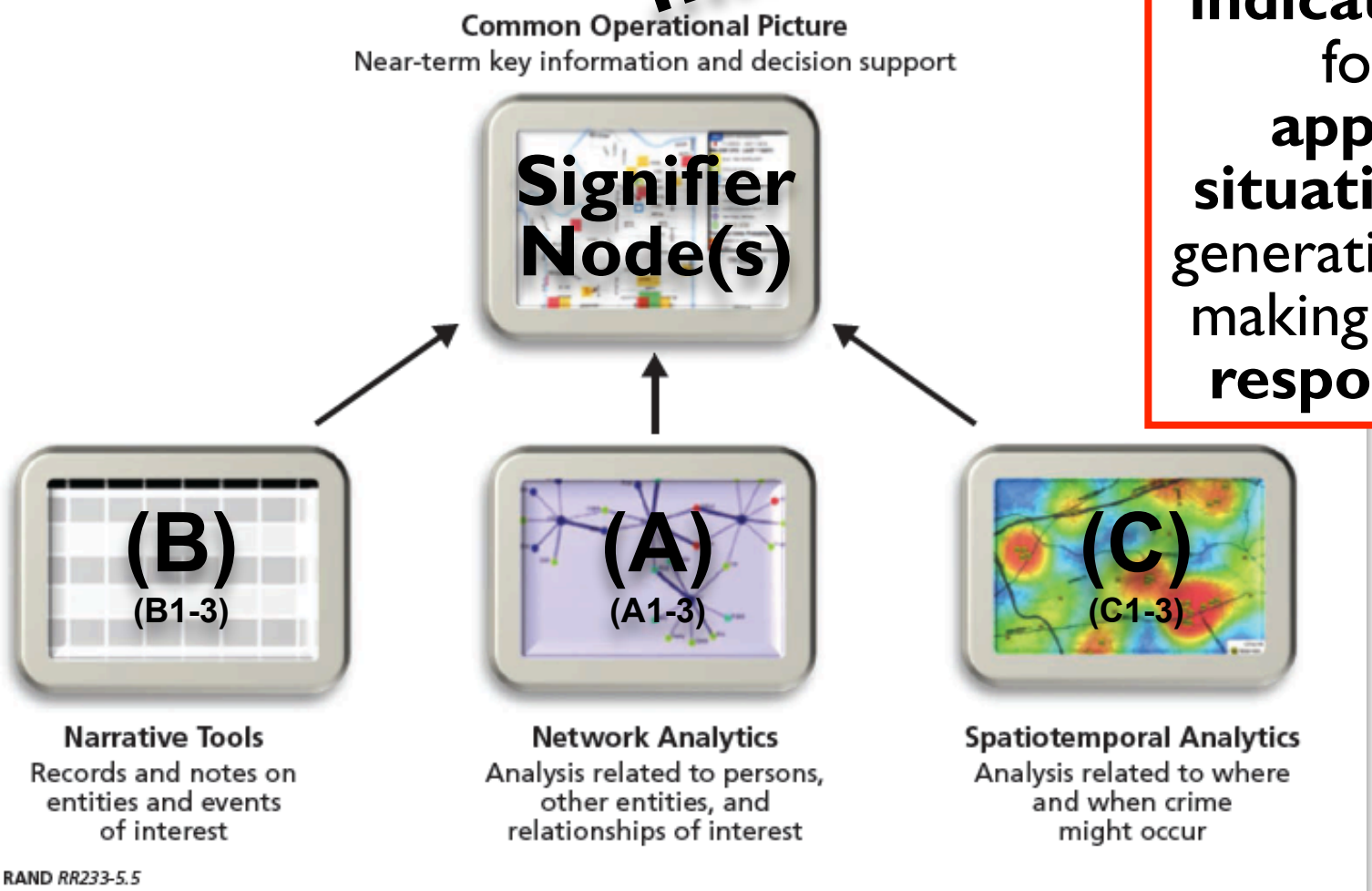
OVERVIEW SNAPSHOT SUMMARY
At a minimum for context consider + fuse:

(A) 'Key Actors' - e.g. who? (e.g. OC groups, individuals, other 'targets', etc.)	**(A1) Events** - e.g. what? when? where?
	(A2) Patterns - e.g. how?
	(A3) Drivers - e.g. why?
(B) 'forces/factors of change' - e.g. what activity? (e.g. SOC areas, etc.)	**(B1) Events** - e.g. what? when? where?
	(B2) Patterns - e.g. how?
	(B3) Drivers - e.g. why?
(C) 'possible change over time' - e.g. when? / where? (e.g. environment, PESTLE/PMESII [SoSD] indicators, SWOT, etc.)	**(C1) Events** - e.g. what? when? where?
	(C2) Patterns - e.g. how?
	(C3) Drivers - e.g. why?

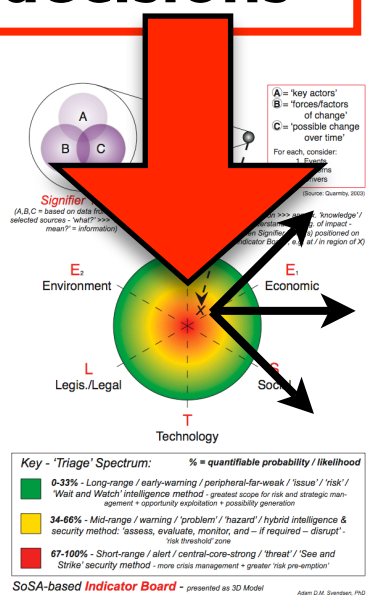
Aim = capture: (i) the **players**; (ii) their **relationships**; (iii) their **drivers** (e.g. their **means**, **motives** & **opportunities**).

Fusion approach #5

Figure 5.5
Tools to Create Shared Situational Awareness



Generation of **'Signifer Node(s)'** for positioning on triage-related/colour-coded **'indicator board(s)'** = for **context appreciation + situation awareness** generation >>> help for making **where next + response decisions**



Conclusions #1

- Arguably **'SoSA+SoSE' (i.e SoSD) approach** advanced here in CYBINT domain >>> better:

  (i) **captures enterprise-relevant 'intelligence dynamics'** - e.g. info flows, cybernetic 'feedback-loop', networked dimensions, etc. - **found in CYBINT** work; +

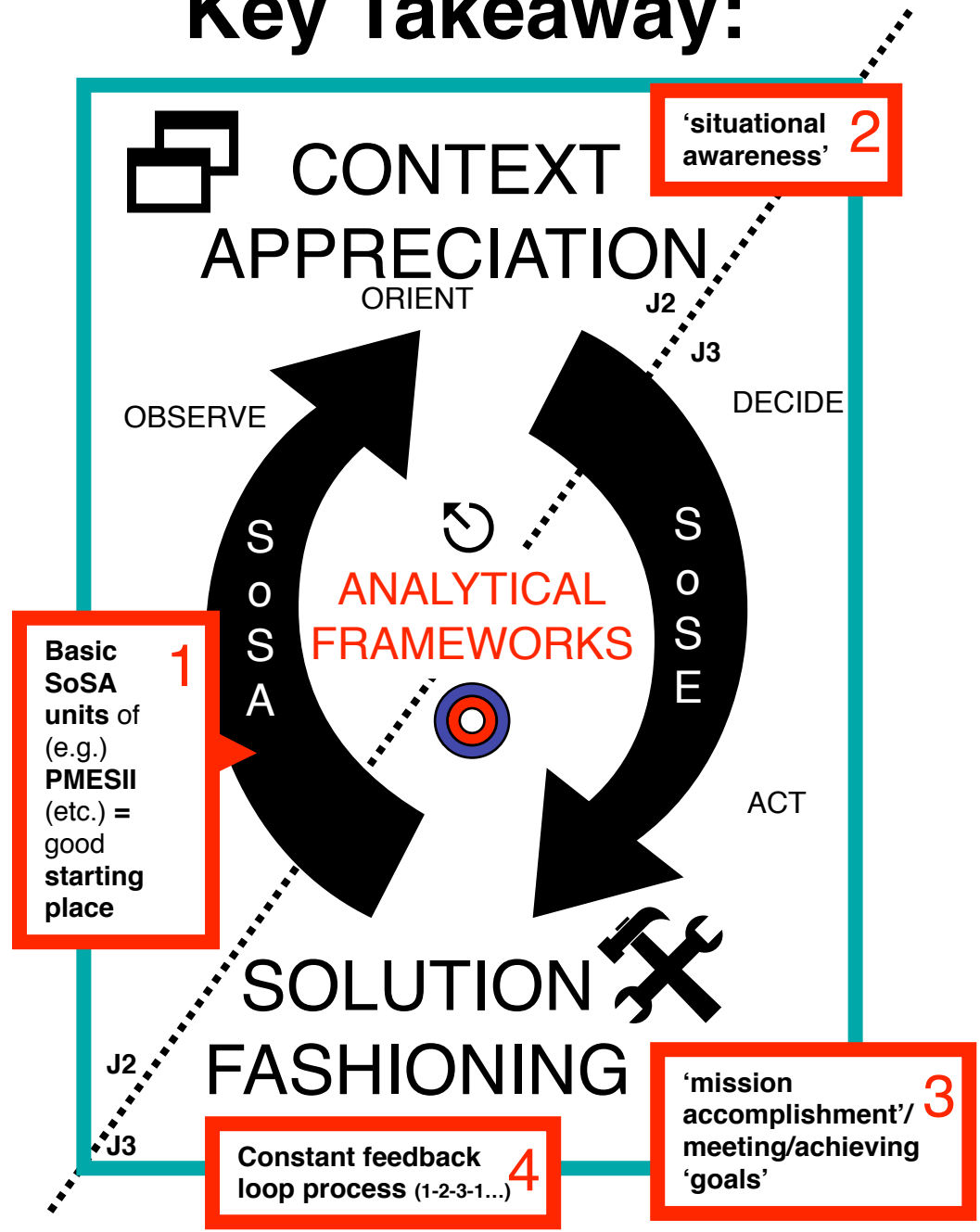
  (ii) **joins up the many different 'systems' involved** + encountered during MFOs (+ *not just in cyber domain*) in overall virtual + physical GSR and CCP environments.

  (iii) **'fills the/any gaps' + offers greater contextualisation** of CYBINT-related full-spectrum-ranging issues, problems, hazards, risks + threats.

Conclusions #2

- Integrated/joined-up/comprehensive CYBINT **'SoSA+SoSE' (SoSD) approach** =
  - Helps **meet 'mission accomplishment' ends** - e.g., transform developments + better **keep 'ahead curve of events'** proactively.
  - Can be readily overlaid with other (perhaps more familiar) approaches - e.g. **OODA Loop**, etc.
  - Encourages **greater 'thinking outside of the box'** in CYBINT-related enterprises.
  - **Assists in/with both collection + analysis** in overall enterprises - e.g. better refines gathering platforms/sensors focus, tasking + targeting, etc.

Key Takeaway:



Conclusions #3

- Generally, **grander strategic + architectural + shaping approaches -** inc. **greater structural + cultural efforts** = esp. pressing:

  (i) during our **contemporary 'Big Data' + 'Cyber' (*writ large*) age** +

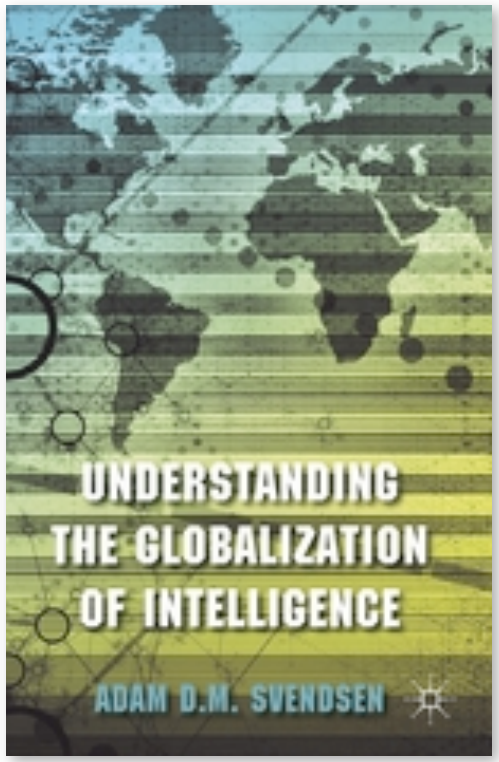
  (ii) when **experiencing much 'sensory' + other conditions of 'information/data overload'** +

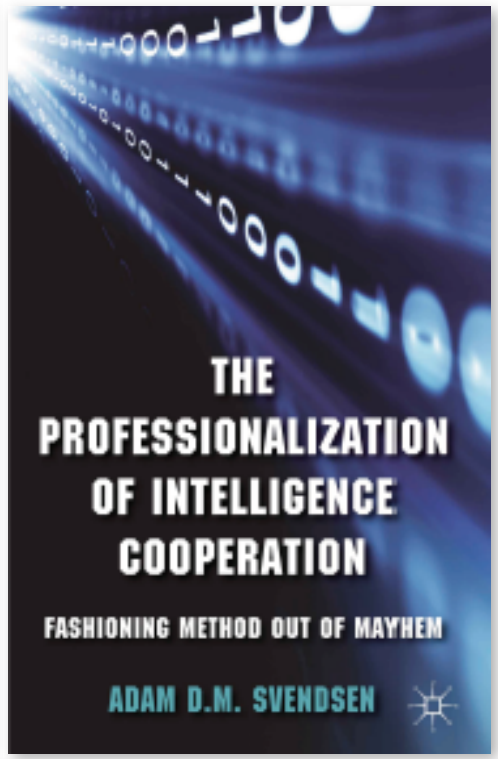
  (iii) as do more **'Collective Intelligence' (COLINT)** while scrutinised more by more involved public +

  (iv) while continually **subjected to, e.g., 'Snowden-related' allegations** (or so-called 'revelations') + assoc. mis-/distrust; +

  (v) as related challenging **'legalisation'/'legalism' trends extend >>> 'Smart-Law'** to instead needing advancement = better weighing Soft/Hard Law dimensions.

Next steps & learn more:





Adam D.M. Svendsen, **'Advancing "Defence-in-depth": Intelligence and Systems Dynamics'**, *Defense & Security Analysis* (2015).

Adam D.M. Svendsen, **'Contemporary intelligence innovation in practice: Enhancing "macro" to "micro" systems thinking via "System of Systems" dynamics'**, *Defence Studies* (2015).

'**The Intelligence-domain System of Systems Dynamics Reference Content (SoSD)' research project** - an innovative partnership between the **Global University Alliance** (www.globaluniversityalliance.net) + the **Copenhagen Institute for Futures Studies** (www.cifs.dk) = focuses on System of Systems Dynamics (SoSD) in CYBINT + other INT domains: www.cifs.dk/en/gua.asp / Reuters ResearcherID: www.researcherid.com/rid/D-9577-2015

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