Validating the NEC Benefits Chain

Georgia Court

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Aim of this Presentation

- To show how with one or two modifications the NEC benefits chain can be supported by quantitative evidence from studies and experiments.
- To show more generally how evidence can be applied to validate benefits chains

NEC is….

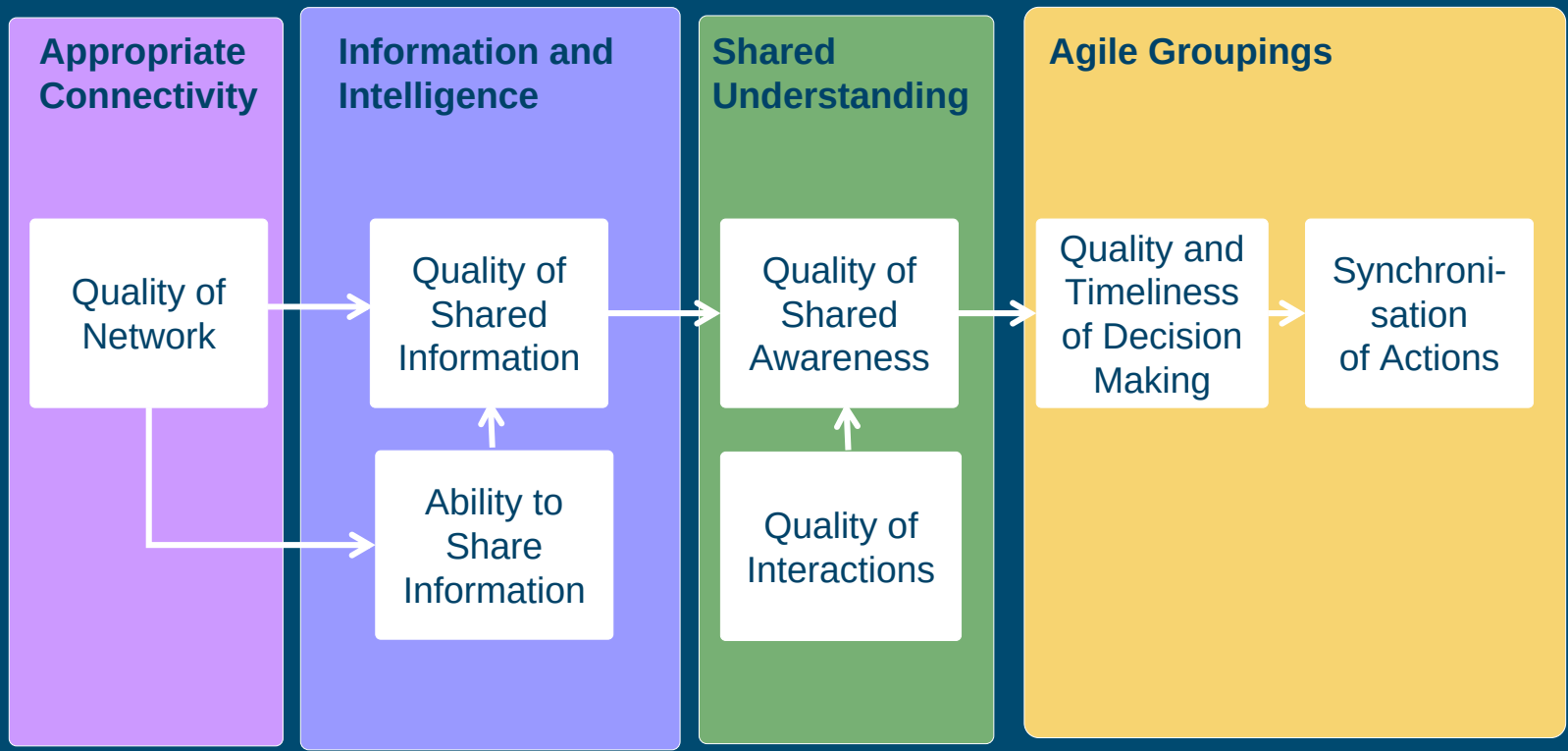
- The coherent integration of sensors, decision-makers and weapon systems along with support capabilities
  - to bring to bear the right military capabilities at the right time to achieve the desired military effect
  - this ability to respond more quickly and precisely will act as a force multiplier enabling our forces to achieve the desired effect through a smaller number of more capable assets
- More than equipment; also transformed doctrine and training and optimised command and control structures

* Source: Defence White Paper, *Delivering Security in a Changing World*, July 2004

Aim

- UK Defence White Paper stated that the transformation of UK forces was dependant on exploiting the benefits of NEC
- UK Defence Strategic Guidance directed that work be carried out to inform MoD Balance of Investment decisions to ensure this benefit realisation
- The first step was to formulate a hypothesised NEC benefits chain to present the benefits asserted by the Defence White Paper and then to test this

The Hypothesis:

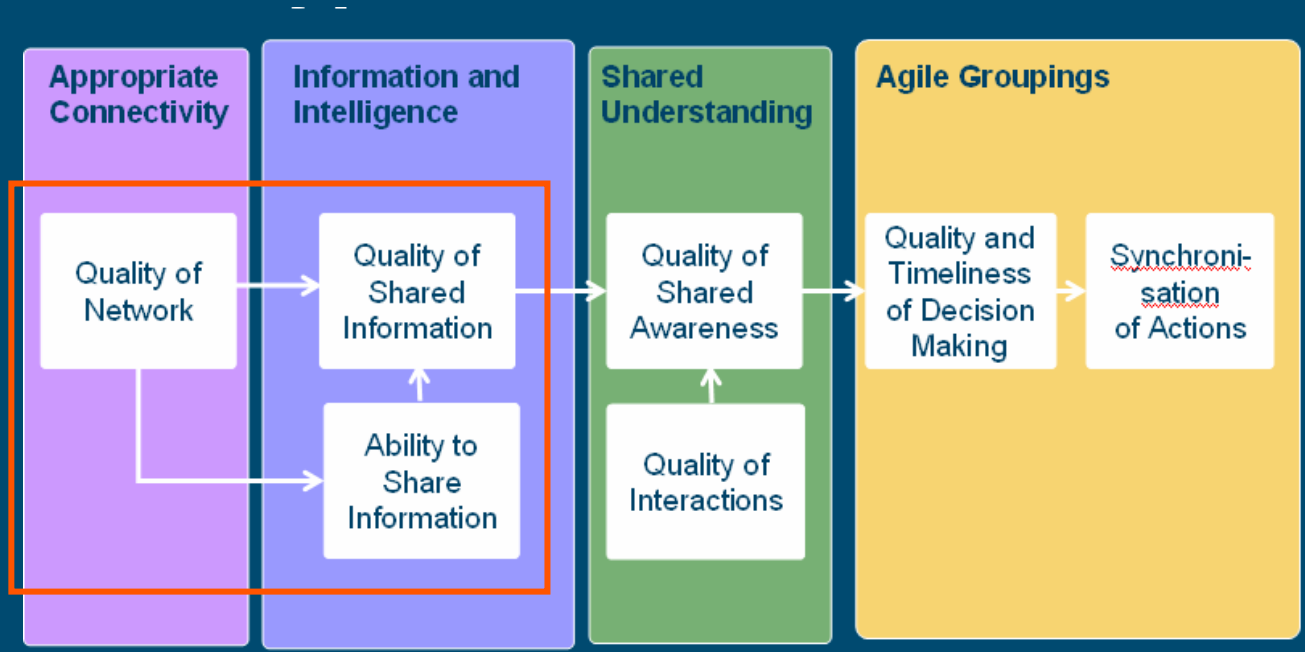


Testing the Hypothesis

- The ideas within NEC are not new - work over past decade or so has considered many of them
- “Knowledge mining” previous work to bring together existing evidence which quantifies potential benefits and risks:
  - Studies
  - UK and Allied Experimentation
  - Evidence from operations
- The evidence collected was then applied to the benefits chain

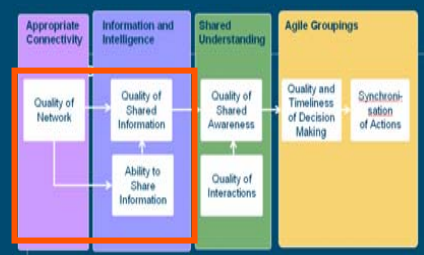
Quality of Shared Information Argument

Original Argument: Robustly networked forces should improve the quality of shared information.



Quality of Shared Information: Evidence

- Many experiments have found that a poor network has led to poor shared information
- A collaborative working tool giving the ability to share information with ease has been shown to provide greater improvements in the quality of shared information than improvements to the network infrastructure alone.
  - The mean rate of requests for information (RFI) being processed
  - The mean time to track the status of extant RFIs



Deduction

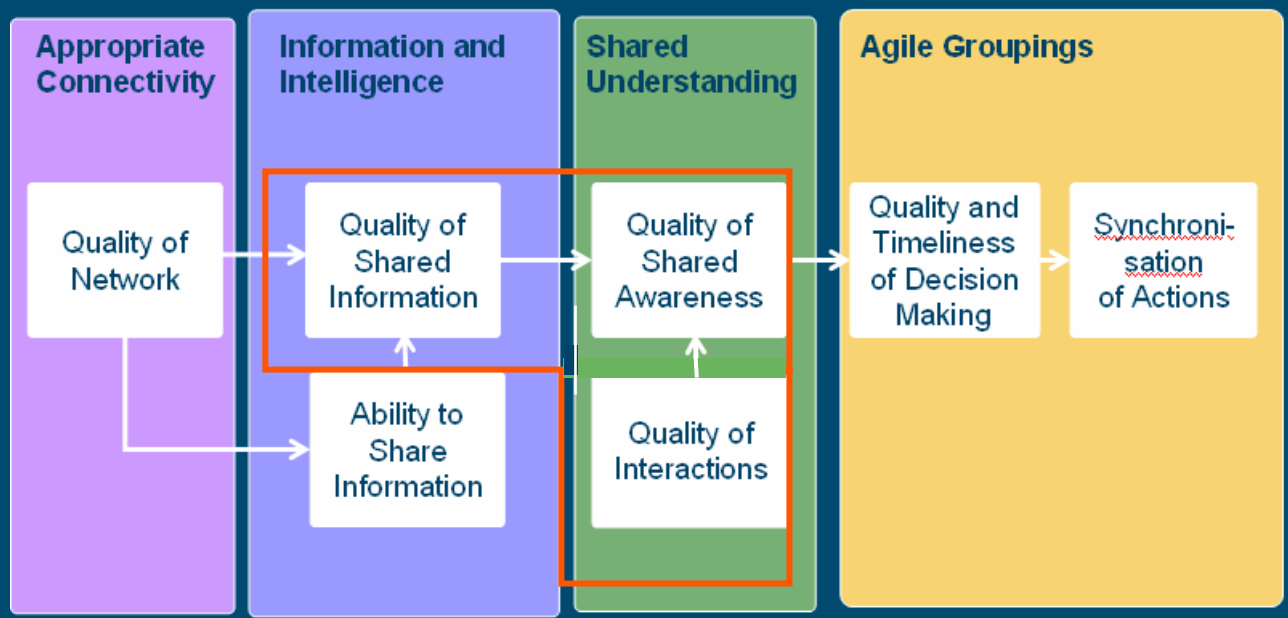
Original Argument: Robustly networked forces should improve the quality of shared information.

Evidence Collected

Modified Argument: A robustly networked force along with the ability to easily share good quality information should improve the quality of shared information.

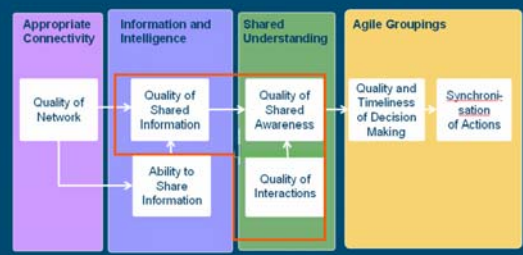
Quality of Shared Awareness Argument

Original Argument: Shared information should lead to an increase in shared awareness through enhanced quality of interactions.



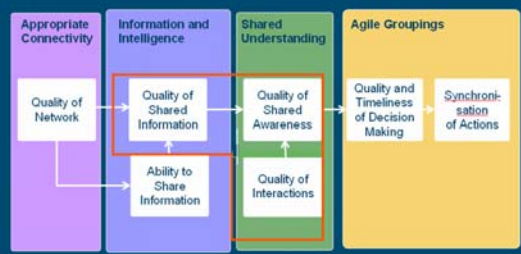
Quality of Shared Awareness – Evidence (1)

- A common picture for air defence weapon systems operators and the commander providing authority to engage generated:
  - A very large increase in likelihood of correctly identifying an authorised target under tight rules of engagement
  - A significant increase in engagement capability on average over all air defence platforms



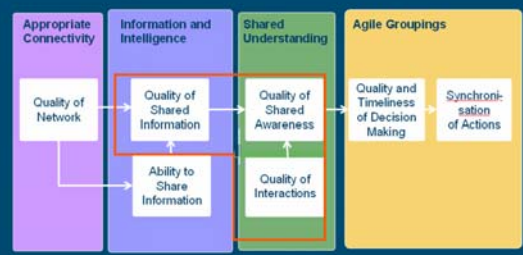
Quality of Shared Awareness – Evidence (2)

- Integrated UK/US working at Bde HQ level led to a significant increase in completeness of shared situational awareness
- Poor interactions can result in poor shared awareness despite good information:
  - During Op Iraqi Freedom, lack of trust in reachback facility led to information it provided not being used
  - When humans interact with automated systems reliance can occur and lead to poor SA



Quality of Shared Awareness – Evidence (3)

- A high quality of shared information and adequate interaction do not always result in a high quality of shared awareness:
  - Experiments have shown cases where information has not been taken account of either because the procedures or training have not been in place
  - Users with good quality information can become too focused on one area of information reducing their overall SA



Deduction

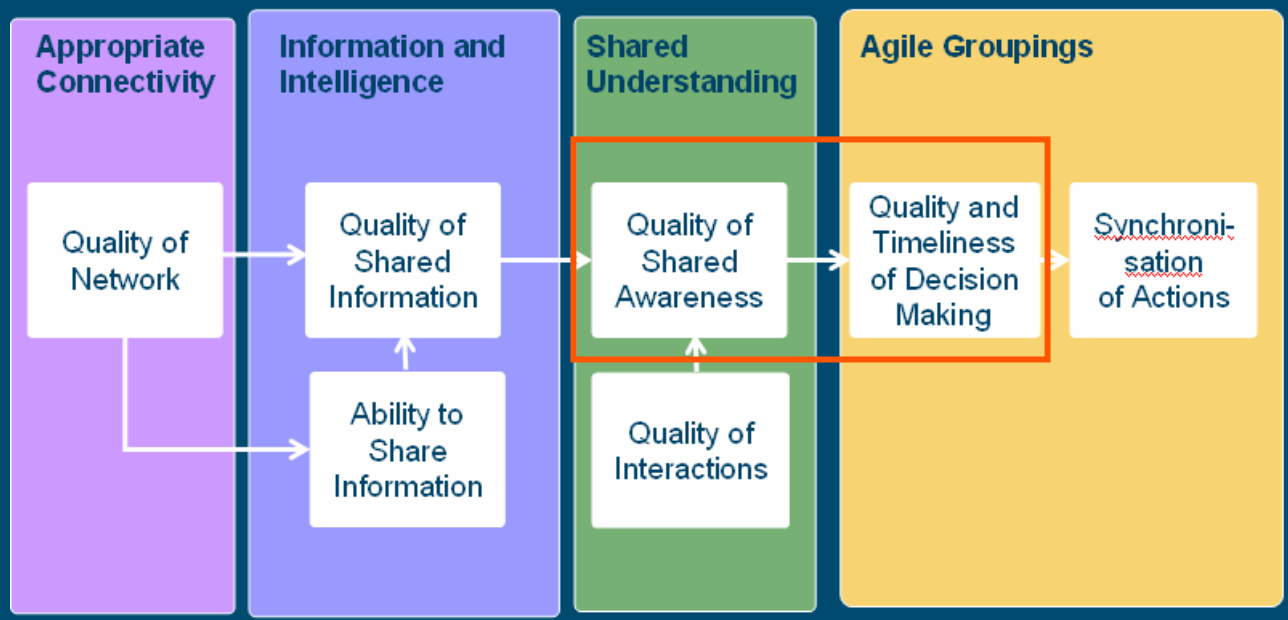
Original Argument: Shared information should lead to an increase in shared awareness through enhanced quality of interactions.

Evidence Collected

Modified Argument: Shared information accompanied by changes to training and processes should lead to an increase in shared awareness through enhanced quality of interactions.

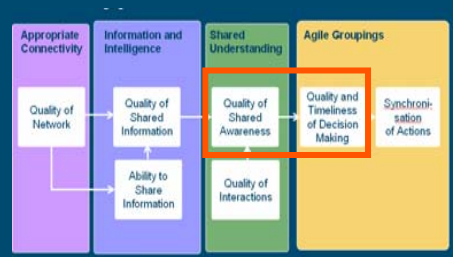
Deduction

Original Argument: Shared awareness should improve the quality of decision-making



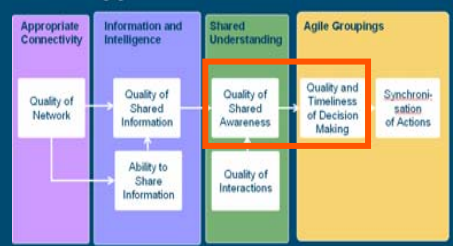
Quality of Decision-Making - Evidence

- Shared understanding has led to improved decision-making (measured in operational outcome):
  - Many studies and experiments have found that land force digitisation reduces Blue losses.
  - Several experiments (US and UK) have shown substantial increases in Loss Exchange Ratio when information can be shared by Link 16 compared with voice only.
- An experiment illustrated that a completed COP in a joint HQ significantly reduced decision-making time
  - The time for staff to become aware of incidents which required them to re-plan was reduced



Quality of Decision-Making - Evidence

- Greater shared awareness does not always result in greater shared understanding:
  - For example, where shared awareness is over-estimated. An experiment found that an incomplete COP increased decision-making time over the baseline of no COP
  - ‘Group think’ where group members’ strivings for unanimity override realistic appraisals of alternative courses of action
- Experiments show that improvements to shared awareness will only result in improvements to decision-making up to a point. Once sufficient information is available to match the situation to experience, no further information will improve the decision



Deduction

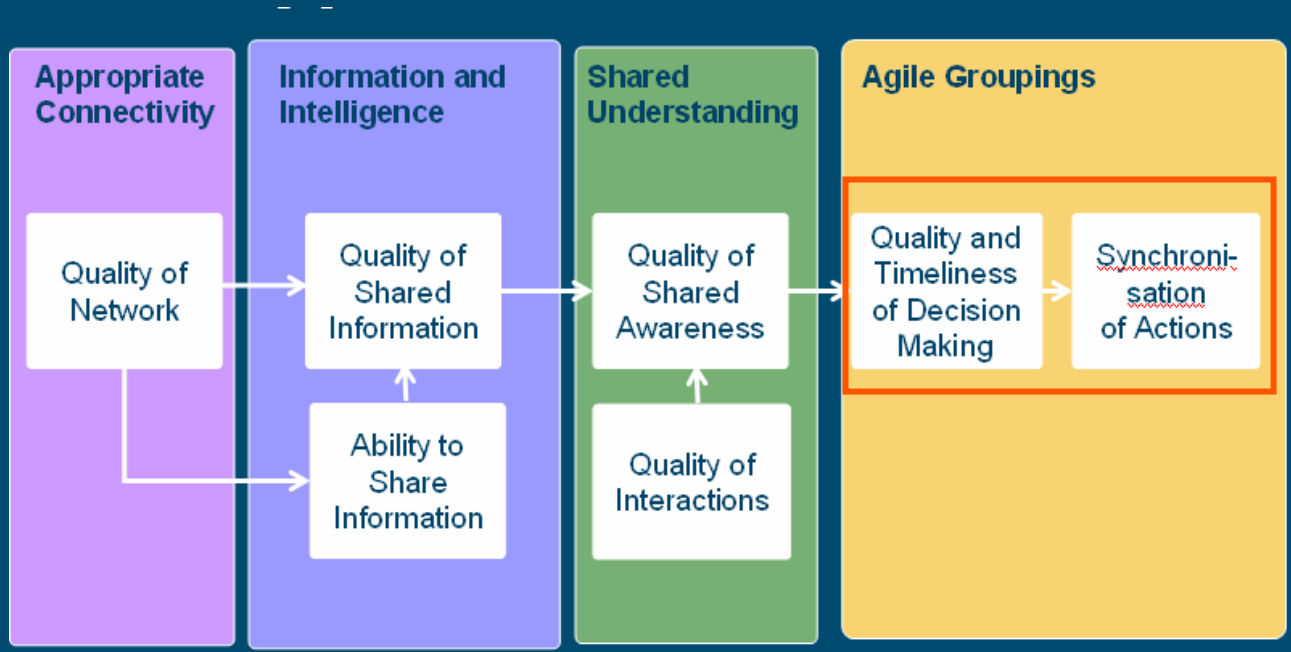
Original Argument: Shared awareness should improve the quality of decision-making

Evidence Collected

Modified Argument: High calibre decision-makers assisted by improved situational awareness should improve quality of decision-making

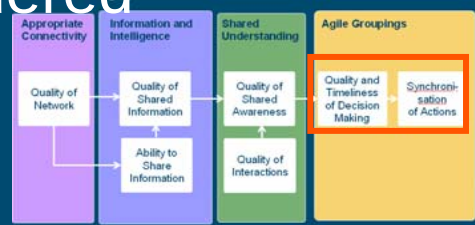
Deduction

Original Argument: Quality and timeliness of decisions should lead to synchronisation of actions



Synchronising Actions - Evidence

- No evidence has been found that good decision-making alone enables synchronisation of actions
- There is evidence that adaptive C2 processes are required to synchronise effects
  - Improving information sharing without improving C2 processes had little effect on operational effectiveness. Making improvements to both made a great difference
- Successful synchronisation does require good decision making to ensure knock-on effects are considered



Deduction

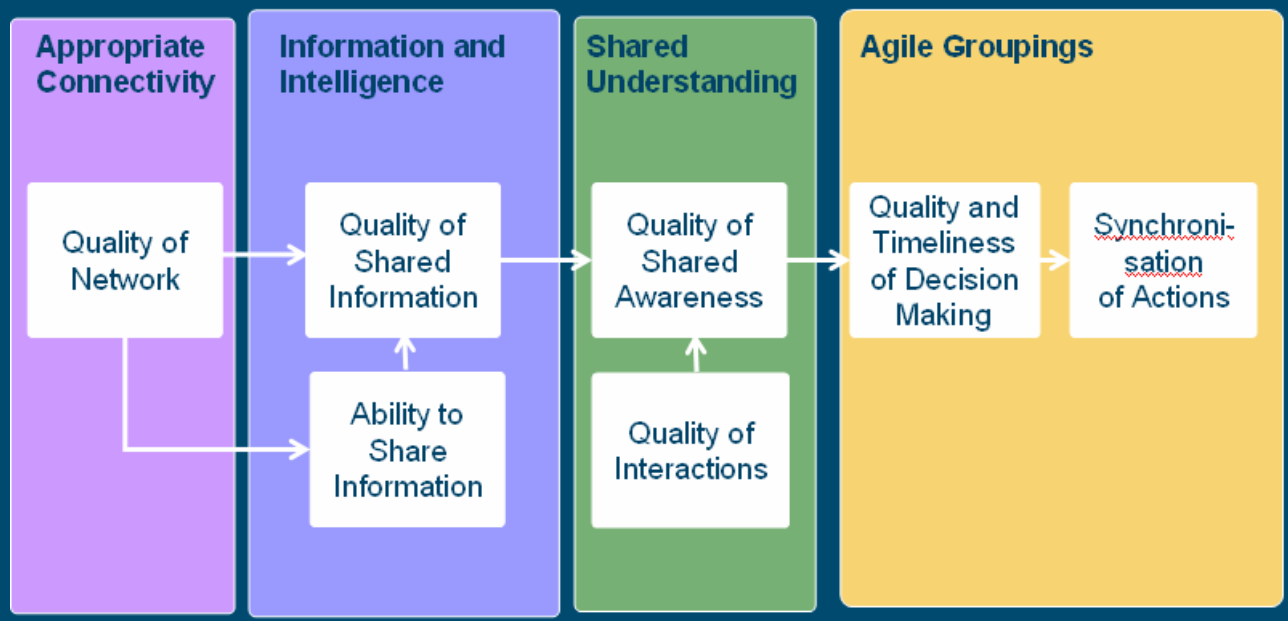
Original Argument: Quality and timeliness of decisions should lead to synchronisation of actions

Evidence Collected

Modified Argument: Quality and timeliness of decisions along with the ability to adapt C2 processes should lead to synchronisation of actions

Deduction

Original Implicit Argument: synchronisation of actions should lead to timely and appropriate effects.



Timely and Appropriate Effects - Evidence

- Research has shown that controlling the sequence and tempo of an operation is crucial
- Historical Analysis indicates that if an attacker can keep a defender continually off balance by getting inside his decision cycle time then the attacker is much more likely to be successful
- Historical analysis shows that an integrated C2 chain to co-ordinate different security force elements, to achieve *common* objectives, is strongly associated with military and political success in counter-terrorism campaigns

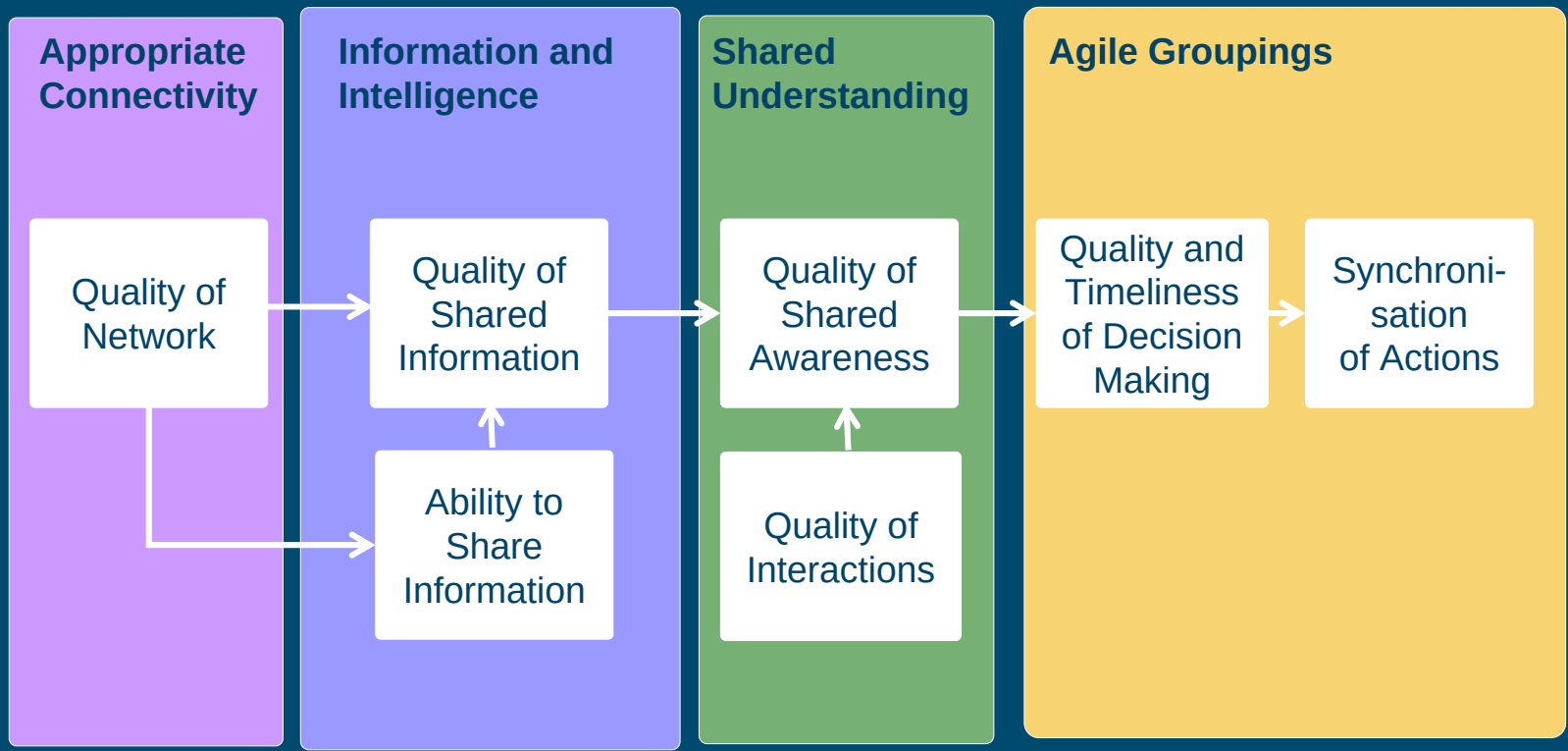
Deduction

Original Implicit Argument: synchronisation of actions should lead to timely and appropriate effects.

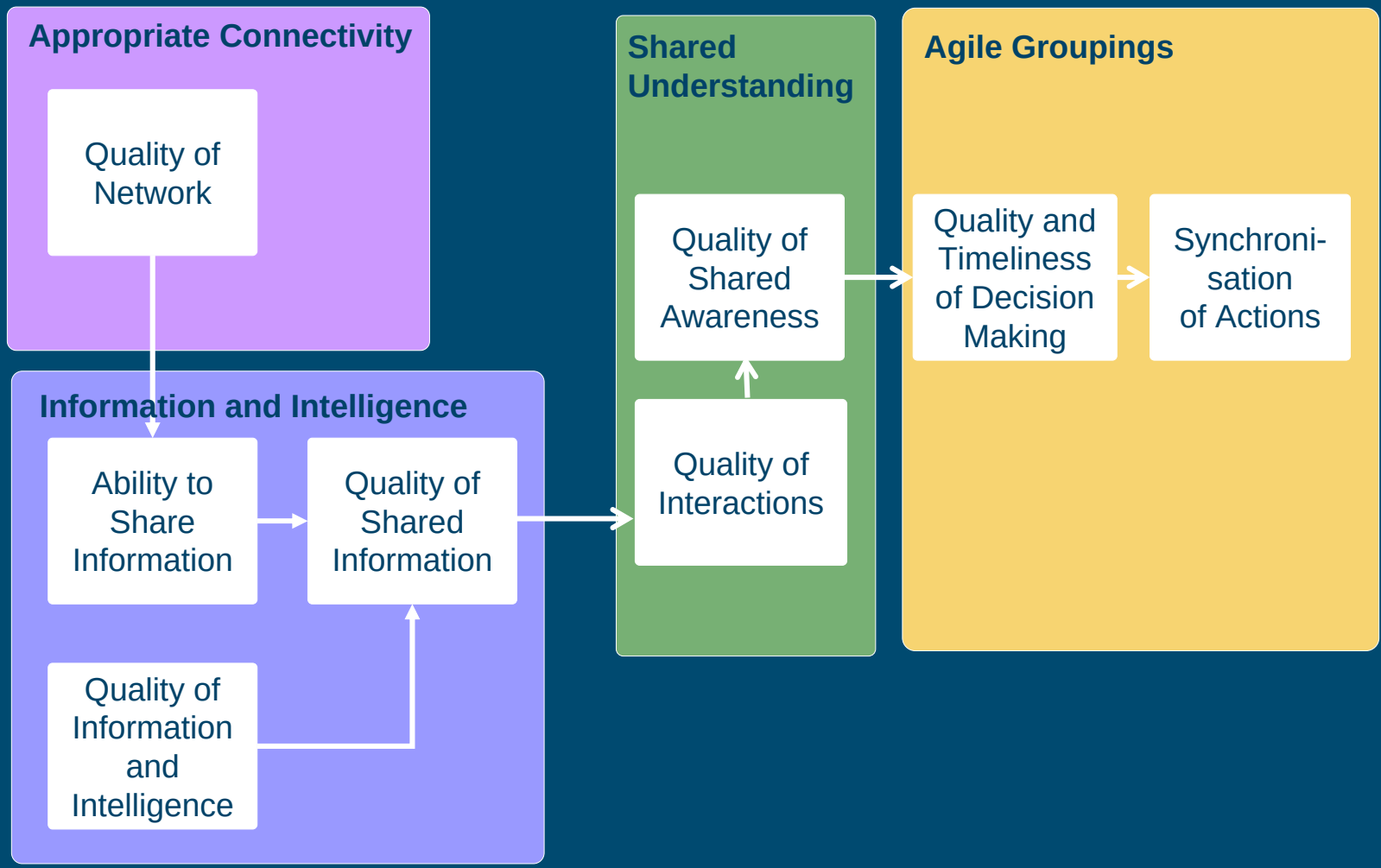
Evidence Collected

Argument is supported by evidence and should be made explicit within the NEC benefits Chain.

The Hypothesis:



The Modified NEC Benefits Chain



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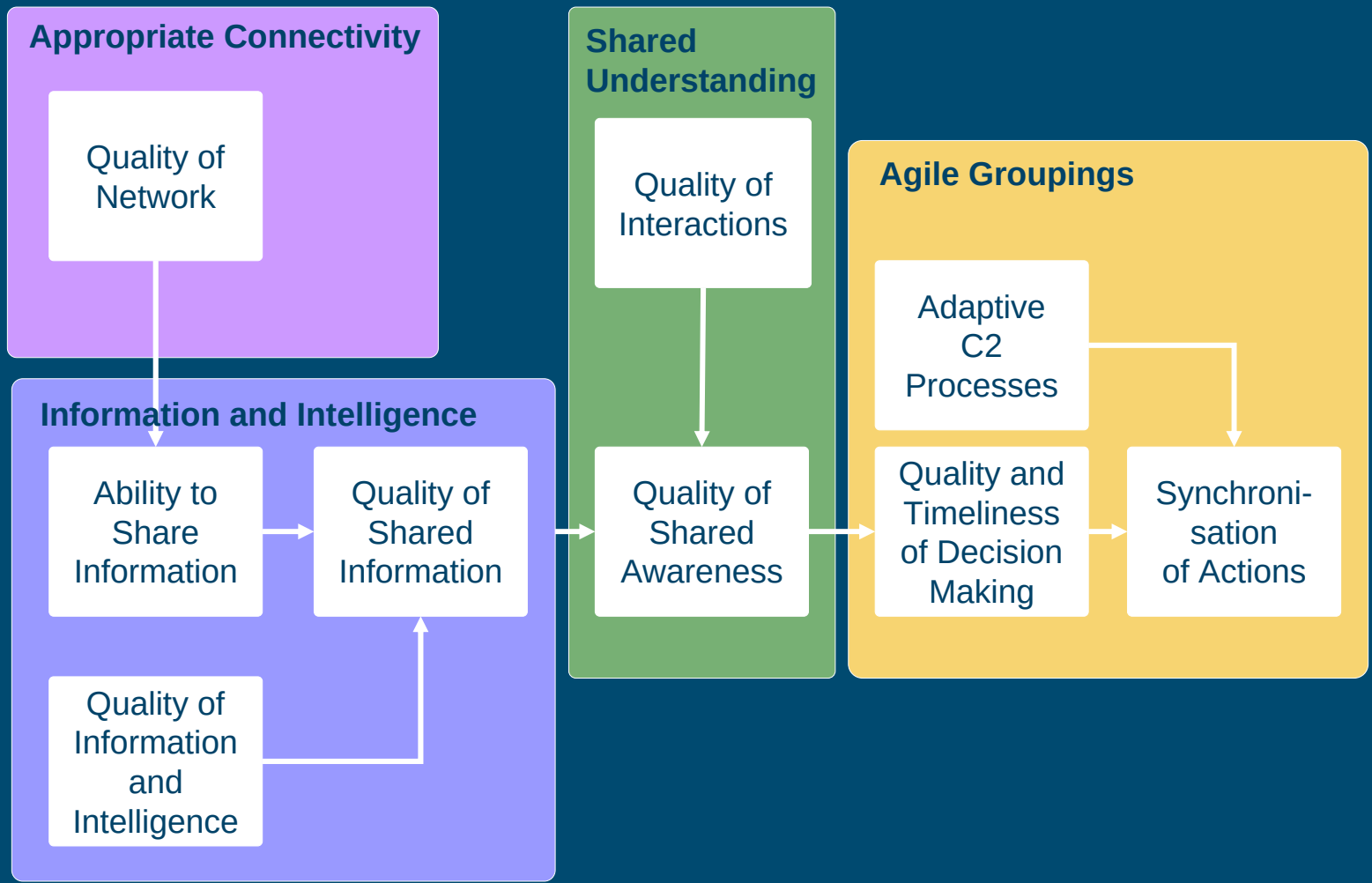

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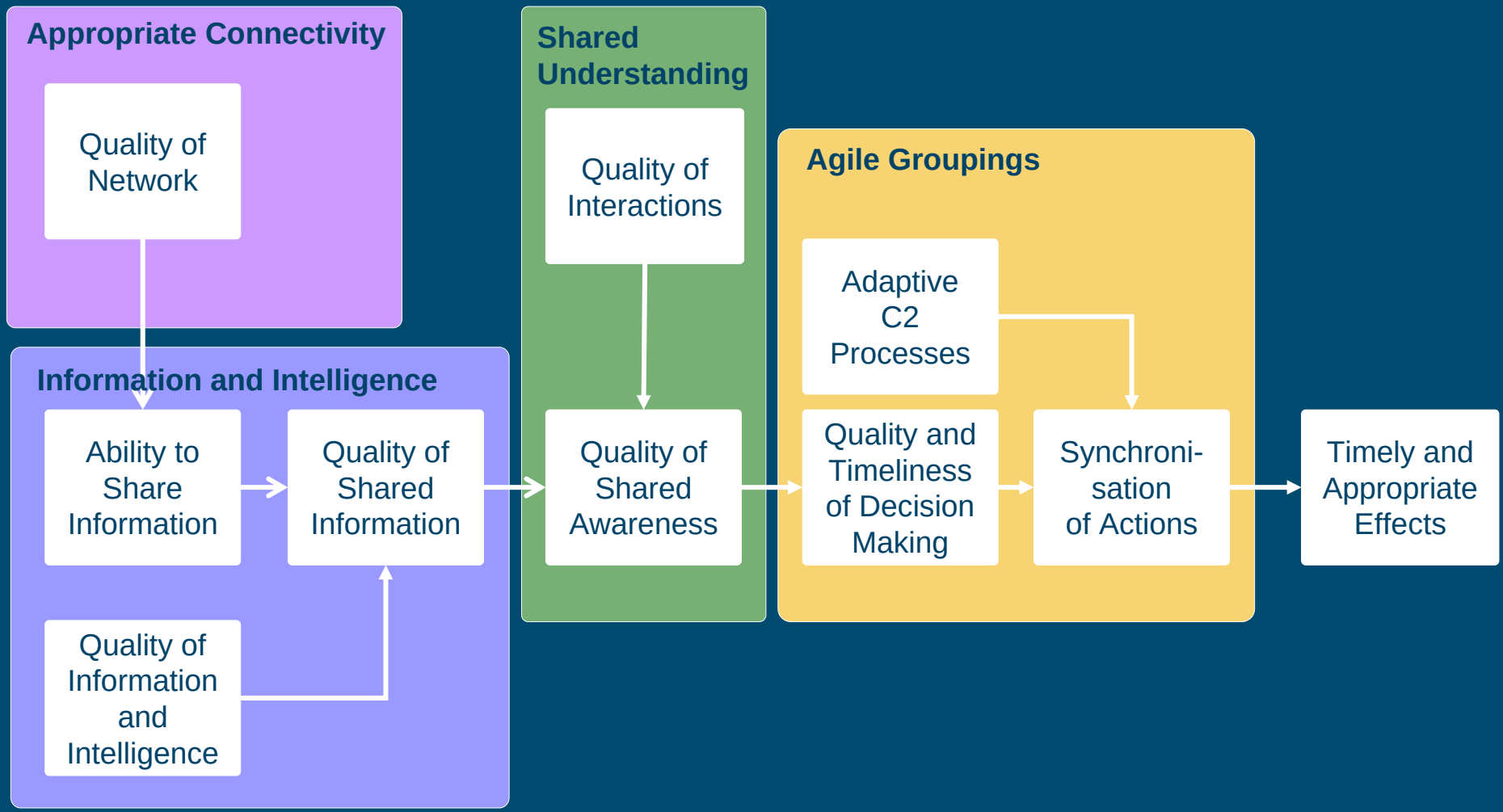

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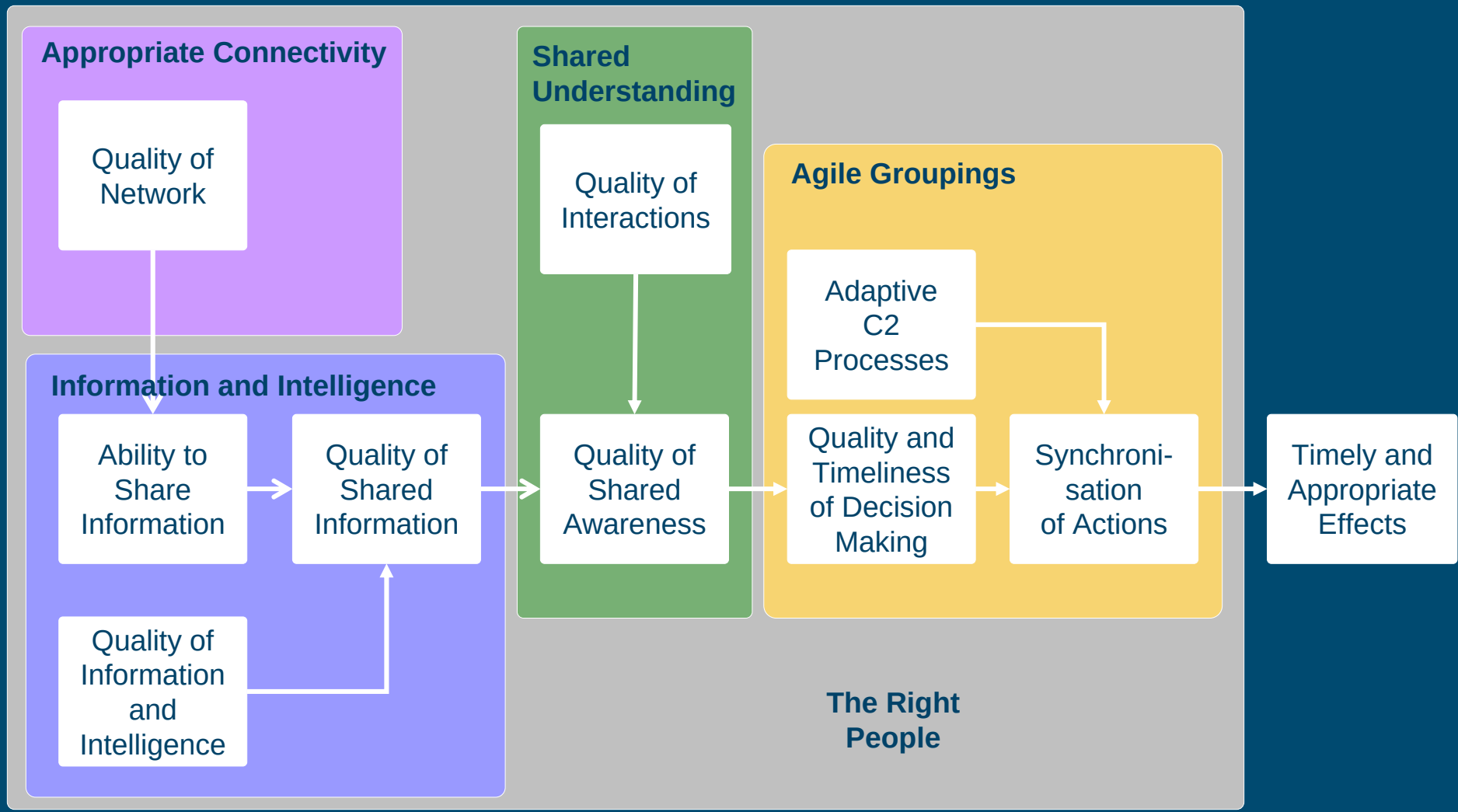

Application

- Process of validating the chain assisted MoD in making decisions about how NEC should be implemented to ensure benefits are realised
  - Coherent investment across the chain is evidently more beneficial and less risky than concentrating on one box at a time
- The modified benefits chain has provided a evidence-based framework for thinking about NEC. It is being used to:
  - Consider future C2
  - Structure an NEC knowledge base

Conclusions

- The NEC benefits chain can be largely supported by evidence with a few modifications.
- More generally, scientific evidence can be used to validate the arguments presented by a benefits chain
  - It has been possible to do this using existing knowledge
  - It has been useful to do so