Australian Government
Department of Defence
Defence Science and Technology Organisation

Extending C2 Assessment Frameworks: A Novel Approach to Assessing Technology Insertion

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OUTLINE

- *Task Context*
- *Why A New Framework?*
- *Multi Disciplinary Approach*
- *Framework Development Process*
- *Framework Application Process*
- *Future Work*

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Task Context

GOAL: *To assess the operational impacts of a new Battle Management System (BMS).*

WHY: *BMS advantages are often assumed with little validation*

HOW: *Develop an assessment framework that helps:*

- *Identify and measure operational costs and benefits*
- *Provide insights into cause and effects*

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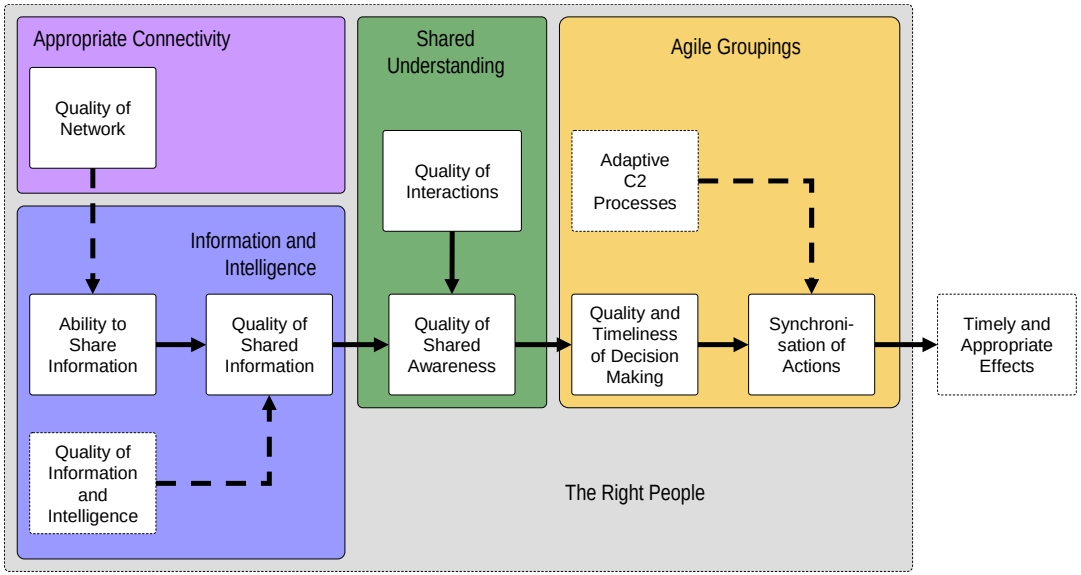
Why a New Framework?

Existing Frameworks useful:

- *NCW Frameworks*
- *Operational C2 Frameworks*
- *Architectural Frameworks*



But have limitations when applied to operational assessment at Army tactical levels:

- *Assessment of performance criteria (from commander's perspective)*
- *Breadth of performance outcomes examined*
- *Explanatory power of assessments*
- *Limited assessment of complex system interactions*

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A Multidisciplinary Approach: 1) Cognitive Engineering

Use of cognitive engineering / human factors techniques & models

- *Simulation Interviews*
  - *Applied Cognitive Task Analysis (Militello and Hutton 2000):*
    - *Soldiers introduced to realistic scenario (video)*
- *Emergent Theme Analysis*
- *Contextual Inquiry*
- *Sociotechnical Analysis*
  - *Cognitive Psychology*
  - *Distributed Cognition*
  - *Evolutionary Psychology*

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A Multidisciplinary Approach: 2) Complex Systems

Framework based on recent approaches to the understanding of complex socio-technical systems

Assessing the effect of new BMS on BG operations is not straight forward because :

- *The effects will be indirect*
- *There will be multiple negative and positive effects*
- *Some effects involve feedback loops*
- *The effects may not be linear*

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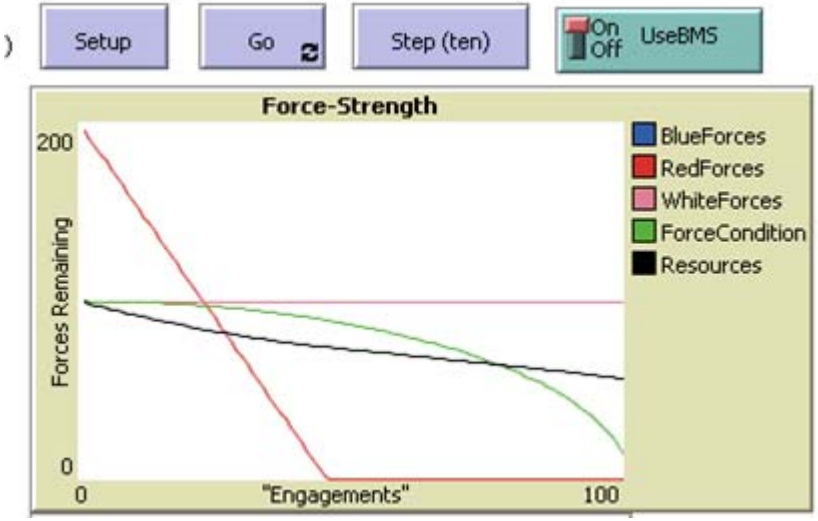
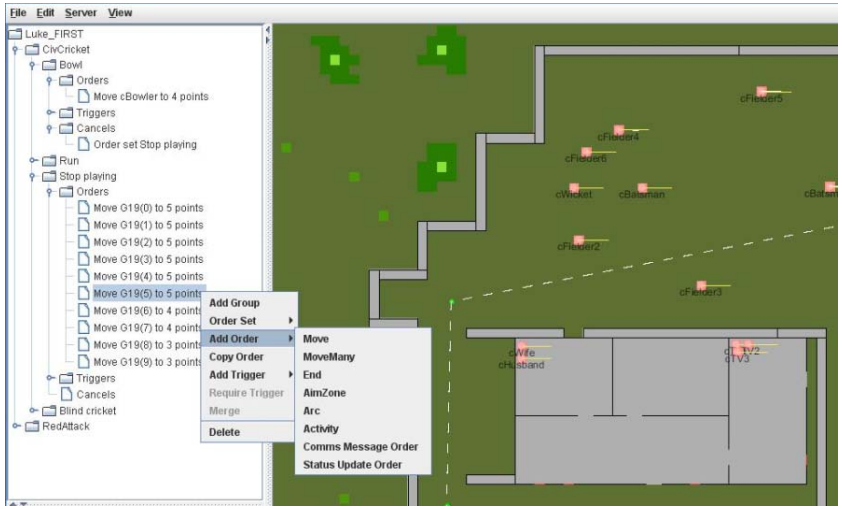
A Multidisciplinary Approach: 3) Modelling & Simulation

Framework supplements observations & measures from 'Human in the loop' exercises & experiments with:





Complex Systems Models:

- *ie System Dynamics and Agent Based.*

Simulations:

- *ie Closed Loop Wargame*

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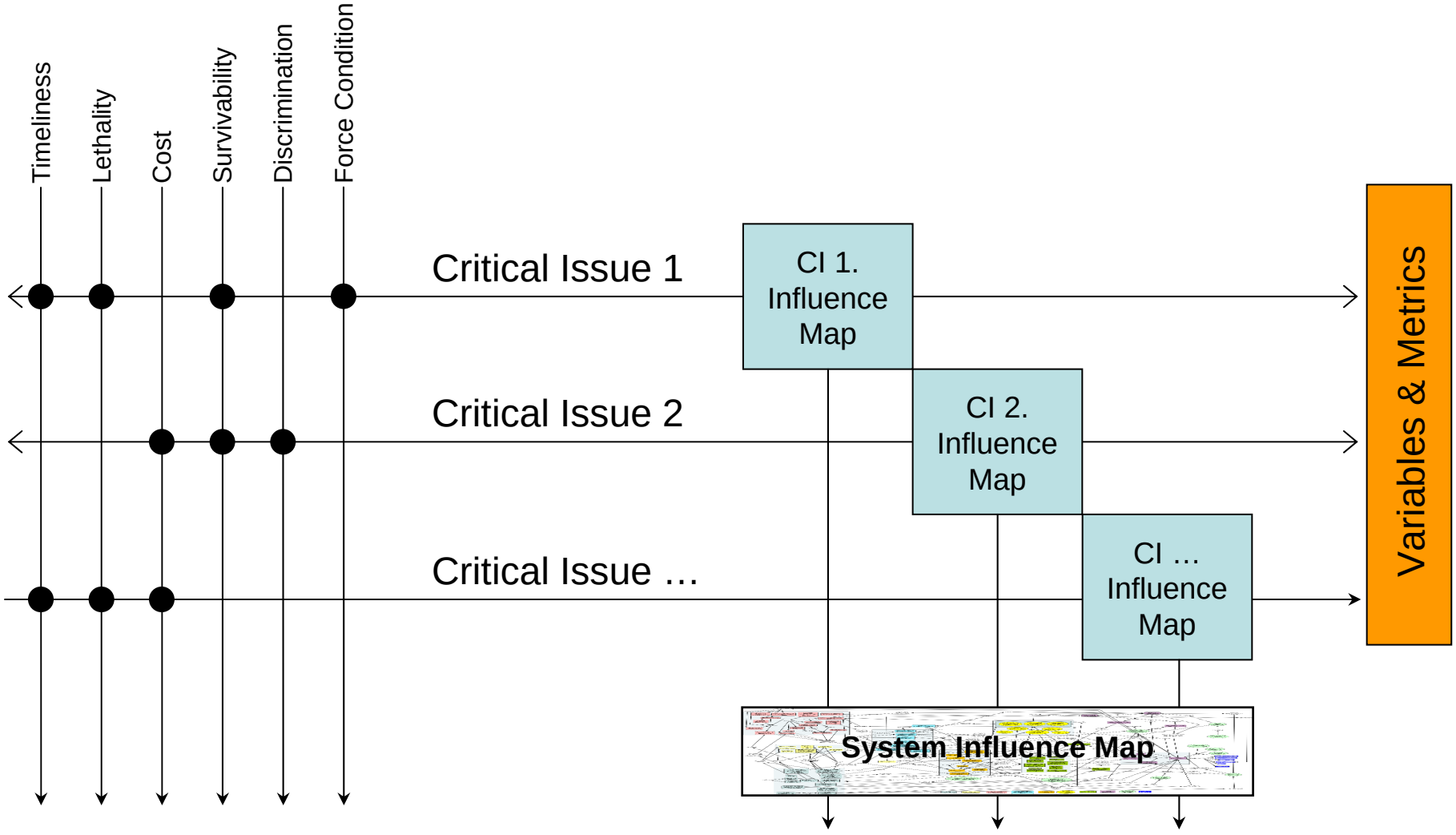
Framework Development Process

BG Performance Criteria



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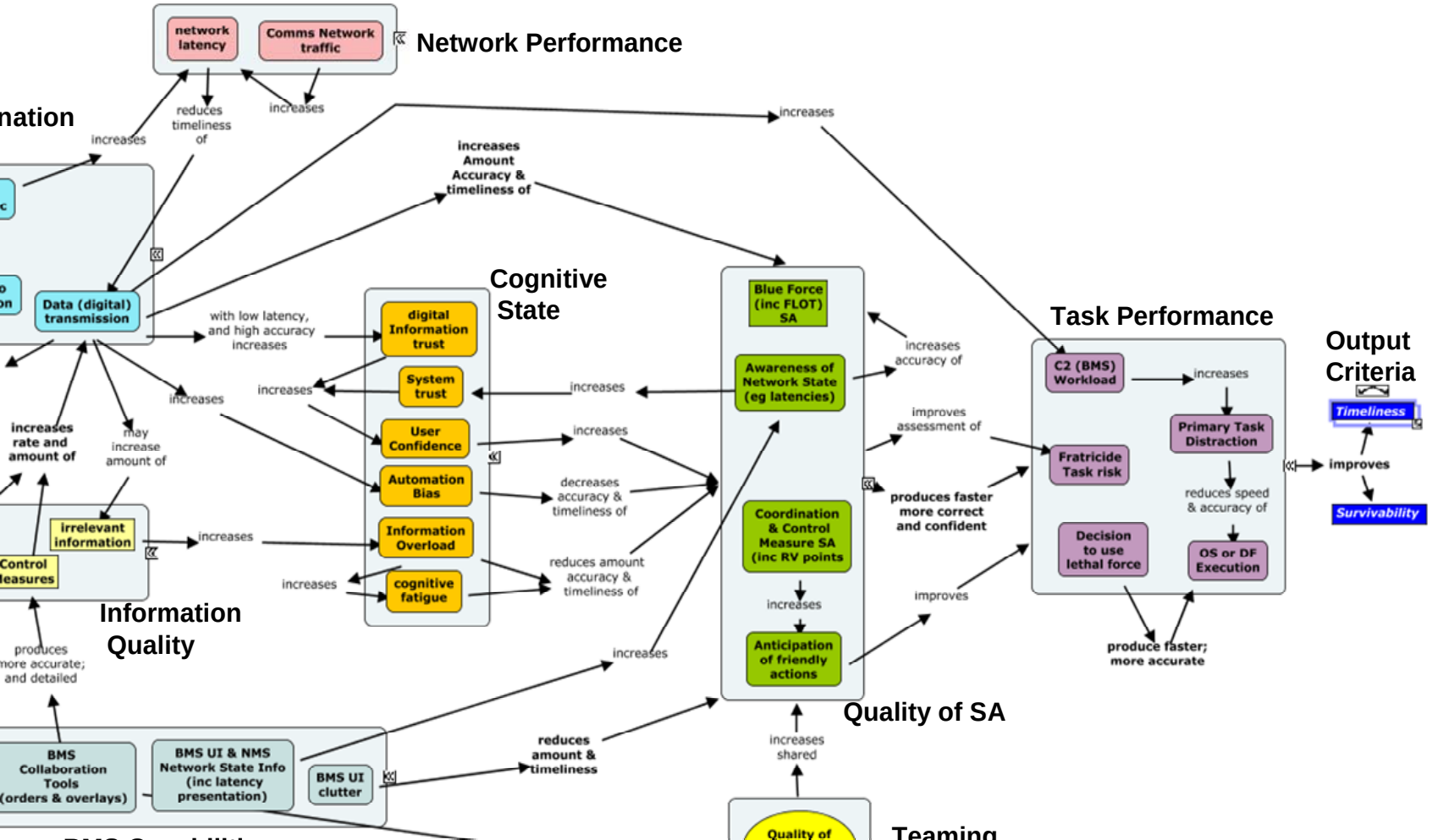
Framework Development Process: Critical Issues

ldier interviews & Lit review identified the 18 critical issues that ay be affected by introduction of BMS

- *Anticipation*
- *Battle preparation*
- *Cognitive workload*
- *Ergonomics*
- *Coordination of CA*
- *Knowledge of blue and red picture*
- *Fratricide*
- *Integration of vulnerable assets*
- *Interoperability*
- *Planning*

Framework Development Process: *Fratricide* Critical Issue Influence Map



Framework Development Process:
Metrics

ified key variables
literature review

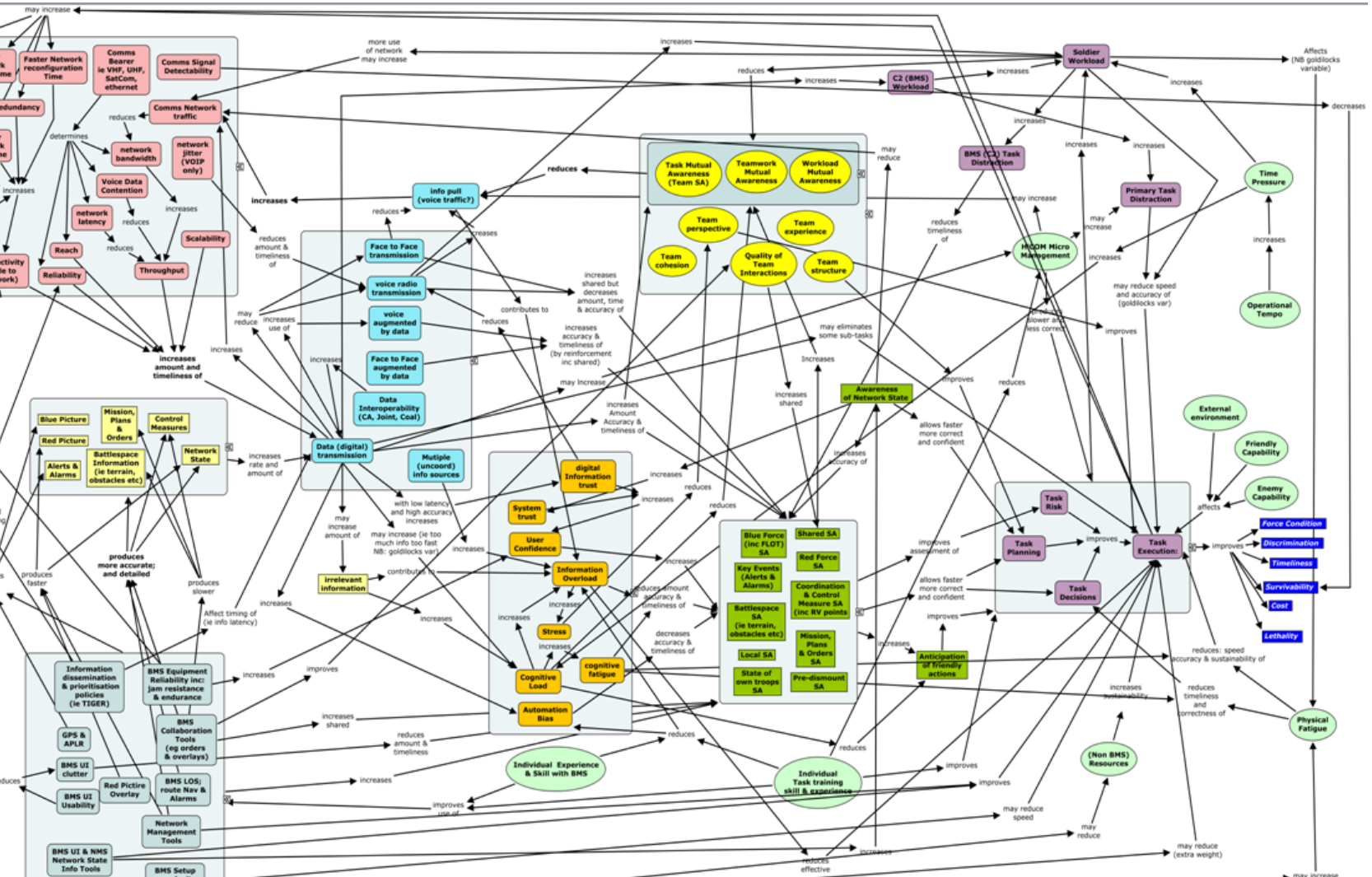
ted within Critical
s

CRITICAL ISSUE: FRATRICIDE

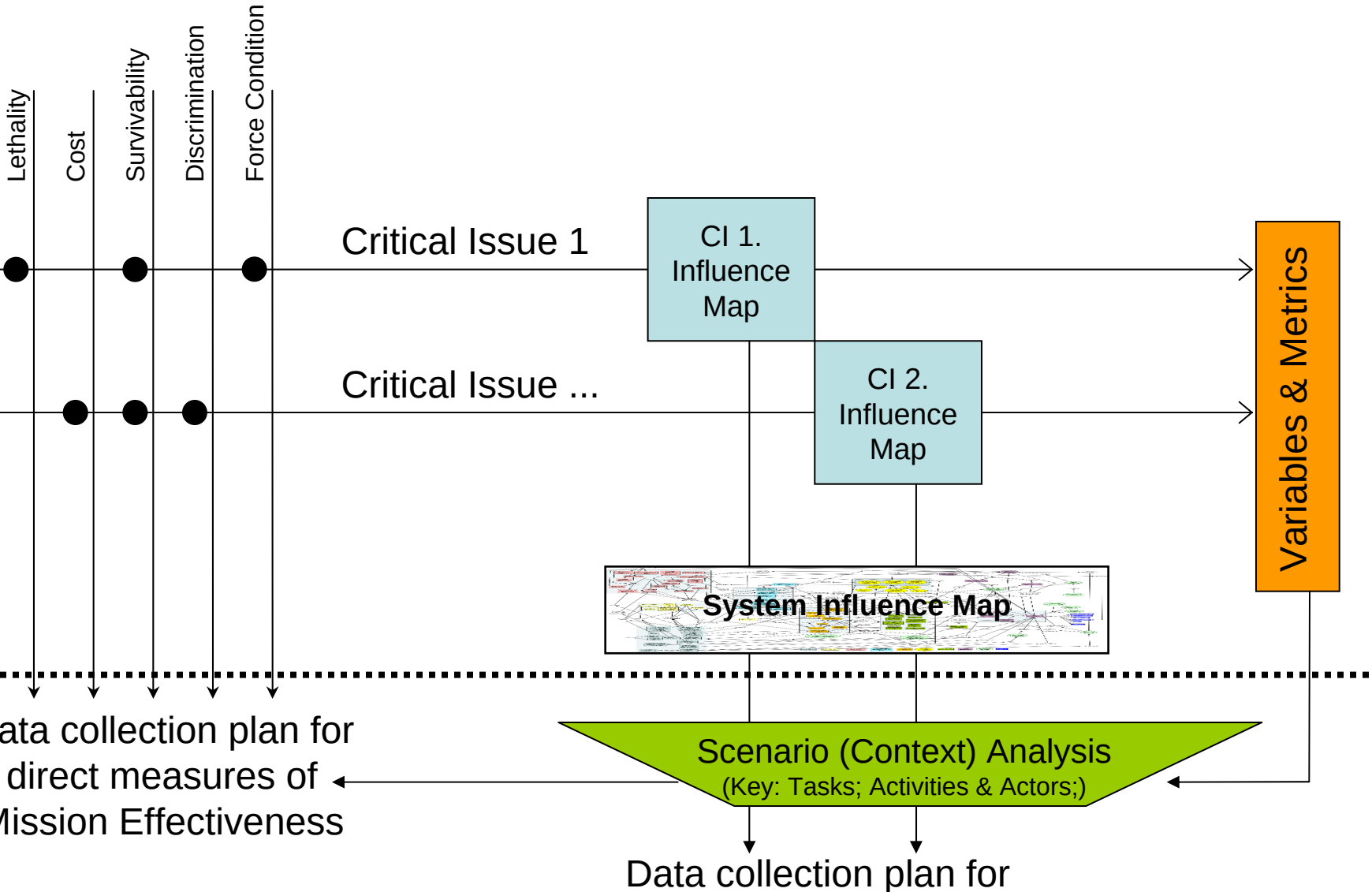
BMS Capabilities and Issues			C2 Information			
Type	**metrics**	**collection mode**	**Type**	**metrics**	**collection mode**	T
GPS & APLR	Was it functioning? / Usability and frustration	Survey / AAR	**Blue Picture**	Time (update rate & latency) & Accuracy	stop watch, post ex survey, AAR. GPS logger, Elbit data logs?	L
BMS UI Clutter	Nu of Objects on BFP? And frustration	Analyst log / Elbit screen capture /survey /AAR	irrelevant information	distraction & relevance	AAR or SMA questioning	C
BMS UI & NMS Network State Info (inc Latency)	usage rate & frustration levels	Survey? SME Obs				

Info Dissemination Mode			Cognitive Effects			
Type	**metrics**	**collection mode**	**Type**	**metrics**	**collection mode**	T
Digital	Coord messages sent about friendly locations & intentions to other blue elements	AAR/ELBIT logs? Analyst record?	Automation Bias	over-reliance on CBP	SMA assessment / questions	?
Voice radio transmission	Coord messages sent about friendly locations & intentions to other blue elements	written radio logs; Analyst records. BMS-E?	Digital Info trust	Level of trust in BMS data	Survey	
Info pull rates	anticipation ratio	Analyst Logs / BMS-E?	User Confidence	Level of confidence in Data	Survey	
			System Trust	Level of trust in Comms System (Hardware)	Question: Ask user to identify when they loose trust in system	
			Information Overload	dependent on mode	SMA assessment / questions	
			Cognitive Load	dependent on mode	standard metrics depending on fielsd / lab	
			Cognitive Fatigue	1 item scale or validitated subjective measures	question probe; SMA assessed, physiological	
			Stress	1 item scale or validitated subjective measures	question probe; SMA assessed; physiological/ voice analysis	

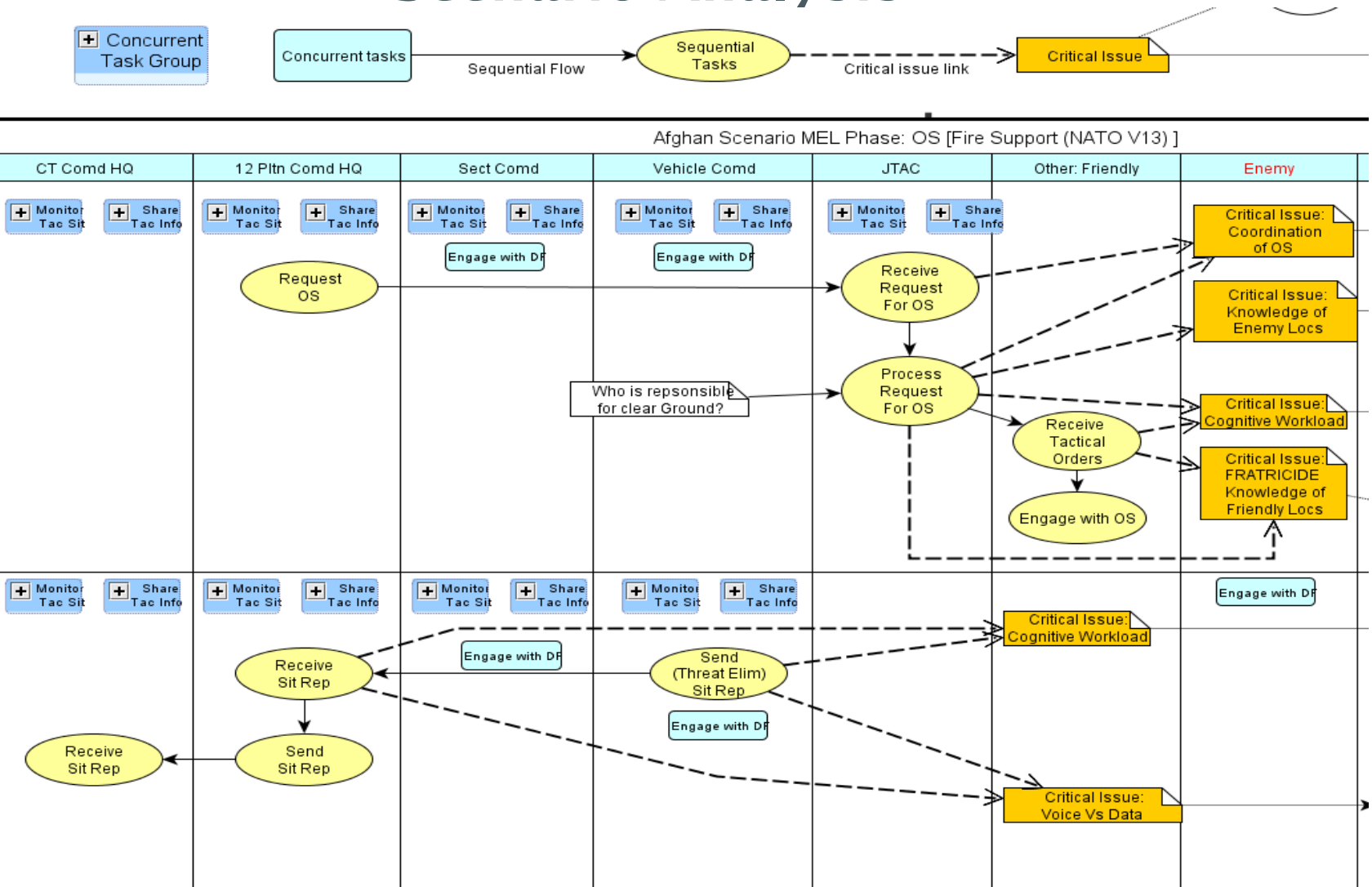
Framework Development Process: "Messy" System Influence Map



Framework Application Process



Framework Application Process: Scenario Analysis



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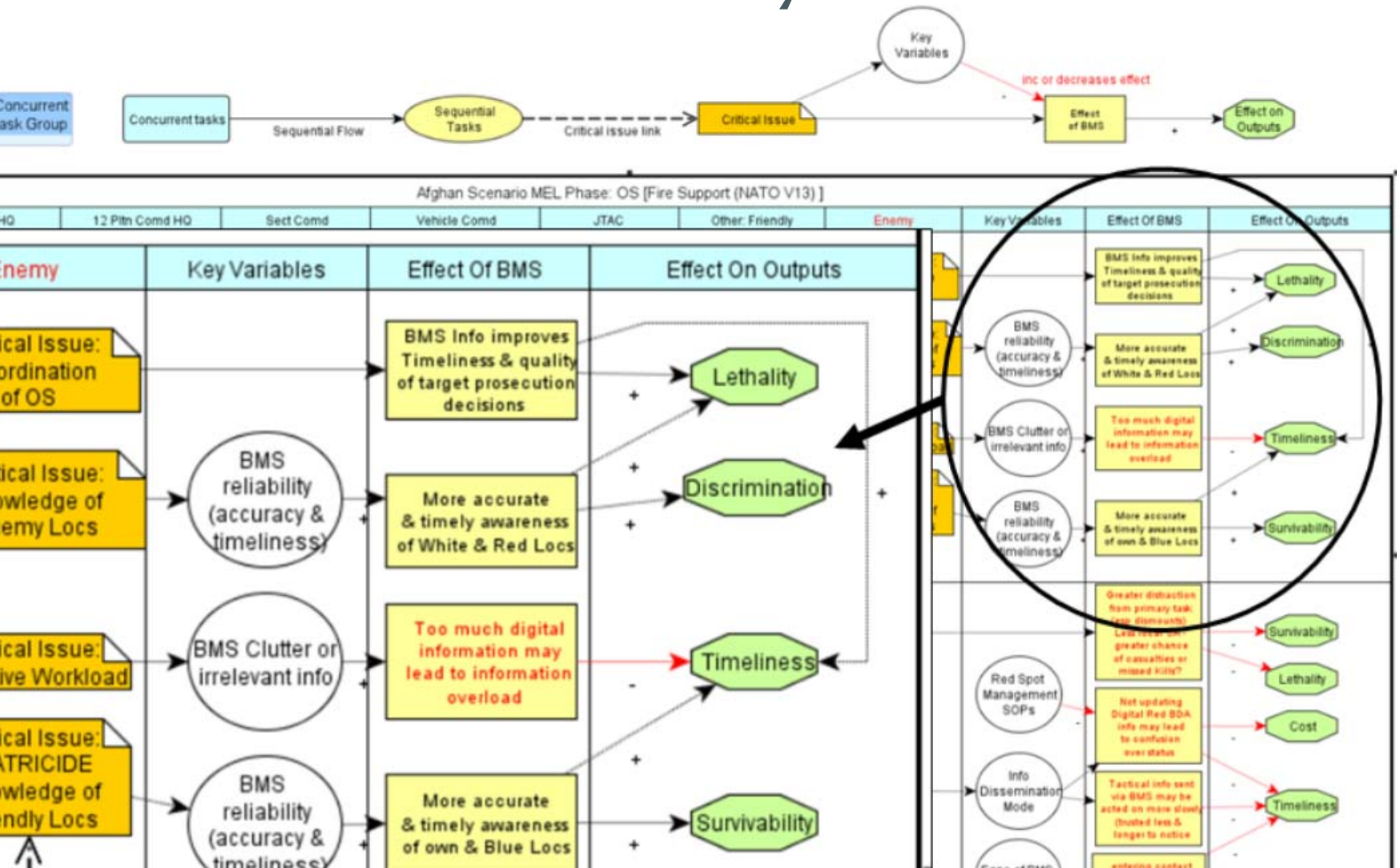
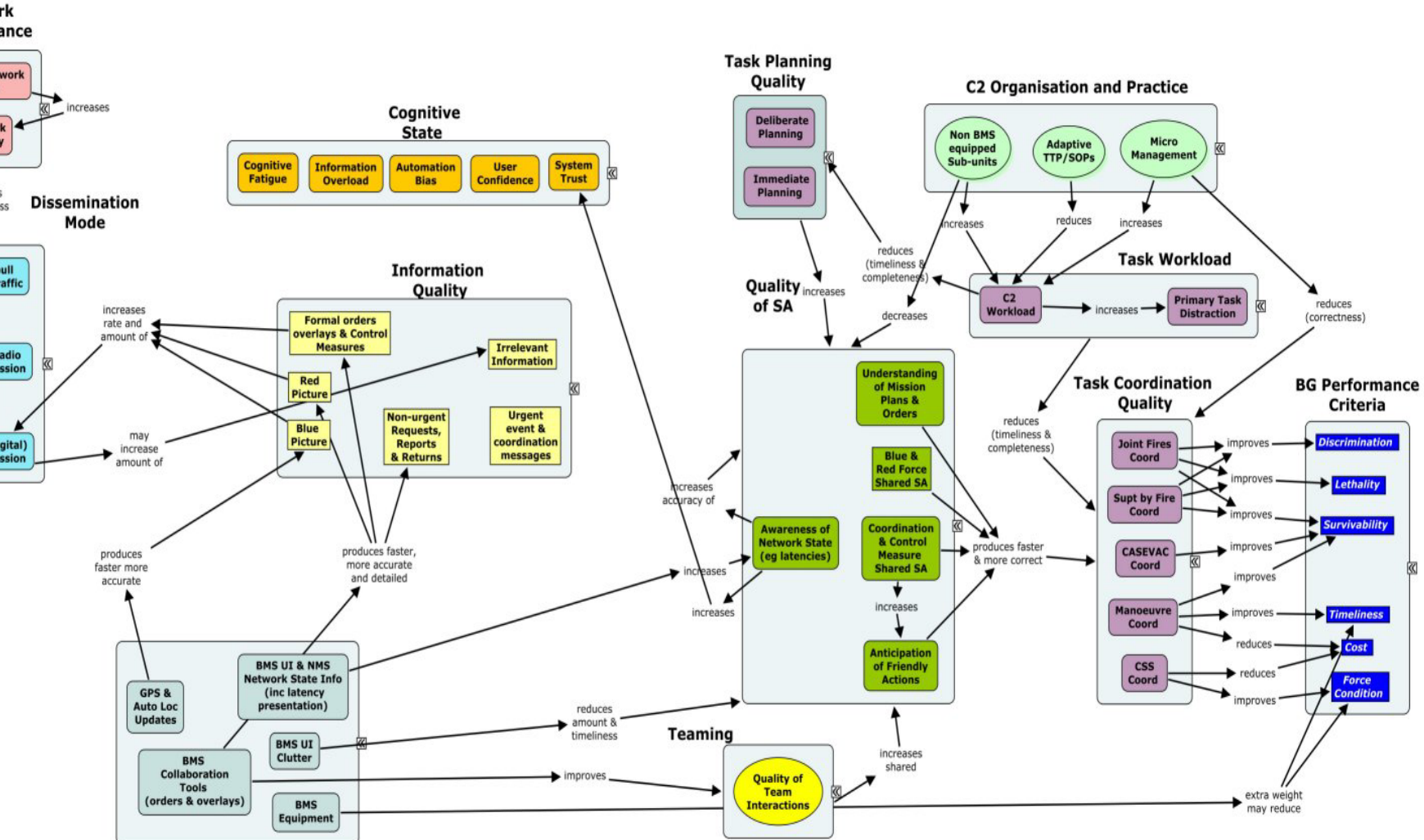


Future Work:
Iteration! – Iteration! – Iteration!



Questions