



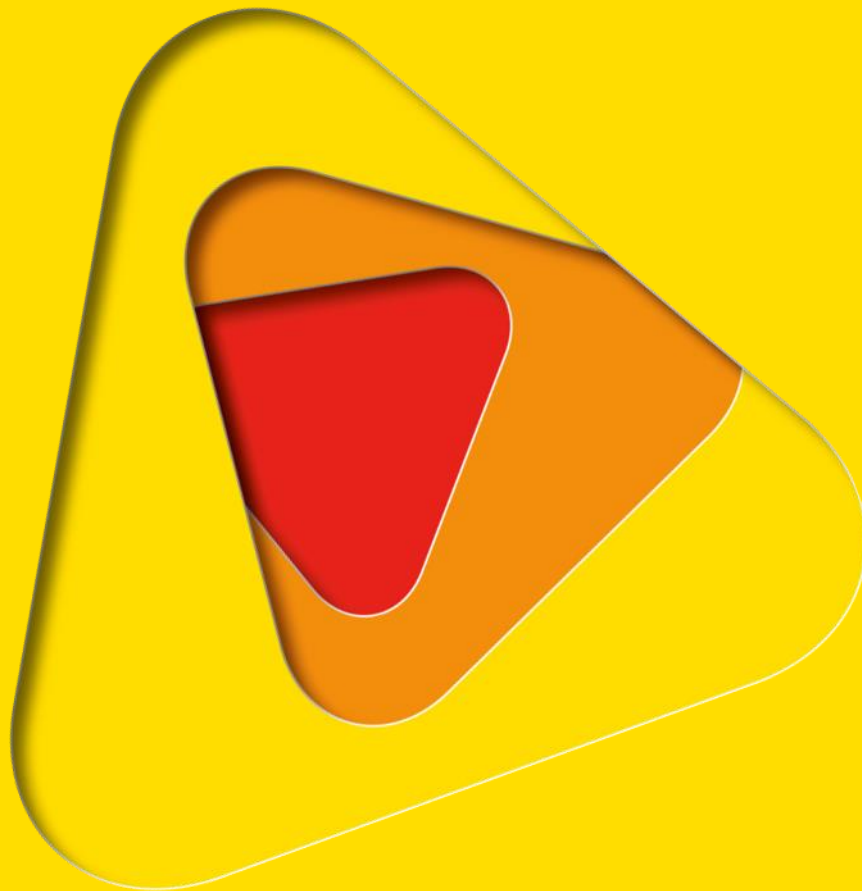
DISCOVERING FUTURE DISASTER MANAGEMENT CAPABILITY NEEDS USING SCENARIO PLANNING

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ABSTRACT

In recent years disaster risk reduction efforts have focussed on disturbances ranging from climate variability, seismic hazards, geo-political instability and public and animal health crises. These factors combined with uncertainty derived from inter-dependencies within and across systems of critical infrastructure create significant problems of governance for the private and public sector alike. The potential for rapid spread of impacts, geographically and virtually, can render a comprehensive understanding of disaster response and recovery needs and risk mitigation issues beyond the grasp of competent authority. Because of such cascading effects communities and governments at local and state-levels are unlikely to face single incidents but rather series of systemic impacts: often appearing concurrently.

A further point to note is that both natural and technological hazards can act directly on socio-technical systems as well as being propagated by them: as network events. Such events have been categorised as 'outside of the box,' 'too fast,' and 'too strange' (Lagadec, 2004). Emergent complexities in linked systems can make disaster effects difficult to anticipate and recovery efforts difficult to plan for. Beyond the uncertainties of real world disasters, that might be called familiar or even regular, can we safely assume that the generic capability we use now will suit future disaster contexts?

This paper presents initial scoping of research funded by the Bushfire and Natural Hazards Cooperative Research Centre seeking to define future capability needs of disaster management organisations. It explores challenges to anticipating the needs of representative agencies and groups active in before, during and after phases of emergency and disaster situations using capability deficit assessments and scenario assessment.

INTRODUCTION

Emergent risk-related phenomena such as climate change; public and animal health crises; destabilised nations; the increasing hyper-complexity of embedded information-communications-technology (ICT); and emergent inter-dependencies within and across systems of infrastructure, create significant problems of governance for the private and public sector alike. Unmitigated disturbances from such sources are likely to generate cascading impacts propagated along unexpected pathways and fault lines throughout commercial and institutional segments of established and establishing economies. The potential for rapid spread of consequences, geographically and virtually, can render a comprehensive understanding of a crisis's context beyond the grasp of competent authority.

Because of these cascading phenomena, response and recovery agencies would be unlikely to face single incidents but rather series of systemic failures: often appearing concurrently. A further point to note is that both natural and technological hazards can impact directly on socio-technical systems as well as being propagated by them: as network events. Such events have been categorised as 'outside of the box,' 'too fast,' and 'too strange' (Lagadec, 2004). Emergent complexities in linked systems often make moving impacts of emergencies difficult to anticipate and consequences difficult to plan for. Further, under emergency conditions the pressure on senior decision-takers to 'make-sense' of multiple lines of information (for both crisis and consequence modes) is significant.

An issue of some importance to both public and private sector alike relates to whether increased awareness, derived from involvement (direct or in-direct) in such failures, can actually reduce the likelihood of future failure or at least attenuate consequent impacts.



A further question of possibly greater importance is whether such enhanced awareness or experience of past disasters can be used to plan future capability need.

This paper presents initial scoping of research funded by the Bushfire & Natural Hazards Cooperative Research Centre (BNHCRC) seeking to define future capability needs of disaster management organisations. It explores challenges to anticipating the needs of representative agencies and groups active in all phases of emergency and disaster situations using capability deficit assessments and scenario planning.

ANTICIPATION NOT PREDICTION

THE NEED FOR FUTURES-THINKING IN DISASTER MANAGEMENT

Surprise has always had an egalitarian affect in society. To be surprised in a pleasant fashion is preferable to the alternative. Unfortunately, the alternative state has been present more often than not in many organizational crises through time and arguably recent natural disasters affecting Australia. Over the past decade the many natural disasters have triggered significant government assessments of the readiness status and efforts of first response and supporting services either via Royal Commissions or other formal investigations.

Critical incidents (or multiple concurrent incidents) may be triggered at any time in large highly complex systems. Such incidents might manifest suddenly and unexpectedly or may 'cook' slowly (without recognition) until some triggering event or process precipitates them. In either case incidents can be surprising and/or unexpected. The wider literature on complex socio-technical systems failure suggests that for many situations evidence is discoverable that confirms there had been 'signs' that a crisis was emerging from organisation's normal functional 'noise' (Perrow, 1984; Turner & Pidgeon 1997; Boin & Lagadec, 2000; Comfort *et. al.*, 2001, Rijpma, 1997).

Furthermore evidence in support of the idea that failure patterns may repeat is found in the cybernetic research of Stafford Beer in 1966 who suggested that while it was not possible to predict events *per se*, the pattern of interaction between *systemic* components (within organisations) is predictable. It has also been suggested that many organisational crises emerge in a number of common ways, yet never manifesting in exactly the same manner (Anderson, 1991).

Consideration that significant organisational emergencies manifest in repeatable and recognisable stages in major socio-technical failure (like fractals) is compelling and is supported by a substantial literature grounded in the analysis of industrial and organisational settings over a number of years. Stead & Smallman (1999) summarise key findings from a selection of this literature that identify specific stages in organisational failure, namely:

- *Pre-conditions* (sets of operational activity where 'signs' were buried or ignored in background noise);
- *Trigger* (an escalation factor either internal or external to an organisation or setting);
- *Crisis* (an emergent process exhibiting uncertainty and potential for loss and/disruption);
- *Recovery* (systems recovery and normalisation of functions);
- *Learning* (identification and changes to functional capacities of organisation/systems).

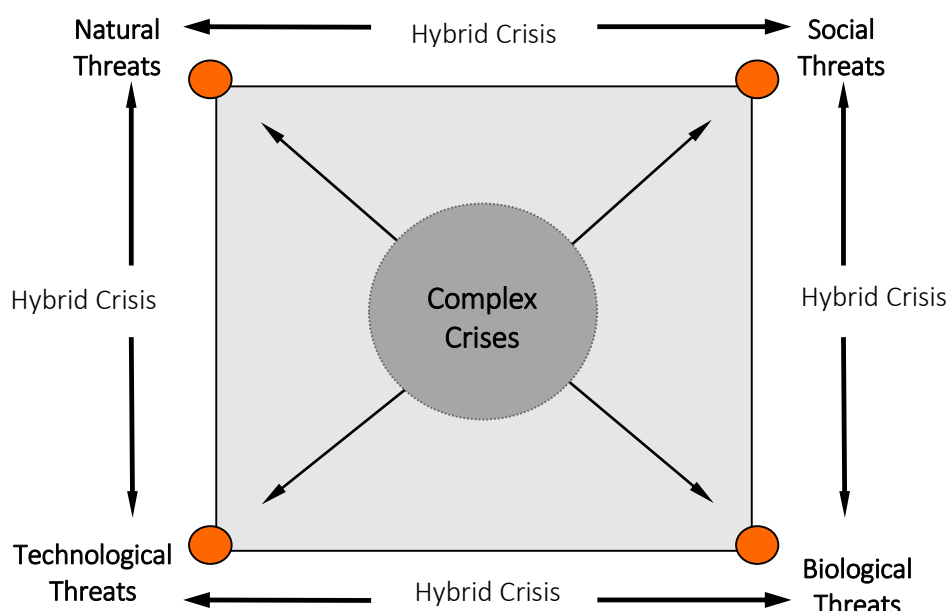
It is arguable that in natural disasters common effects inherent to the events themselves require degrees of repetitiveness in response and recovery actions.



So with a presumption that causal and conditional evidence about such failures always awaits discovery, normally afterwards, and that humans and human systems do 'learn' in such circumstances, the benefits of trying to anticipate future disturbances seems obvious. So apart from being professionally competent emergency and disaster response agencies, must also at times unlearn established practices (retain a capacity to adapt) in order to survive when the signs of imminent chaos are detected (Nystrom & Starbuck, 1984:53).

A practical reality in many larger natural disasters is that initial threat conditions rapidly morph into social, technical and biological impacts: facilitated by the socio-technical interdependencies of modern infrastructure systems (Parker & Tapsell, 1995). Figure 1 depicts this complex relationship. Response and recovery efforts for different aspects of such 'Complex' crises are normally coordinated by different agencies: as are prevention/planning and preparation efforts.

Figure 1: Complex Crises



With the assumption that a degree of familiarity exists amongst agencies with responsibilities for emergency and disaster management an appreciation that the cascading sub-category impacts would normally be present during large protracted events suggests a deeper understanding of the standard stages of the conventional (prevention, preparation, response, recovery) disaster continuum. The extensions¹ of the continuum are:

- **Prevention** – vulnerability reduction and recognition capability for emergent events and impacts;
- **Preparation** - for the both expected and unknown;
- **Response** - making effective decisions and having them implemented; and
- **Recovery** - restoring normality and learning.

However, both *preventing* and *preparing* for emergency situations presumes a deep and effective understanding of the manner in which the 'unknown' factors and conditions can manifest and how they might directly or indirectly exploit organizational and institutional vulnerabilities.

¹ Derived from Rhinard, M. et al. (2004).



Responding and *recovering* from crises also assumes an effective appreciation of mitigation and consequence factors. These levels of understanding presume planning, advice and that response agencies retain tacit knowledge of past disasters and can make-sense of confusing and at times conflicting information flows: a presumption that many iconic disasters have shown to be unsupported.

While the relative importance of these skills and the benefits of pursuing them are self-evident, in practice, they are not always present in a sustainable manner even in wealthy economies. There is also generally little said in major post-disaster inquiries about how to develop and sustain organisational capabilities that could form the basis of providing assurances to governments that institutions can apply response and recovery efforts efficiently and effectively.

A parallel issue to the notion that emergencies and related disruptions seem to manifest in familiar ways is the repetitive findings of many boards of inquiry into disasters and their impacts. Like the idea of failure fractals it is arguable that institutional capability and interoperability deficits may also exist. A 2011 review and analysis of recent Australian disaster inquiries by the Monash University Injury Research Institute (Goode et. al., 2011) identified common strategic issues and themes of significance that warranted addressing in order to enhance disaster management arrangements. These included:

- Critical infrastructure resilience
- State Emergency Management arrangements
- Shared responsibilities between Emergency Management agencies
- Professionalising Emergency Management workforce
- Research & databases
- Implementation of gaps and opportunities from (post-disaster evaluations)

Pollock (2013) identified similar findings in a review of deficiencies in large-scale disaster operations in 32 recent major disasters in the United Kingdom. Common factors include:

- Poor working practices and organisational planning;
- Inadequate training;
- Ineffective communication;
- No system to ensure that lessons were learned and staff taught;
- Failure to learn lessons;
- No monitoring/audit mechanism;
- Previous lessons/reports not acted upon.

Donahue & Tuohy (2006) provide evidence of similar deficiencies in United States responses to a number of iconic disasters: Hurricane Andrew; the Oklahoma City bombing; the September 11 attack; and Hurricane Katrina. Convergent findings suggest further familiar issues:

- The need to radically improve the way we train and exercise;
- The need for a comprehensive, nation-wide capability to gather and validate the information we learn from incidents, develop and vet corrective actions, and disseminate them to those who must inculcate the changes;
- The need for incentives to institutionalize lessons-learning processes at all levels of government.

In light of these findings it may be prudent to consider the benefit of a means to better understand how deficits in these areas might be better addressed. One particular organisational strategy relevant to enhanced understanding is the application of 'foresight' techniques.

**Table 1:** General Classes of Foresight Methods

Criteria	Methods
(1) Methods that are based on eliciting expert knowledge to develop long-term strategies.	<ul style="list-style-type: none"> • Delphi method • Expert panels • Brainstorming • Mind-mapping • Scenario analysis workshops • SWOT analysis
(2) Quantitative methods that make use of statistics and other data	<ul style="list-style-type: none"> • Trend extrapolation • Simulation modelling • Cross impact analysis • System dynamics
(3) Methods to identify key points of action to determine planning strategies	<ul style="list-style-type: none"> • Critical/key technologies • Relevance trees • Morphological analysis

Foresight is a systematic, participatory process, involving gathering intelligence and building visions for the medium-to-long-term future and aimed at informing present-day decisions and mobilising joint actions targeting future need (European Communities, 2001).

As shown of Table 1, scenario analyses are one of a number of strategic tools within a wider method-base of Foresight practice. Scenario making and analysis is a systemic method for thinking creatively about possible, complex and uncertain futures (Peterson et al. 1993).

The most effective use of scenarios with emergency management professionals would derive from avoiding the most likely event(s) and include a variety of disruptions and unanticipated situations, thus seeking to create a more reliable emergency response when confronted with a novel emergency (Bañuls et al., 2013).

The opportunity that this research seeks to take advantage of is the combination of the availability of many sources for 'lessons not-learned' from previous inquiries into disaster response, in combination with projections of weather variability, demographic change, and increased reliance on systems of critical infrastructure to create plausible future scenarios for the assessment of capability needs.

THE RESEARCH STRUCTURE

The Capability Needs for Emergency & Disaster Management project examined here combines approaches from futures thinking generally and scenario planning in particular in an all-hazards/all-agencies context to develop processes for engaging public and private sector organisations in examining a range of capabilities likely to be needed individually and collectively for managing near term and future disasters. It seeks to provide an approach for the development and testing of strategies, policies and capabilities in plausible future disaster contexts.

The research will engage with state and federal response agencies, as well as those supporting response and recovery, and local government, to examine in-depth lessons learnt from historical emergencies and disasters on a case study basis and via analysis of capability and capacity deficits. From this it will examine options for defining agile and sustained skills sets across the full cycle of disaster management. This study will also seek to enhance planning mechanisms to inform the delivery of effective disaster response and efficient recovery strategies for future emergencies.



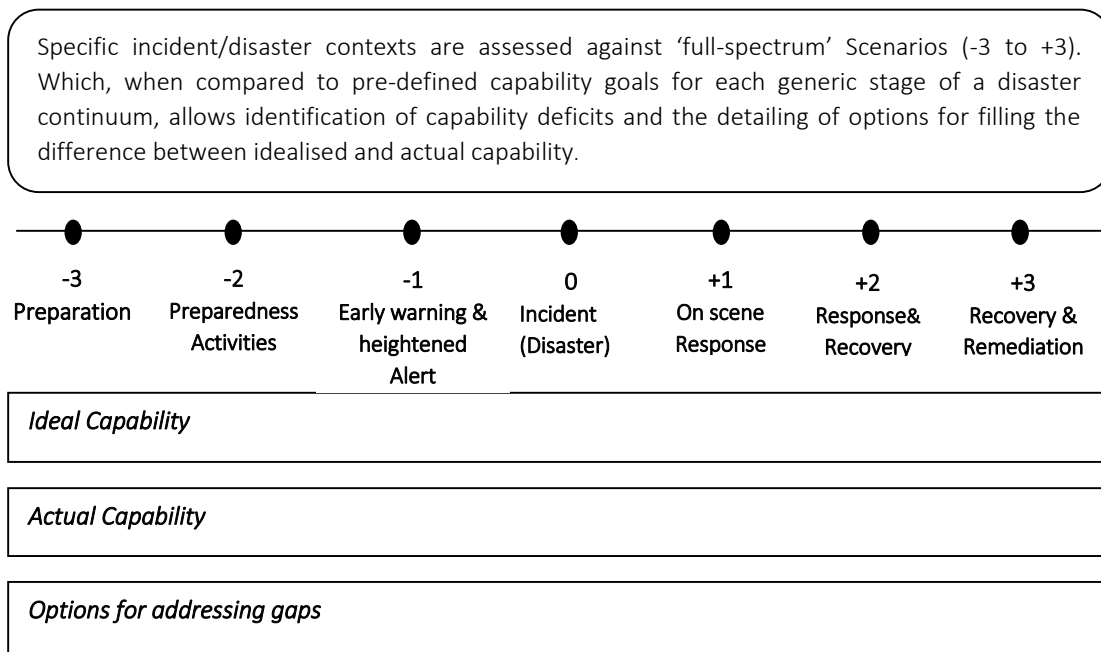
The combination of capability gap analysis and scenario based futures-based thinking will allow the formation of scaled descriptions of capability along a continuum of increasing effectiveness, adaptability and sophistication to contribute to strengthening community resilience.

The work is separated into three stages. **Stage one** will be exploratory with a number of reports planned to document initial findings related to interoperable capability needs relevant to response, recovery and other groups as well as incident scenarios (normal, infrequent and complex) and, the challenges of addressing certain types of capability needs assessments. It will also include the final design and testing of a capability gap assessment tool against three disaster scenarios in-concert with non-Government Organisations (NGO's), local government and state-based disaster management organisations across two state jurisdictions.

In addition to testing the tool, assistance from end-user representatives (above) will be sought to inform design and content of three disaster scenarios emphasising detailed descriptions of a range of consequences. The first scenario will be derived from recent disaster experiences in Australia and include aspects of the lessons not learned (from sources referenced above). The second scenario will be projected into the future and include the effects of expected climatic variability and socio/demographic changes to create a suite of plausible consequences maps against which capability gap assessment tool will be applied. The third scenario will projected further into the future and, like the second scenario, be made relevant to individual state jurisdictions and more broadly operational needs at a national level.

Stage 2 of the work will apply an accepted version of the Capability Gap Assessment (CGA) Framework (Figure 2 below) to detail initial assessments of capability deficits by engaging representatives from selected State-based agencies to document and contrast comparisons of idealised with actual capability to plan and prepare for, as well as respond to and recover from the impacts detailed in the disaster scenarios.

Figure 2: Scenario-based Capability Gap Analysis



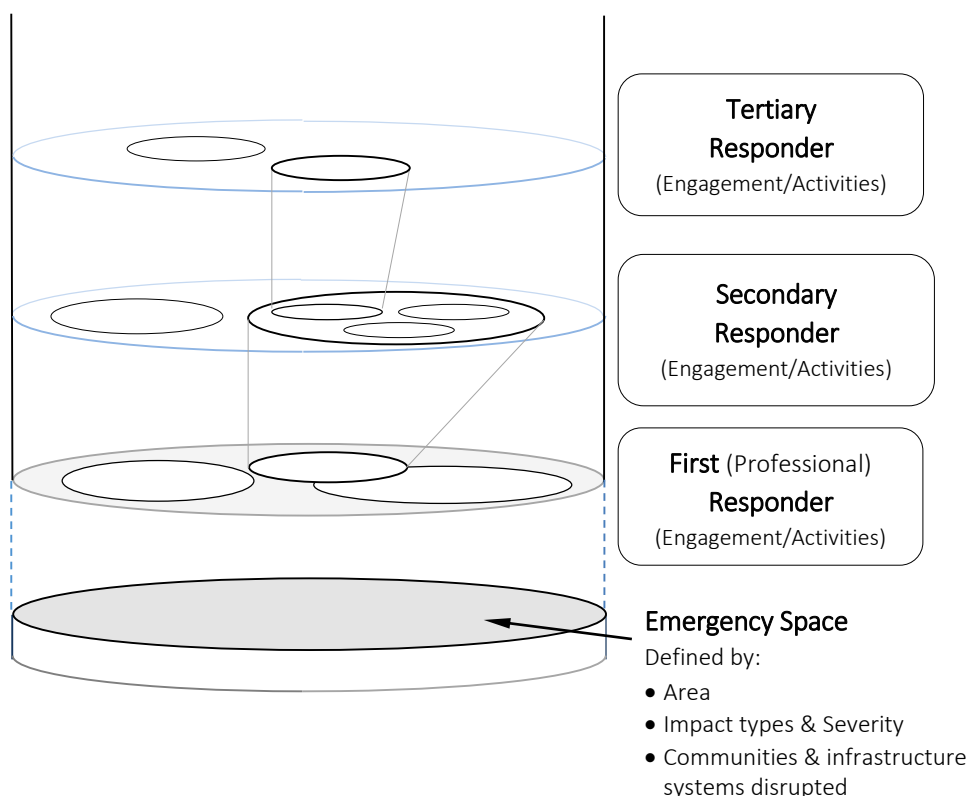


The first scenario will be grounded in recent experience of natural disasters (generic to most Australian state jurisdictions) and will be used to determine current gaps between idealised suite of capability descriptions and actual capability. The two other disaster scenarios mentioned above will be set at ten and twenty years ahead of current time. These projections will be reflective of current projections of climatic and environmental conditions expected to exacerbate the consequences of damage and disruptions from disasters.

Stage 3 of the work will apply the insight and findings derived from stage 1 and 2 to consider operational dependencies and interdependencies between agencies involved in disaster management. The viability of this endeavour is that an actual “all hazards/all agencies” response effort will entail planning and coordination across multiple groups within and outside government and a real-time, multi-location response. Pressure testing the vertical integration of the agencies is a likely to be a useful in the provision of disaster resilience at a state level.

Figure 3 below displays a representation of a vertically integrated capability map applied to an ‘emergency space’ that identifies certain key interdependent relationships needed to effect a comprehensive and sustained response and recovery effort. As detailed earlier the capability maps that this project seeks to create will entail defining key relational elements that embody the interdependencies of effective response recovery and remediation of essential services.

Figure 3: Vertically Integrated Emergency Response Capability



Critical relationships between responder agencies as groupings depicted in Figure 3 are central to the evaluative focus in this research. It is hypothesised that the effectiveness of disaster response will be level support entity.



The staged engagement of each layer of response into the emergency space will typically involve first Responders, and across secondary and tertiary stages, state Government Departments and Agencies, local government, as well as volunteer groups and welfare groups. Examining these relationships will address a major gap in the understanding and integration requirements across influenced by degrees of dependency extending vertically through the full response effort. In figure 3 for example a first response group is supported by the efforts of a cluster of secondary groups: one of which relies in turn, upon a tertiary and within disaster management organisations (Turoff et al. 2009).

The third stage of the work will also involve specifying a scaled continuum of possible levels of capability elements, from lower to more complete, that seeks to enhance planning and carrying out agile and effective disaster management at local, regional, state and Federal levels.

This will lead to a definition of a high-level prototype Maturity Model (MM) incorporating capability assessments for Industry consideration and comment. From this work individual candidate MM's will be prepared for consideration by state-based organisations. While these MM's will include specific details relevant to different organisations, an emphasis will be on whole-of-state considerations. This is important given variation in agency responsibilities across the States.

A central strategy in the delivery of value in this project is ensuring utilisation of findings and entails a range of knowledge sharing opportunities of varying formats both internal and external to the CRC End-user group. Close links with end-users is a central design feature of the work and cooperation in planning of objectives and timelines for delivery of findings will be explicit as will where viable, joint participation the analysis of findings. From this engagement we will seek to maximize fit of both what is investigated, and from this, the relevance to practitioners of what is discovered. The inclusion of end-users in the final design of investigative and analytical frameworks is strategically important, as this will enhance the uptake and usefulness of findings.

It is envisaged that representatives from selected end-user groups will be embedded or closely associated with the research team for agreed periods to provide advice on the design of the "future" disaster scenarios to be used in the capability gap analyses, exchange expertise, and to facilitate direct transfer of findings and provide feedback to the research team.

CONCLUSION

A critical component of the work is capturing the integration of capabilities of relevant agencies active in 'operational' response and recovery in all hazards contexts. Key aspects of this integration include:

- The exploration of options for how Local, State and Federal agencies, as well as local communities, can collaborate more efficiently and effectively to inform choices for maximising adaptable decision-making under disaster conditions.
- The creation of a sustainable and agile emergency management workforce equipped to meet the needs of future disasters with a detailed understanding of the conditions under which planning, preparedness, response and recovery and remediation of infrastructure systems may need to take place.
- The capability needed by first and second responders, and allied agencies, to match current and future disaster contexts, including the disruptions caused by climate variability and geo-political unrest.

From this it will seek to document options for defining agile and sustained skills sets across the full cycle of disaster management.



This study will also seek to enhance planning mechanisms in support of the provision of effective disaster responses and efficient recovery strategies for future emergencies. The combination of capability gap analysis and scenario-based futures-based thinking will allow the formation of scaled descriptions of capability along a continuum of increasing effectiveness, adaptability and sophistication to contribute to strengthening community resilience.



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