

**SHOAL™**

# **REFRAMING OUR FUTURE**

**POST COVID-19**

**2020**

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The Australian response to the Coronavirus Pandemic has highlighted the need for us, as a nation, to become more resilient. As we step out of damage control and into the future, now is the time to bring perspective and insight, and reframe the discussion.

Evidenced-based decision making, across the whole of society, will be important in addressing future crises. We need to ensure that these decisions appropriately balance what might be competing or contradictory actions.

The gathering and presentation of all factors, their relationships, and an understanding of the various impacts on different parts of society will be critical in optimising future responses.

Assessing this is no easy task.

# INTRODUCTION

This report builds a case to **reframe our future** and build national, strategic resilience. We explore the elements to consider, the methodology, modelling and implications, to identify frameworks that enable:

- Information-based decision making in challenging and dynamic contexts
- Exploration of patterns and interrelationships, across industry, and their strategic implications for us, as a nation.

From the Australian response to the Coronavirus pandemic, two things are certain:

## 1 **The responses made on this occasion will provide the template for future responses**

To this end we need to closely consider both the actions and the reactions, assess the various inputs and outputs, and hence gauge the linkages and relationships of the response as a system, within the broader system of Australian society.

## 2 **There is always room for improvement**

That is, the template created from the current situation can be improved to potentially provide a more targeted, more nuanced, more effective response to the next crisis.

We need to identify and understand the conceptual structures and principles for integrating the economic, social, ecological, legal and institutional dimensions of these decisions.

By doing so, we reframe the discussion into one of national, strategic resilience.

# REFRAMING

‘Reframing’ is a technique that we use to understand a point of view or different perspective.

Reframing a situation can change the way we think, feel, or behave. In **systems thinking** and **systems engineering**, we design and apply frameworks to support decision making. Decision frameworks are diverse and vary in their application, but they can and should be applied to influence and improve the way in which we think about our future response options to build national, strategic resilience.

# VISION FOR NATIONAL RESILIENCE

The COVID-19 crisis has exposed elements of Australian society with respect to our ability to operate, indeed survive, through a concentrated period of national disruption. Whilst the situation originated as a health crisis, it rapidly developed into an economic crisis and highlighted the importance of understanding relationships between elements of the Australian society and the associated vulnerabilities. In that sense, it has also become a social crisis.

Although Australia has been more fortunate in terms of health impact in comparison to Europe and the United States, the crisis provides an opportunity to assess these vulnerabilities, and not only to just address them, but to consider at the strategic level the vision for Australia as we move into a new reality. In this way we can build a stronger, more resilient nation, and be better prepared when the next crisis develops. At its core, there are only a small number of key factors that drive our consideration of the future.

1

## **We want to be independent and secure**

Independence implies that we have freedom to choose our system of government, and the ability to evolve societal norms such as freedom of the press, the right to free speech, and respect for the privacy of an individual as our society chooses. This requires the rule of law to prevail, and hence we need functioning social institutions such as parliament and the courts.

## Security is the natural corollary of independence

Security, in turn, is largely a function of credibility; credibility that the nation is able to take such actions necessary to deter or defeat a would-be aggressor. The path to security, however, involves more than just the military. It also requires diversified trading and supply chain partners so that one supplier is not able to exert unacceptable and unsustainable economic pressure. Security also requires a stable society. Security therefore requires national resilience, the ability to weather the storm of a crisis and the ability to recover afterwards.

We have an obligation on future generations to use the current crisis to review and improve resilience within the Australian community.

Life after the current pandemic cannot just be a restart of an approach that has been inadequate.

Resilience can be addressed through concentration on a small number of factors, determining how they inter-relate, and hence having a picture, a model, of this inter-connectedness. At the macro level these factors can be considered as:

### Continuity of **government**

Requires the ability to choose and to conduct free and fair elections

### A capable and functional **defence force**

Necessary for deterrence and for defence. In turn, this depends on defence industry capabilities

### Provision of **energy** in a reliable and sustainable manner

### A capable and functioning **health system**

### Ongoing provision of **food** and **water**

### A functioning **telecommunications network**, with a high level of **cyber protection**

### Robust transportation

All of these factors are inter-related and all will depend on additional inputs from other areas within society, such as having a productive industrial base and an advanced academic system. Given that investment is likely to be required and funding will be finite, it is also going to be important to prioritise the available resources into the most critical areas, to understand the interactions across and within the local economy and supply chains, and to understand the flow-on impacts from the decisions that are made in order to maximise value of the investment.



# THE CYNEFIN FRAMEWORK

During the early days of the pandemic, the way that governments, authorities and organisations managed the emerging, volatile, or even chaotic, pandemic environment can be explained David Snowden's Cynefin framework. As Snowden and co-author Kurtz highlight, it is a framework that *"...gives decision makers powerful new constructs that they can use to make sense of a wide range of **unspecified problems**."* It helps decision makers avoid using the same approach in all circumstances by refocusing and adjusting the approach to the context at hand.

The Coronavirus Pandemic is certainly an *"unspecified problem"* that exists in a challenging and dynamic context. From the Cynefin framework, it is clear that Australia was in a chaotic decision-making context, with cause and effect unclear, and Governments needed to act quickly to stabilise the situation ('flatten the curve').

On the 22nd March 2020, the Australian Prime Minister announced a number of extraordinary actions that set the rules on how we, as a society, needed to respond to the Coronavirus Pandemic. It was clear that there was no guidebook that could be harnessed to deal with the significant health and economic impacts of the pandemic. As the Cynefin framework proposes, there was no 'rational choice'. The Government just had to act. This action appeared to stabilise the situation here in Australia, for the moment.

Governments must continue to sense the situation and respond accordingly. As Snowden indicates, the goal is to move from the **chaotic** to the **complex** decision-making context of the Cynefin framework. That is, we have moved to a context where patterns emerge and *"...cause and effect relationships ... defy categorisation or analytic techniques."* This gives us time to probe, experiment with response options and expose patterns in a considered way, using guidance from available expertise. We can do so safe with the knowledge that we can revert to previous measures, if required, that can control the situation.

Our national response 'writes the guidebook' for future responses. This emergent practice, as Snowdon hypothesises, is what can be used to make Australia more resilient to future pandemics. However, we must be cautious not to become complacent, because the definition of resilience needs to be explored across our community, as first responders, as essential workers, in food security, in infrastructure, national security, sovereignty and beyond. And, as we have found during the pandemic, our resilience is limited.

In parallel to our response to the Coronavirus pandemic, we need to learn from it and start shifting our thinking towards preparedness for the next national shock. For future shocks, our emergent practice for managing the response may only be part of the solution to achieve and sustain national resilience.

Resilience is a hard-won concept to achieve and we must continually evolve and improve. To do so, a National Resilience Framework is needed to enable impartial, consistent and contestable decisions to shape the nation's balance of investment and give the greatest level of resilience.

We will continue to explore various frameworks, whether that framework is established within the context of the Cynefin framework, or others.

As a nation, we need to challenge ourselves to be more resilient across all aspects of society and prepare ourselves for the next shock.





# UNDERSTANDING RESILIENCE IN SYSTEMS

## SO WHAT IS RESILIENCE?

The word **resilience** is derived from the Latin verb 'resilire', which means to 'recoil'. When you think of this in terms of a spring, recoiling is to return to its original form. For another definition, we can look to Merriam-Webster's online dictionary. It provides two definitions of resilience that are broadly similar, except that they diverge through the perspectives of the physical and functional aspects of systems:

1

### Physical

The capability of a strained body to recover its size and shape after deformation caused especially by compressive stress

2

### Function

An ability to recover from or adjust easily to misfortune or change.

For a National Resilience Framework, in the COVID context, we need to focus on the behaviour of a system, or its function. We are considering that the system of interest needs to perform (function) in a resilient manner i.e. being resilient to recover from misfortune.

In some contexts, resilience can be considered opposite of brittleness. If there is no resistance to the

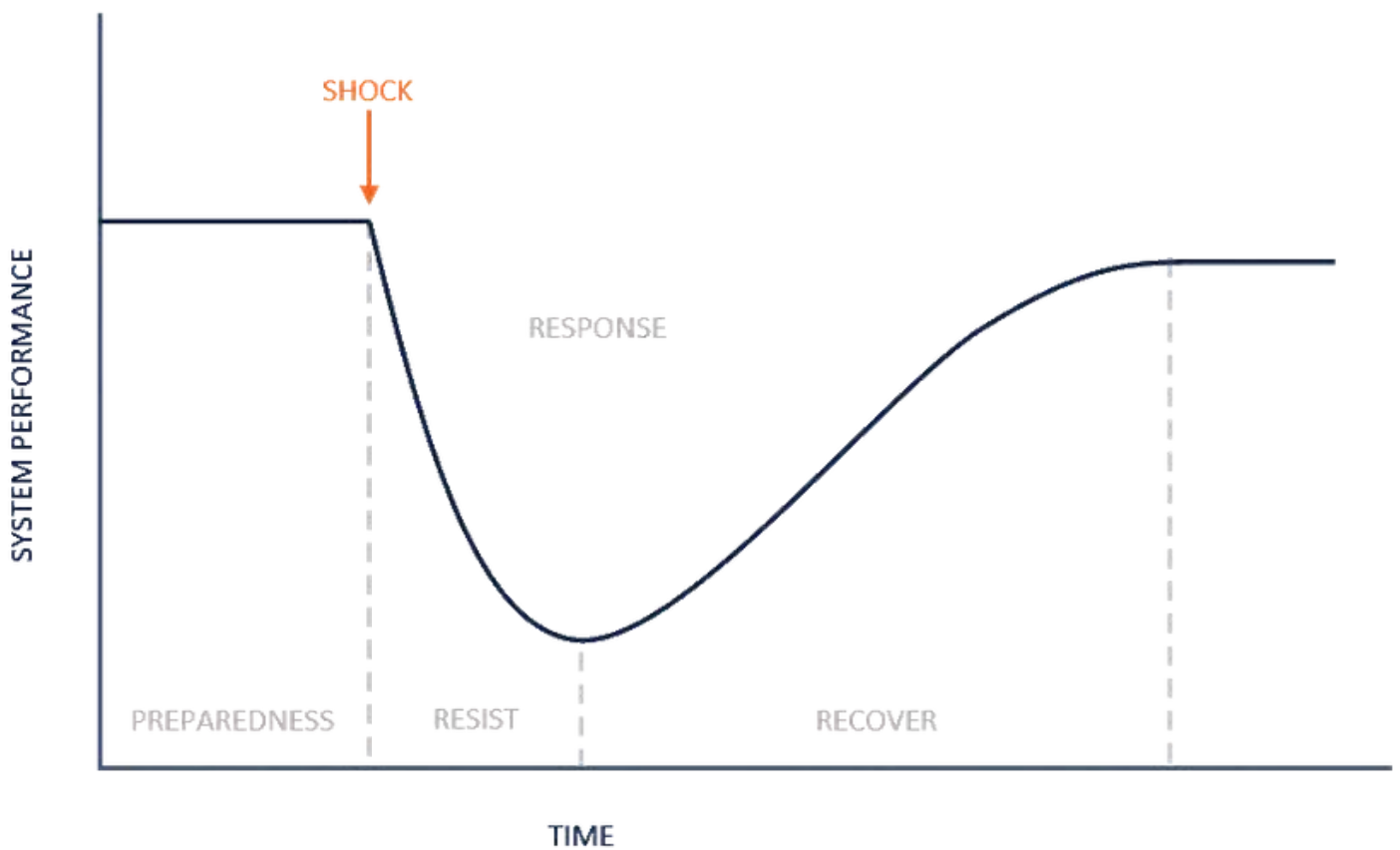
shock and the effects promulgate through the system unabated, then the system will fail. There will be no opportunity to recover. If there is resistance to the shock, but no recovery, then the effects of the shock will still promulgate through the system unabated, albeit at a slower rate, and the system will fail. In both cases, the system is brittle, with catastrophic failure resulting from the shock.

A simple example maybe that of a GPS-based electronic map versus a paper map. If you drop your electronic device and break it, the electronic map has failed too. It becomes a dead weight. It is brittle. Conversely, if you drop a paper map, it may become dirty or torn, but the map can still be used, albeit in a somewhat degraded state. It is resilient to the shock.

As you can see by this example, resilience is context dependent. With the map example, a shock of a fire would have a different outcome. The paper map would be ash, but the electronic map would be singed but still working. Context is important.

Resilience in systems, whether they are physical, organisational, or societal, is the ability of that systems to resist and recover from a shock to the original performance or better.

# SYSTEM PERFORMANCE OVER TIME



Resilience is the ability of a system to firstly resist the misfortune, or **shock**, and then to **recover** from the shock-induced drop in performance and re-attain the original performance or better

# UNDERSTANDING DECISION FRAMEWORKS

A methodological approach of exploring how we develop a National Resilience Framework is from a Systems Thinking perspective. Systems Thinking, and the range of associated methodologies, tools and frameworks, provide an insight on how a National Resilience Framework can be constructed and applied in practice.

Decision Frameworks are diverse and vary in their application and, at their core, are designed to facilitate robust and contestable decisions. They include aspects such as problem definition, strategic goals, planning and observations, and provide a conceptual, or abstracted view, of the issues and insights that inform decision making.

Structuring, or codifying these conceptual and integrated aspects, provides a richer picture to the decision maker. Decision Frameworks give structure to the information, integrating multi-disciplinary domain knowledge, thereby enhancing the understanding in the decision maker.

Decision Frameworks, based on systems thinking, support policymakers to understand the multi-domain and interrelated consequences. At Shoal, we employ model-based frameworks to improve our designing of resilient and elegant solutions to complex problems, whether they are physical, organisational, or societal.

They provide us with three main outcomes:

1

They facilitate the exploration of options and capture decisions, with rationale

2


They integrate information from across multi-disciplinary domains

3

They enhance our knowledge transfer, providing a current and common understanding such that the knowledge from the mind of the producer (analyst) can be easily transferred to the mind of the consumer (decision maker).

As highlighted by Senator the Hon David Fawcett in his recent Covid-19 pandemic article in The Strategist, *'failure mode effects and criticality analysis'*, or FMECA, is a decision framework that supports the analysis of component systems, generally from different disciplines, in order to determine the failure probability of the whole system, such as an aircraft in Senator Fawcett's example.

This FMECA facilitates the exploration of failure probabilities with rationale (Outcome 1, above), integrates the knowledge from across the different system components (Outcome 2) and then communicates this to decision makers (Outcome 3).



Another example is the Causal Loop Diagram (CLD). A critical Systems Thinking tool, this aids decision making by representing the different interrelated components, and their relationships to inform decisions. Declan Bradley and co-authors published an article on [“A systems approach to preventing and responding to COVID-19”](#) that demonstrated the application of a simplified causal loop diagram to illustrate the interacting *“components in a society responding to the threat of COVID-19”*.

In this example, CLD provides a visualisation of the different interrelated components that represent societies response to COVID-19. The connections between components indicates either a positive or negative relationship which allows for the closed cycles to be discovered as either a reinforcing or balancing feedback loop. Their CLD facilitates the exploration and analysis of the components in society (Outcome 1), integrates the knowledge from across the different components (Outcome 2) and then communicates this to decision makers (Outcome 3).

As we can see from these two different examples, Decisions Frameworks have common principles, processes, and practices that enable information and analysis to inform decisions. They identify the problem, support the capture and analysis of information and build the knowledge towards informing decisions across all aspects of society. If we are to develop a National Resilience Framework, we must capture the relationships between the various components within

society in order that the most effective decisions can be made.

A well-structured, model-based decision framework can allow us to achieve this and deliver the robust and contestable decisions we need.

# RESILIENCE

## FROM POLICY TO IMPLEMENTATION

We want to be able to withstand a future pandemic or shock inducing event. We want to be a resilient society. To do so, we need to consider risk. A risk-based approach to national resilience would see resilience activities, including supply chains, broken down into three categories.

1

### High risk

Those goods and services that we must control from within Australia, as not to do so would expose us to totally unacceptable risks – existential risks. Addressing these risks cannot rely upon anyone else – not even the closest of allies.

2

### Medium risk

Those goods and services that are not potentially existential, but of sufficient concern that we cannot just rely upon market forces, and certainly not on authoritarian governments or easily-interdicted supply chains for their provision.

3

### Low risk

In this case open, market-driven, global supply chains are acceptable, as we have made the determination that the risks are low.

When allocating good and services to each risk category, we need to understand the supply chain. Importantly, we need to understand changes in those supply chains, in order to determine if / when they cease to be low risk, for example, and become something else.

Three key elements for policy arise from this discussion.

### Vary policy according to risk

High risk products and services are likely, in the near term, to require government investment to establish the relevant domestic capability – given that these are unlikely to currently exist. (If they did, we would not be having this discussion). In the longer term, government monitoring and management going to be required, as high risk products and services are likely to change over time as the geopolitical situation changes, as technology changes, and as Australian society changes. Whilst medium risk and low risk categories will require levels of investment commensurate with the risk, that is less investment as the risk reduces, ongoing review will be required to account for the changes as outlined above.

## Extent

The second issue relates to extent. It simply will not be acceptable to stove-pipe the policy settings required into the familiar departmental structures. The categories noted above cover a broad swathe of the Australian economy, all inter-related, and it will be important to understand these relationships and the flow-on effects across the economy, and across society, of particular actions.

## National Resilience Roadmap

The third issue, that flows directly from the second, is that a National Resilience Roadmap is required, together with a National Resilience Framework, for its implementation. The Framework must capture the relationships between the various components within society in order that the most effective decisions can be made. As discussed, a framework gives decision makers a tool to identify relationships and adjust levers and see the cause and effect implications of each.

# REALISING A NATIONAL RESILIENCE FRAMEWORK



We set out on the path to 'Reframe our future', as a way to step out of the Australian response to the Coronavirus Pandemic of 'damage control' and bring a perspective on reframing the discussion to build national resilience. Damage control has been an important step, but it has accentuated the fragility of our economy, our sectors, supply chains, health system, border security and sovereignty. It has also highlighted another key aspect; that is, the interrelationships between each element of a resilient society.

Each of these elements are a system within themselves and none of these systems are discrete. They are, in fact, a 'system of systems'; which is where Systems Engineers can make a real contribution to enable strategy and support change. By modelling the systems and their interrelationships, we can integrate and analyse information across multi-disciplinary domains to inform decision making and enable strategy.

**What is, and how would you implement, a National Resilience Framework at the technical level to support the decision makers?**

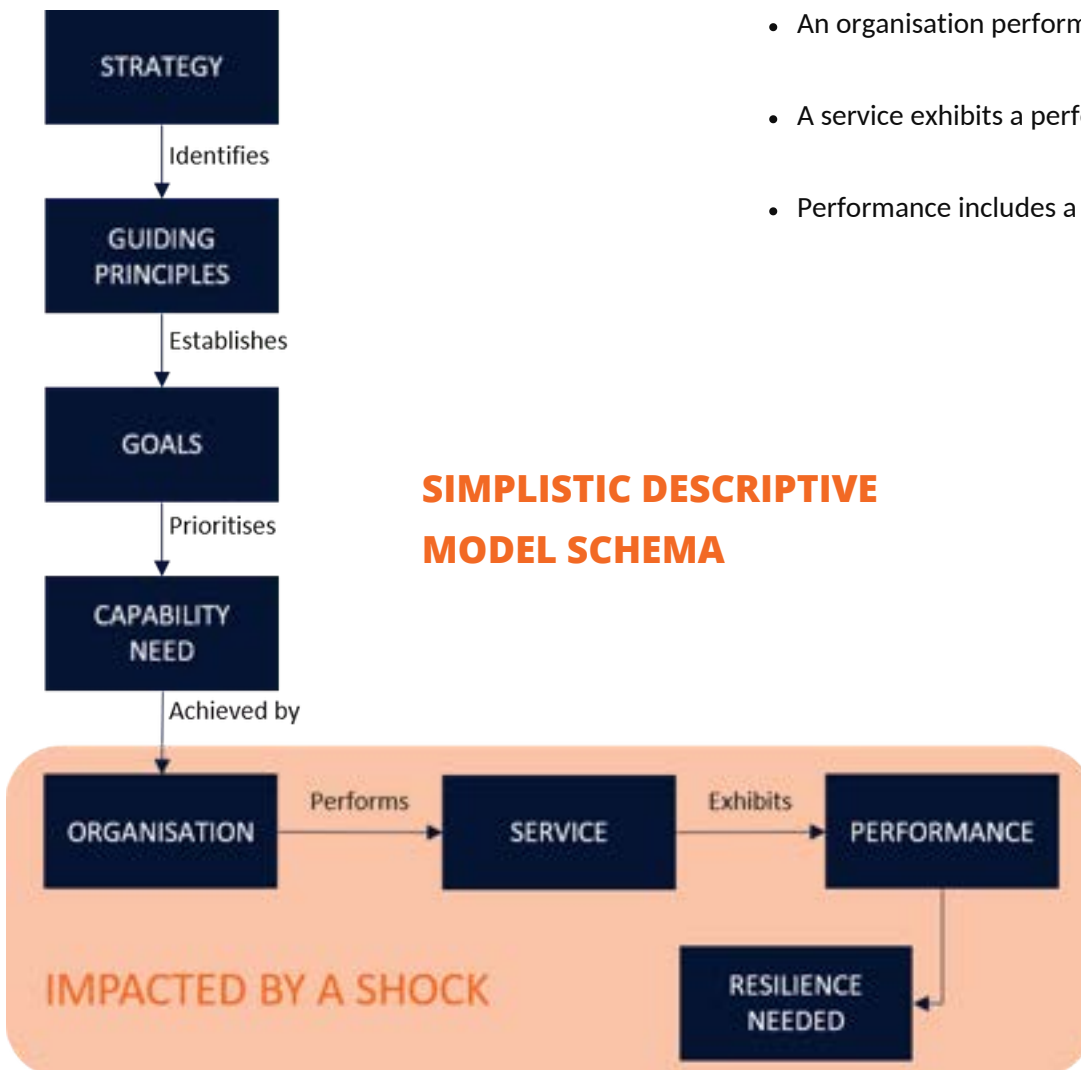
We have explored frameworks such as a Causal Loop Diagram (CLD) or a Failure Mode Effects and Criticality Analysis (FMECA). Outside of this is the recent rise in visual-based decision frameworks. These 'dartboard' style frameworks generally categorise many aspects such as leadership, society, or health in quadrants of a circle. They then provide some guiding principles and goals to address each of these categories, around the outside of the quadrants making up the dartboard. Visually, they are a useful tool and have their place, however, as a framework, they are too high-level. They lack the analytical detail of interrelationships and activities provided in tools such as CLD and FEMCA.

Regardless of the approach taken to decision frameworks, there is a need to codify these high-level conceptual guiding principles and goals, and relate, or trace, them to the analytical detail of interrelationships and activities at the implementation level. In other words, provide a **digital thread** of logic, from strategy to implementation. This 'digital thread' codifies the information and decision rationale to deliver the robust and contestable decisions we need.

An entity-relationship model (ER Model) is applicable in this context. Originally designed by Peter Chen in his seminal work on a 'Unified View of Data', an ER Model provides us with a valuable and robust approach that describes the interrelated aspects (such as 'guiding principles' or 'failure modes' referenced earlier) in a specific domain of interest. This description of the 'Entities' their 'Relationships', and attributes of each, enables both a digital thread of logic and a codified definition of a problem space that can be systematically analysed and decisions subsequently made.

As a simplistic example, and drawing on the referenced decision frameworks, consider the following thread of reasoning and logic:

- A strategy identifies guiding principles
- Guiding principles establishes goals
- Goals prioritise capabilities needed
- Capabilities needed are achieved by an organisation
- An organisation performs a service
- A service exhibits a performance
- Performance includes a level of resilience needed





This simplistic underpinning schema, or ontology, categorises the information classes of the problem of interest and provides the structure that delivers a decision framework. This can then be used for robust and contestable decisions. The structure in the schema is utilised to capture the instantiations of the real-world information of the problem, in a 'descriptive model'. The instantiated descriptive model provides the analyst and decision makers with the visible knowledge at their fingertips to gain the insights from a digital thread of logic and reason over issues such as the impact of a shock or viable solution options.

The challenge with the complexity of 'wicked problems', such as enhancing our national resilience, is that some **Systems Thinking** tools cannot be stretched to robustly cover all aspects of the problem space. As considered by George Miller, from Harvard University, in his 1956 paper in the Psychological Review, that is still relevant today, we limit our "...judgments to about seven categories." This is where a well-structured descriptive model can help. The structure allows for the decision maker to focus on a single digital thread of reasoning and only visualise the aspects needed to make the decision, whilst being informed on the broader issues. Other tools, that aren't model-based, quickly become unacceptable for supporting the decision making when they extend beyond tens of components and relationships. This is the level of complexity that we expect with a National Resilience Framework.

A model-based decision framework enables better decision making by providing a structure and hence bringing clarity to the interconnectedness of cross-domain problems and solutions. This is even more

important for decisions around building national resilience, where Government investment is likely required and funding will be finite. It will deliver a 'rich picture' of an appropriate sub-set of information to the decision makers providing the digital thread of rationale that realise contestable decisions. Better decisions. Particularly around prioritising available resources to maximise the value of the investment.

Expertise and an understanding of the ontology of problems is important in framework design. How decisions are made, and information and rationale must be captured in descriptive models by experienced **systems engineers** to support development of a National Resilience Framework for robust and contestable decisions.

## ABOUT SHOAL

We are leaders in **systems thinking**. We use it to help clients define, manage and deliver big projects in complex environments; the kinds of projects that you dream of, but then have nightmares trying to figure out. These projects often have lots of moving pieces that are interrelated and technically challenging, so we use a rigorous, complex **systems engineering** approach, based on best practices gleaned from around the world (amongst which are our own).

When we do this, all the pieces of the system come together to enable our clients to make better decisions, adapt, avoid risks and achieve objectives through robust decision frameworks and modelling.

Founded in 2001 and headquartered in Adelaide, our team extends across Australia, New Zealand and North America.

# MEET OUR AUTHORS

As Chief Engineer and Head of Blue Water, Kevin leads the engineering and innovation capability at Shoal. He oversees the development of individual and team professional mastery in systems engineering and technical domains; ensuring the delivery of quality products for domestic and international clients.

Kevin also heads Blue Water, providing leadership in innovation, and research and development. Blue Water is a strategic business focus area that ensures we retain our competitive edge in systems engineering internationally and invest in commercialising new technologies, approaches and methodologies.

Along side his commitments to Shoal, Kevin is an active contributor to professional associations and is widely published. He is a Chartered Engineer and has two MSc, one in Control Systems Design and one in Guided Weapons Systems Engineering.



**KEVIN ROBINSON**

Chief Engineer and Head of Blue Water

As Head of Strategy at Shoal, Graeme works closely with our leadership and business development teams. He seeks to align opportunity with our vision, to enable Shoal to grow and extend our knowledge and **systems thinking** expertise in complex problem solving to new clients and markets.

Currently undertaking a PhD on defence industrial sovereignty at the Australian National University, Graeme is a regular contributor to publications including The Strategist, Australian Pacific Defence Reporter and Australian Defence Magazine.

Graeme has significant international experience as a business manager, project manager and business developer, working in Europe, the United Kingdom, Singapore, Pakistan and India. He holds Master's Degrees in Strategic Studies and Maritime Defence Technology, a Bachelor of Science in Pure Mathematics, an Insignia Award in Technology from the City and Guilds of London Institute and a Diploma of Maritime Studies.



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# REFRAME

PROBLEM SOLVING TO BUILD  
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