Natural Hazards Research Australia

# The current state and future needs of decision making: knowledge, practice, tools and training options

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We acknowledge the Traditional Custodians across all the lands on which we live and work, and we pay our respects to Elders both past, present and emerging. We recognise that these lands and waters have always been places of teaching, research and learning.





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# Table of contents

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# Abstract

Decision making in emergency management (EM) is challenging. Australian EM organisations need to ensure that they appropriately train, develop and support their personnel so that they can make effective decisions in challenging situations. This report synthesizes the findings from the first phase of the Natural Hazards Research Australia (NHRA) decision making research project and provides a situational analysis of operational EM decision making in Australia. The report first summarises three literature reviews that examine: emerging issues (stress and fatigue, interoperability and ethical decision making) (Butler et al., 2024); use of cognitive aids (Penney et al., 2024); and EM decision making training (McLennan et al., 2024). The results of a survey and a series of semi-structured interviews are presented, providing a detailed examination of EM decision making in Australia. One-hundred and fifty-four participants completed all of the questions in the survey (84 per cent of the participants were male, 15.5 per cent were female and 0.5 per cent were non-binary). Thirty-six people participated in the semi-structured interviews (86 per cent of the participants were male and 14 per cent were female). The data showed:

1. There is a clear opportunity to enhance EM decision making training. While the majority of participants felt that the general training they had received from their organisation had improved their ability to make safe and effective operational decisions, it was clear that the majority of participants also felt that the approach to operational decision making taught during any training was sometime or mostly ineffective.
2. The large majority of participants follow their organisations' rules and procedures, however there can sometimes be a mismatch between what the rules and procedures say and the best decision based on participants' knowledge, experience and training. This and lack of resources were major reasons why participants sometimes didn't follow organisational policies and procedures.
3. EM decision makers generally use a combination of recognitional and analytical processes to make decisions. While some participants identified problems with using recognitional and analytical processes, most seem to be unaware of the strengths and limitations of the different types of decision making and how they work together to create decisions.
4. While the majority of participants thought that decision making tools provided by their organisation were clear and easy to use, a number of problems with such tools were identified (such as taking too long, being difficult to use and not applying in most situations).

Based on these findings, ideas about options that can be used to enhance EM decision making training and practice are proposed.

# Reviewers

This document was formally peer-reviewed by the following people:

- Paul McGuiggan, Fire and Rescue NSW Deputy Commissioner Field Operations
- Sandra Lunardi, Director of Industry Workforce Development, Australasian Fire & Emergency Service Authorities Council (AFAC)
- Mike Wouters, Former Manager of Fire Science & Mapping, Department for Environment and Water, South Australia

We would like to thank each of the reviewers for the time and effort that they put into reviewing this report. We have considered each comment carefully and made appropriate changes to the report. We have included each review in full at the end of the document for full transparency. We encourage readers to review the comments, particularly their commentary on the parts of the report relating to EM decision making and other areas for improvement.

# Introduction

The need for effective operational decision making in EM is ubiquitous, whether this be for first on-scene responders, incident management teams or regional/state level coordination. Australian EM organisations need to ensure that they train, develop and support their personnel so they can make effective decisions in challenging situations that may be uncertain, dynamic, time-pressured and involve high stakes. Moreover, the broader environment in which EM organisations need to operate successfully continues to evolve. Macro-forces such as an ageing workforce (Chong et al., 2022), new technologies (Misra, 2020; Pine, 2018; Zarghami & Dumrak, 2021), workplace safety legislative requirements (Penney et al., 2022) and the adverse impact of climate change on the frequency, scale and complexity of incidents (Bosomworth et al., 2017; Mach et al., 2016) will continue to create a challenging decision-making environment.

This report synthesises the findings from the first phase of the Natural Hazards Research Australia (NHRA) project, *Enhancing decision making in emergency management*, and provides a situational analysis of operational EM decision making in Australia. This is the first time that such a detailed examination of the Australian EM sector's operational decision making has been undertaken. Making effective decisions is a core operational capability for EM organisations. Understanding current EM decision-making doctrine, training and practice provides an important baseline to understand the present and evolving needs of EM decision makers and opportunities for the sector. This report also draws from the recent literature to outline emerging issues for decision-making practice, the use of cognitive aids in decision making, and decision-making training. This report will assist EM organisations to consider opportunities to strengthen their current decision-making doctrine, training and practice for the evolving operational environment.

Section 2 provides a brief background to the research project and highlights some key decision-making research literature and concepts pertinent to this report. Section 3 highlights the key findings from the project's three literature reviews on emerging issues in EM decision making, cognitive aids used in EM decision making, and training EM decision making. Section 4 of the report outlines key findings from the survey and interview phase of the research. Section 5 of the report briefly discusses the overall findings. The report's final section (Section 6) outlines some of the training implications of this research. Several ideas about options that can be used to enhance EM decision-making training and practice are proposed and will be discussed further with the project development team in the next phase of the research program.

# Background

There is considerable literature discussing various aspects of decision making and judgement. This topic has been researched and written about since at least the sixth century BC when Confucius outlined the principles that should guide decisions (Buchanan & O'Connell, 2006). Much of the contemporary research on decision making has tended to focus on individual decision makers and, to a lesser extent, on group-based situations, such as courtroom juries whose members all receive the same information. It has only been in quite recent times that there has been interest in team and distributed decision making (characteristics of EM decision making), where different members are each responsible for a particular aspect of an incident and may or may not be co-located (e.g., Cannon-Bowers & Salas, 1998; Guzzo et al., 1995; Klein et al., 1993; Rasmussen et al., 1991). More broadly, decision making is one of the seven key non-technical skills that underpin successful task performance in complex dynamic environments (Bearman et al., 2023; Hayes et al., 2021; Hayes et al., 2022). In addition to decision making, the key non-technical skills in emergency management are situation awareness, communication, coordination, cooperation, leadership and coping with stress and fatigue (Hayes et al., 2021; Hayes et al., 2022). Non-technical skills are sets of cognitive, social and personal resource skills that complement technical skills (such as deploying flood boats, operating a pump or writing an incident action plan) to ensure safe, effective and efficient task performance (Flin et al., 2008).

Various perspectives have been adopted in the study of decision making. Researchers have tended to focus on

1. how people should make decisions
2. how people do make decisions
3. how to train people to make better decisions (Hayes, 2014).

Research on how people should make decisions compares people's decisions to a variety of standards of normative decision performance, such as Bayesian inference, sampling statistics, regression analysis and expected utility theory (Edwards, 1954; Kahneman,1991). Expected utility theory for example proposes that people should make decisions that give them the best outcome on some value that is important to them (Edwards, 1954). Research on how people should make decisions has led to structured decision processes that attempt to maximise utility for each decision that is made. For example, Janis and Mann (1977) advocate that decision makers should:

1. canvas a wide range of options
2. survey full range of objectives
3. weigh the costs, risk and benefits
4. search for information to evaluate options
5. assimilate all information
6. examine the consequences (positive and negative)
7. carefully plan to include contingencies.

Decision making from this perspective then uses a structured analytical process and it is argued that if people follow the process, they will make good decisions. However, in real-world settings, such as EM, it is rare to have sufficient information or enough time available to undertake this kind of process (Gyles & Bearman, 2024a; Klein, 1999). This process is also quite slow and in dynamic environments, it is likely that by the time the process is completed, the situation will have changed, meaning that the analysis is obsolete (Gyles & Bearman, 2024a). Finally, the calculations required to weigh each option on several dimensions is cognitively demanding and will likely exceed most people's cognitive capacity for all but the most simple decisions.

It is clear that people typically don't make optimal decisions. Instead, people use a variety of heuristics (or rules of thumb) that can lead to biased decision making (Gilovich et al., 2002). A large number of biases have been identified, but the most important ones for EM appear to be:

- confirmation bias, where people tend to seek information to confirm their ideas and resist disconfirming evidence
- anchoring bias, where initial judgements tend to limit people's scope of decision making
- availability bias, where information that can be accessed more easily from memory is more influential
- picture superiority effect, where pictures and images are more influential than written sources of information
- mere exposure bias, where people have a preference for things that are familiar
- authority bias, where people tend to defer to people in authority
- curse of knowledge, where people who know information falsely assume that other people also know this information
- planning fallacy, where people underestimate the time it will take to complete a task
- bandwagon effect, where people tend to follow others
- goal seduction/sunk cost bias, persisting with a course of action because of the effort and resources already committed

(Brooks et al., 2020)

Another main tradition of research has explored how people actually make decisions rather than explore why people don't make decisions according to a normative standard. One of the main approaches in this tradition is naturalistic decision making (NDM) which advocates the study of decision making by experts in real world settings (cf. Orasanu & Connolly, 1993). One of the most popular theories in this tradition is Klein's recognition-primed decision (RPD) model (Klein, 1999). The model proposes that expert decision making is based on pattern recognition. We recognise a situation as familiar and that triggers solutions in memory that have worked in the past. If the situation is not recognised as familiar then we may need to go through a process of story building to understand that situation and if we are not quite sure whether a solution will work, we are likely to go through a process of mental simulation (Klein, 1999). RPD is fast, largely based on recognitional (or intuitive) cognitive processes and generally provides a workable solution to a problem when used by experts (Klein, 1999). Given that our interest is in decisions made by experts (EM practitioners) in real-world situations, our research is located in the NDM tradition of decision-making research.

Despite the separation of the literature on analytical and recognitional decision approaches, it is likely that the two are used in conjunction to complement each other in most real-world work settings. A number of theories have been proposed that have identified the characteristics of the two types (or systems) of decision making (Evans & Stanovich, 2013; Evans, 2019; Gyles & Bearman, 2024b; Stanovich & West, 2000). The first type is largely intuitive and automatic. The second type is more structured, conscious and analytical, requiring more cognitive resources (especially working memory). Most of the current dual theory models are based on lab studies using novices and artificial materials. However, a dual theory of decision making based on experts in the real world (air traffic controllers) has recently been proposed by Gyles and Bearman (2024a). This model argues that decision making is underpinned by cognitive processes related to orientation (situation awareness), goals, plans, actions and feedback (see Figure 1). In the orientation phase, individuals search and respond to cues and signals in the situation based on their understanding of their job role and tasks. The orientation process primes plausible goals, plans and actions that can be achieved. Each of these aspects is regulated by recognitional (intuitive) and analytical processes. It is likely that the recognitional (intuitive) function runs all

the time, suggesting plausible goals, plans and actions based on pattern recognition and previous experience. The analytical function intervenes when more conscious and deliberate thought is required. For example, if there is uncertainty about whether the plans or actions will achieve a goal, then additional data may be sought to increase confidence.

Analytical processing is more likely when a decision is more complicated or critically important (McLennan et al., 2001; Steigenberger et al., 2017). It can also occur when an action needs to be evaluated prior to implementation or when a point of no return is about to be reached. McLennan et al.'s (2001) study of on-scene fire commanders found that when the complexity of incidents was low (i.e., the incident was transparent, familiar to the participants and adequately resourced), the participants largely relied on recognitional decision processes. For low complexity events, the fire commanders initiated suitable actions, monitored the unfolding situation and made minor corrective actions where necessary. However, when the complexity of incidents was high (i.e., they were more opaque, unfamiliar and under-resourced), the participants incorporated more analytical decision processes and reported higher levels of self-monitoring and self-regulation. For these incidents, the on-scene commanders built a working hypothesis about key aspects of the incident and then cautiously implemented actions based on this understanding. Feedback was sought and if the working hypothesis was found to be incorrect, this would be revised and the plans and actions modified or changed.

Research by Steigenberger et al. (2017) undertaken with Baltic maritime search and rescue (SAR) practitioners complements McLennan et al.'s (2001) work by showing that task complexity influences whether analytical decision-making processes are favoured in EM. This study's findings from SAR simulations and field exercises showed that there was not one dominant decision-making approach used and that some aspects of intuition and analytical decision making enter into most decisions. Steigenberger et al. observe that intuition is favoured in contexts when:

- "Cues are reasonably consistent,
- the link between cues and outcomes is stable over time, and
- that the incident is not too different from previously experienced incidents" (p.28).

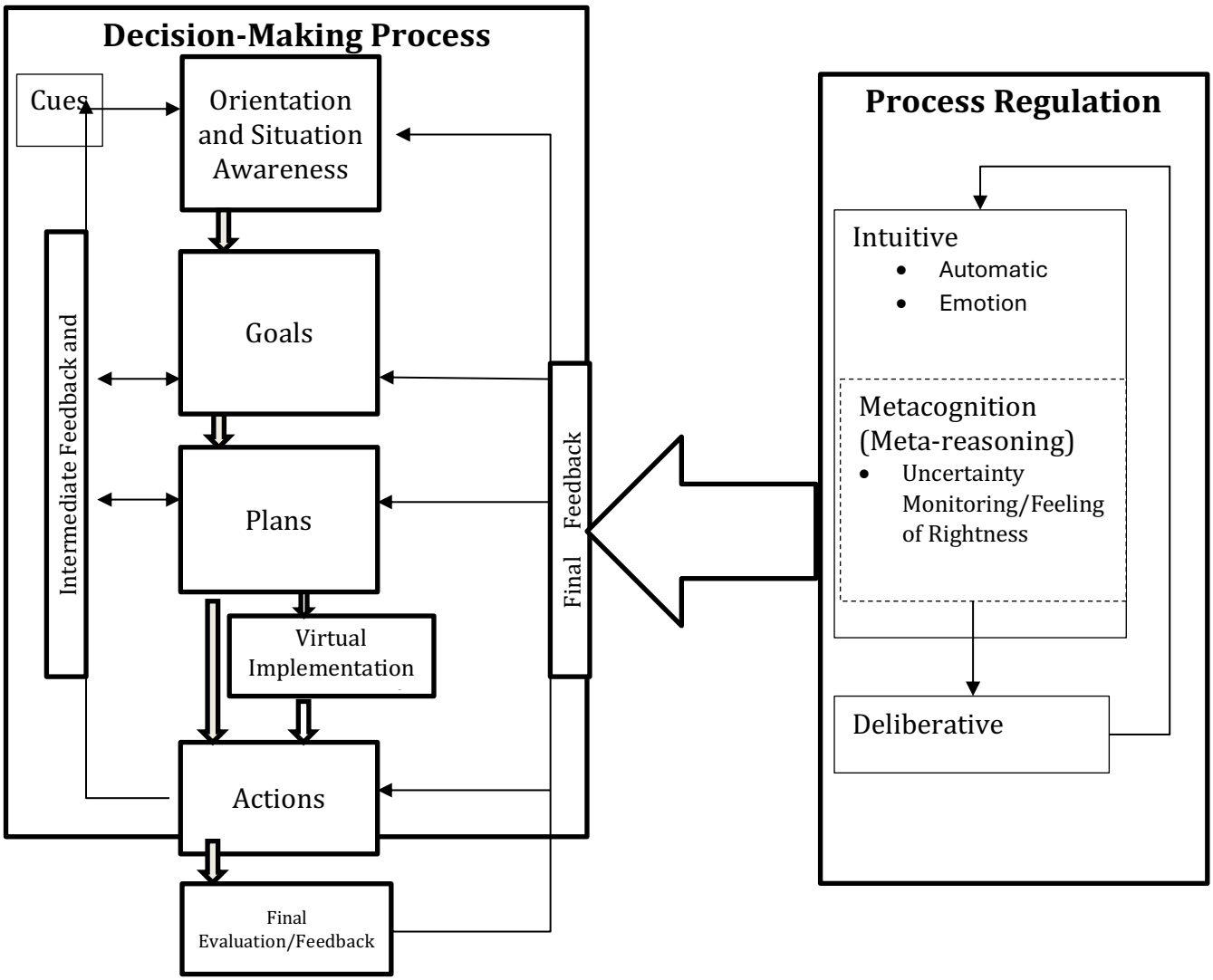
In contrast, analytical decision processes are favoured in task contexts when:

- "Relatively few cues carry strong predictive power,
- low time pressure,
- salient cues are misleading, and
- inconsistent goal structure" (p.36).

A further observation from the Steigenberger et al. (2017) study was that at very high complexity levels there was a point at which decision makers revert to somewhat more intuitive decision making.

Gyles and Bearman's model describes how experts make decisions in the context of work. As such the organisation exerts an important influence in shaping how decisions are made. The organisational policies, procedures and operational doctrine all serve to proceduralise some aspects of decision making. This can be done using either automatic intuitive processes for well learned routines or conscious deliberate processes for unfamiliar or less well learned routines. An additional function of these documents is to form heuristics that can inform conscious analytical processing.

Figure 1. Model of expert decision-making in air traffic control. (© Gyles & Bearman, 2024, Reproduced with permission)



# Literature Reviews

During the initial phase of this project the research team undertook three literature reviews (Bearman et al., 2024) that examined:

1. emerging issues (Butler et al., 2024)
2. use of cognitive aids (Penney et al., 2024)
3. EM decision making training (McLennan et al., 2024).

These reviews were published in the October 2024 issue of the *Australian Journal of Emergency Management* (AJEM). In this section, some of the most pertinent findings from these three reviews are outlined.

## Emergency management decision-making challenges

This review by Butler et al. (2024) examined the challenges faced by EM decision makers. Given that Penney, Launder, et al. (2022) and Reale et al. (2023) have recently published extensive systematic literature reviews, this literature review focused on literature published from 2022 onwards. From this review three themes emerged that significantly impact EM decision making:

1. stress and fatigue
2. interoperability
3. ethical decision making.

These are briefly discussed in the next sections.

### Stress and fatigue

The literature continues to highlight the adverse effect that stress has on situation awareness and decision making. Sallis et al. (2022) showed how the responses of fire and rescue service incident commanders to stressful simulated incidents indicated information bias, distorting what information was accepted for decision making. In an interview study of police commanders, Steen and Pollock (2022) investigated the perceived impact of stress on decision making and performance. The commanders reported that stress impaired sense-making by compromising their ability to perceive a situation and could have other effects, such as making them over- or under-reactive. They also reported that the impaired sense making could affect situation awareness, team collaboration, coordination effectiveness and organisational support for the use of professional judgement. Further, stress could result in inaction or inappropriate decisions to avoid the appearance of being indecisive.

Fatigue can also have a significant adverse impact on EM decision making. Brooks et al. (2018) found that fatigue contributed to decision errors during three major bushfires. Yung et al. (2021) examined the effects of fatigue on Canadian first responders, finding that a decrease in performance due to fatigue endangered EM personnel and the public. Dawson et al. (2021) provided some nuance around the effects of fatigue on EM personnel. Dawson et al. highlighted that the likelihood of fatigue resulting in a high risk of error is not necessarily linked directly but is dependent on context. They also highlighted that there is often a false perception of fatigue as low risk (due to an inherent coping capacity). Both Yung et al. and Dawson et al. recognised that cultural change across the emergency services was necessary to understand fatigue as a high-risk phenomenon needing to be managed.

## Interoperability

The ability for EM organisations to work effectively with one another during a large-scale incident is central to ensuring a cohesive response. Unfortunately, the literature highlights a variety of issues that continually undermine interoperability. These issues stem from ineffective communication, poor leadership, issues associated with situational awareness, and questionable decision making (Pollock, 2013). From an Australian perspective Cole et al. (2017) and the Commonwealth of Australia (CoA; 2020) found similar shortcomings to Pollock (2013). Waring et al. (2020) studied a major incident exercise to explore multiagency decision processes. They found that decision making was undermined by problems of developing adequate situation awareness. This was due to information being withheld, delays in sharing information, incompatible communication technologies and a lack of familiarity with other agency roles (so people don't know who to share information with). Each of these issues impacted upon the ability of teams to execute their plans, which in turn contributed to decision delays.

There has been work undertaken to improve interoperability in the United Kingdom (UK) and Australia with initiatives such as the development of Joint Emergency Services Interoperability Programme (JESIP) and the Australasian Inter-Agency Incident Management System (AIIMS; AFAC, 2017). However, ongoing reviews of inter-agency exercises continue to highlight issues with communication, information sharing and the development of shared situation awareness. Power et al. (2023) recently conducted an interview study with UK EM managers to evaluate JESIP concluding that to achieve the desired improvements in interoperability would require considerable investment, training, review of organisational structures and a large amount of time.

## Ethical decision making

EM decision making can be very challenging. Deciding whether to put first responders at risk to save life or property, having to choose the least-worst option (Shortland et al., 2019), making consequential decisions with inadequate or poor-quality information and triaging to prioritise who receives treatment first are just some of the difficult decisions EM practitioners face. Moreover, these decisions often need to be made in chaotic and difficult conditions and are subject to stress and fatigue which puts pressure on decision making (Dawson et al., 2021). EM practitioners are expected to make thoughtful and ethical decisions (Boin & Nieuwenburg 2013), yet the conditions may be unfavourable for the more analytical and deliberative approach required (Messervey et al. 2023; Steigenberger, 2017).

The requirement to make these very difficult decisions may also have consequences for the decision makers. Research on the Memorial Hospital tragedy following Hurricane Katrina found that the use of discretion by frontline medical staff significantly impacted the lives of those affected and the decision makers (Boin & Nieuwenburg, 2013). In recent years, the term moral injury has come into use to describe problems caused by a substantial conflict between a critical situation and an individual's ethical or moral beliefs. For EM practitioners, this distress may come about from having to make decisions or act in a way that is at odds with their moral beliefs. In particular, moral questions and ethical dilemmas that require people to make difficult choices between the lesser of two evils compel decision makers into morally perplexing circumstances (Frame, 2020).

There has been some guidance developed to help reduce ethical conflicts for decision makers, especially in healthcare. Lieder et al.'s (2017) review of healthcare ethical guidance noted that at some point during critical incidents and disasters, emergency managers realise that they need to move away from meeting the needs of individuals to focus on the needs of the wider community. Cuthbertson and Penney (2023) highlight how the moral judgments of EM practitioners can vary based on their individual beliefs and the perception of the communities involved. They noted a lack of ethical frameworks for the emergency services. With respect to training, most military ethics training focused on awareness and was classroom based, with little evidence this training would prove successful on the battlefield because it could not replicate the stressors of combat

(Messervey et al. 2023). Appropriate organisational support for ethical decision making in EM remains one of the key challenges for the sector.

## Use of cognitive aids

The review by Penney et al. (2024) examined the use of cognitive aids in emergency management. This paper outlines the role that these aids can play in supporting EM practitioners' cognitive processes during conditions of heightened workload, stress and fatigue. Overload of cognitive processes can lead to task performance that is less fluid, slower, and more susceptible to errors and/or omissions. To help EM practitioners in these demanding environments, a number of cognitive aids have developed and subsequently been adopted by individuals and organisations alike. Narrative synthesis was used to understand the use of cognitive aids within the context of EM as well as exploring how existing knowledge regarding the use of cognitive aids from other industries may be translated to the EM context.

The term cognitive aid was originally used in the 1970s to describe decision support systems (McLaughlin et al., 2020). However, over time the term has become increasingly used to describe various tools and systems that support other cognitive processes. This review used an expanded version of Marshall's (2013) definition of the term cognitive aid so that it encompassed a broad range of tools used to support the operational performance of individuals and teams working under pressure. Five broad categories of cognitive aids were discussed: (i) decision process and behavioural tools; (ii) tools to support analysis; (iii) checklists; (iv) operational procedures and guidance; and (v) cues and alarms.

Four implications of the review were noted. First, EM agencies and practitioners need to ensure they identify the outcome they are seeking to achieve and then select the correct cognitive aid that will help achieve this outcome. Second, EM agencies need to acknowledge that poorly designed cognitive aids may cause more harm than good, regardless of whether they are applied in the right context. Third, to improve the use of cognitive aids during EM events, agencies need to ensure EM practitioners are appropriately trained in their selection and use. Finally, agencies need to recognise the different needs of their staff depending on their expertise and cater for this in the tools they provide. Critically, there is a difference between the way tools are applied between novices and experts, with novices tending to adhere strictly to defined steps and protocols while experts desire greater discretion to apply principles within the dynamic nature of an individual event (Penney et al. 2022; Launder & Penney 2023).

## Emergency management decision-making training

The review by McLennan et al. (2024) examined the literature on EM training design, delivery, implementation and evaluation. The review adopted Goldstein and Ford's (2002) definition that training is "the systematic acquisition of skills, rules, concepts, or attitudes that result in improved performance in another environment" (p.1). The important distinction between two types of knowing was highlighted in the paper. These were: declarative or explicit knowledge (*knowing that*) and procedural or tacit knowledge (*knowing how to*) (e.g., Kole et al., 2020).

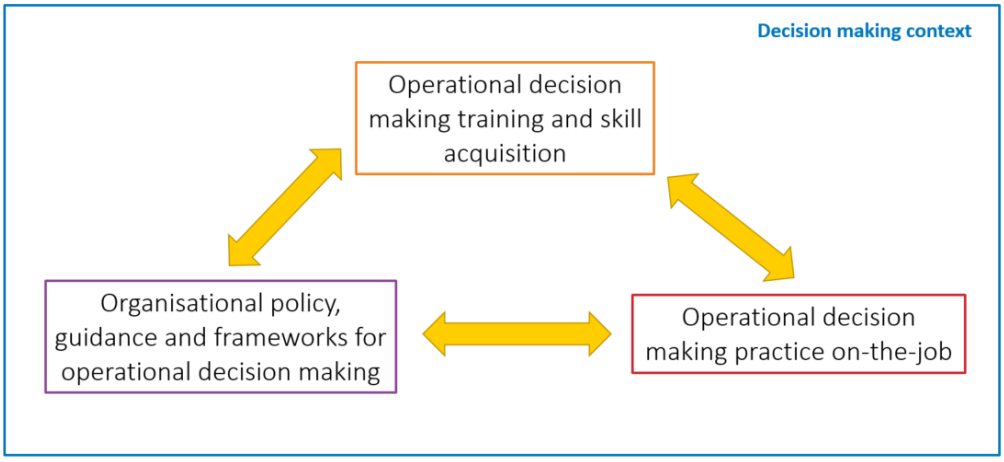
The review was structured using Skrybrina et al. (2017) and Chen's (2014) work classifying training activities into four broad categories of: 1) discussion-based (workshop, tactical decision game, and table top); 2) E-based (computer supported simulation exercise, virtual/augmented reality based simulation); 3) operation-based (drill, emergency management centre exercise, field exercise); and 4) post incident learning activities. A wide range of literature covering these training methods was discussed, but a recurring limitation of this literature is the almost complete lack of evaluation. The paper offers some important points for organisations to consider in relation to EM decision-making training. These are presented here in their original form (McLennan et al., 2024, p.15):

1. “It cannot be assumed that participation in emergency management decision making training will result in improved performance. That can only be determined by appropriate training outcomes evaluations.
2. Training activities will not, of themselves, result in improved emergency management decision making that will only occur if the activity results in learning. Practice does not necessarily make perfect; it may merely make the imperfect permanent.
3. The endeavours of trainers/facilitators are crucial in promoting learning, through stimulating and guiding trainees’ self-reflections on the quality of their situation assessments, decisions and actions during the exercise and how these might be improved.
4. EM decision making competence is a depreciating asset. It needs to be maintained by opportunities to use it through exercises and sustained by an organisational culture which values and supports learning.
5. If agency EM activities will require the involvement of other organisations, then appropriately planned and conducted training activities involving participants from these other agencies are essential.
6. It seems self-evident that the most constructive action an EM organisation could engage in to improve the EM decision making effectiveness of its personnel would be to undertake a critical review of current arrangements for emergency management decision-making training in order to ascertain:
    - Is there an organisation-wide program of EM decision-making training, development and maintenance covering all the four levels of emergency management decision making?
    - Is the organisation’s EM decision-making program adequately resourced in terms of both training staff expertise and material resources?
    - Does the EM decision-making training program match the organisation’s operational EM decision-making responsibilities?”

# Research studies on the current state of operational decision making in Australia

A survey and interview study were conducted to obtain a comprehensive understanding of EM decision making in Australia. These studies were based on a conceptual model of EM decision making that considered four main elements: 1) training and development of decision making, 2) organisational policies, guidance and procedures, 3) operational decision-making practice and 4) contextual factors. These four elements are shown in Figure 2. The conceptual model highlights that these elements interact with one another and implies that there is a need for some degree of alignment between them. Moreover, the model indicates that decision making guidance, training and practice occurs within a broader context, and that this influences how decision making tends to occur.

Figure 2. *Conceptual model of the broad factors shaping EM decision making*




Note: Decision making context covers a broad range of factors such as hazard type, stage of incident development, incident scale, complexity and novelty, resources available, skill and experience level of the individual or team making decisions.

## Method

### Design

An extensive study of how people make decisions in EM, the tools they use and the training they receive was conducted. This consisted of a large-scale survey and semi-structured interview study with people working in urban fire, rural fire, State Emergency Services (SES) and forests, parks and wildlife in every Australian state and territories. Both studies received approval from Central Queensland University's Human Research Ethics Committee via the low-risk review process (Approval number 2023-020).

# Participants

## Survey

One-hundred and fifty-four participants completed all of the questions in the survey. 84 per cent of the participants were male, 15.5 per cent were female and 0.5 per cent were non-binary. Fourteen participants were from Queensland, 60 participants were from New South Wales, 28 participants were from Victoria, 25 participants were from Western Australia, 12 participants were from South Australia, 8 participants were from Tasmania, 3 participants were from Northern Territory and 4 participants were from the ACT. Seventy-four participants were based in a city, 46 participants were based in a regional centre, 30 participants were based in a country location, and 4 participants were from Other. Table 1 shows the different hazards that participants managed.

*Table 1: Main hazard environments managed by the study's participants*

| Hazard environment |
|---|
| Structure fires |
| Bushfire/wildfire |
| Road crash rescue |
| Heavy rescue |
| Hazmat |
| Flood |
| Swift water rescue |
| Storm |
| Cyclone/hurricane |
| Earthquake/landslide/building collapse |
| Tsunami |

## Interviews

Thirty-six people participated in the semi-structured interviews. Eighty-six per cent of the participants were male and 14 per cent were female. One participant was from Queensland, 18 participants were from New South Wales, 6 participants were from Western Australia, 4 participants were from Victoria, 3 participants were from South Australia, 2 participants were from Tasmania and 1 participant was from the Northern Territory. Eighteen participants were based in a city; 17 participants were based in a regional centre and 5 participants were based in a rural town.

# Materials & Procedure

## Survey

The survey used the Qualtrics platform (Qualtrics, 2024). Participants were recruited by promotions of the survey by their EM organisation and in various media articles and social media published by the NHRA and AFAC. These publicity materials provided a brief description of the survey, its estimated completion time and a

URL to the Qualtrics questionnaire. There were 70 questions in the survey. These questions covered the three main topics of: 1) types of decision making (intuitive and analytical); 2) the availability, advantages and limitations of tools and procedures to support decision making; and 3) the nature and contents of formal and informal training opportunities. The survey was designed so that the questions that participants were asked depended on their answers to previous questions. At the start of the survey the participant was provided with a participant information sheet and an informed consent checkbox to confirm they were 18 years of age or older, that they understood the nature of the survey and that they could withdraw from this research at any time whilst completing the questionnaire. At the end of the survey participants were thanked for their participation and asked if they were willing to be contacted for an interview. If they agreed to be interviewed, they submitted their email for follow-up from one of the research team.

### Interviews

The semi-structured interview was a discussion with the participant about their experiences in relation to the key topics:

1. types of decision making (intuitive and analytical);
2. the availability, advantages and limitations of tools and procedures to support decision making; and
3. the nature and content of formal and informal training and learning opportunities.

Researchers contacted via email a sample of participants who had opted in to be interviewed via the survey. The email invitation included a copy of the participant information sheet and indicated the interview would take about 60 minutes. A suitable date and time were organised for a Zoom or Microsoft Teams based interview to be conducted. At the beginning of the interview the researcher introduced themselves, briefly outlined the interview and confirmed informed consent. The researcher then engaged in a discussion with the participant about their decision making. The semi-structured interview contained six main questions plus additional prompts. Depending on the responses from participants, the interviewer would deepen the discussion to explore issues that arose. At the end of the interview the participant was asked if there was anything else they would like to add that hadn't already been covered.

## Results

In this section the results of the survey and interview study will be discussed together in relation to the key themes of the study.

## What training in decision making do people receive and how good do they think it is?

Just over half (54.55 per cent) of the survey participants said *yes* they had attended formal training on decision making, 20 per cent (19.48 percent) said *maybe* and a quarter (25.97 per cent) said *no*. Interview participants reported that training for their role tended to focus on general incident management, with limited content focused specifically on decision making. Many of the interview participants have taken external courses that contain some content on decision making, generally in leadership courses.

With regards to general training just over 50 per cent of participants (59.74 per cent) thought the training they had received from their organisation had improved their ability to make safe and effective operational decisions, with 27.92 per cent unsure (*maybe*), and 12.34 per cent (1 in 8 people) stating that training had not led to improvement. More concerning is that nearly half of the survey participants (48.05 per cent) felt that the approach to operational decision making taught during any training was sometimes ineffective, with a further

11.69 per cent saying that training was ineffective most of the time. Nearly a third (29.22 per cent) of survey participants said that decision making training rarely or never changed their on-the-job practice.

In terms of preferences for decision-making training method the survey participants had a clear preference for exercise, simulation and/or scenario-based training with 41.5 per cent of participants ranking this first and 29.87 per cent ranking this second (total 71 per cent). This was followed by on-the-job supervision (1st and 2nd ranking total 39.61 per cent); case studies in decision making (1st and 2nd ranking total 35.71 per cent); lectures, webinars, video and podcasts (1st and 2nd ranking total 31.82 per cent); as part of training aimed at developing other skills 1st and 2nd ranking total 15.58 per cent); and through debriefing (1st and 2nd ranking total 5.84 per cent).

Many interview participants saw the benefits of effective mentoring/coaching in helping to build key decision-making skills. This was almost always done informally by approaching a respected colleague rather than through formal mentoring schemes. These results are consistent with a survey of 26 Australian EM organisations by Hayes (2018), who found that 13.5 per cent had coaching programs in place and 26 per cent had a formal mentoring program in place. In terms of the value of mentoring, one participant in our study explained:

*"In the very early days of being an inspector I had some amazing mentors. Incredible inspectors that had a lot of firefighting experience, and they were able to pass on their knowledge to me, and I was sucking it up like a Hoover vacuum cleaner. These guys had been to a lot of fires in the 70s. In the 80s. And in the 90s. And they had had so much information that they were passing on. It was just invaluable and stuff that's not written down anywhere. And now that I'm in this role, I try as often as I can to do the same thing with my own station officers. You know we. We bring them all in for training, and we discuss things, and I try and mentor them as much as I can. And it's about the decision-making process … about an incident. Learning to pull information in, process it and then make a decision."*

This quote shows that learning to become a more skilled EM decision maker requires developing tacit knowledge (i.e., knowing how to), which by its very nature is not written down.

## How does the organisation shape decision making?

Most EM organisations have developed doctrine, procedures and training that generally provides robust and suitable guidance for managing a range of foreseeable incidents. When doctrine is appropriate, it enables organisations to ensure consistent and legally defensible decision making and behaviour. The survey found that 83.12 per cent of survey participants *mostly/always* followed the procedures and rules of their organisation in their operational decision making. 50 per cent of survey participants stated that the best decision based on their previous experience *sometimes* contradicted their organisation's formal policies or procedures and 40.26 per cent of survey participants stated that the best decision based on their training *sometimes* contradicted their organisation's formal policies or procedures. The highest rated reasons for not following procedures included: lack of personnel (59.74 per cent); a lack of equipment or other basic resources (55.84 per cent); the suggested solution is not the most appropriate for the situation (40.91 per cent); personal experience or training provides a more appropriate procedure (39.61 per cent); the procedure was overly prescriptive or bureaucratic (38.96 per cent); or an alternative solution improved/maintained your relationship with a third party (35.71 per cent). One interviewee explained that they largely followed their organisation's operational guidelines but acknowledged the need to sometimes deviate because of circumstances such as fuel load, water pressure or people trapped.

Nearly a quarter of survey participants (24 per cent) thought that the organisation didn't provide clear instructions on how to make operational decisions. This was also highlighted by interview participants when discussing organisational guidance and doctrine. An example of organisational guidance not always being appropriate was highlighted by this participant's comments:

*"I would just say, really any incidents we have especially when we've got varying critical factors. Obviously, it's very dynamic. And we're supposed to follow a procedure RECEO, but oh sometimes that's not the case. And we have to go essentially. Go out there, make that decision at the time."*

Some interviewees reported that sometimes there was no organisational guidance available for the particular situation they were managing. A simple example provided was the lack of guidance to deal with automatic fire alarms. One participant explained:

*"So yeah, essentially, we, don't have any guidelines in regard to automatic fire alarms, so essentially we are just troubleshooting."*

A senior EM practitioner managing the clean-up of a significant flood event outlined an instance when there was no relevant organisational guidance and outlined how they received conflicting advice from various government departments and agencies with interests in this operation:

*"So our operating is really in that ambiguity part, and no one wanted to accept any responsibility for it. So they made it mine. Okay, we'll find and do this. So it'll be different the next time. Indeed, if they think about it before now, and the next time. … so that there's a fair bit of political pressure being applied indirectly. So, directors of and State departmental secretaries sort of twisting the arms of their bureaucrats to say, we don't go anywhere near this. And then other departments have, pointing a finger at each other to say, No, it's your problem. It's your problem, your problem. No, no, I see you've all made it my problem. So be it, and if you don't like that, then whoever it is you're reporting to minds, give me a call. I'm quite happy to stop doing this."*

One senior EM practitioner detailed that they thought there had been an erosion in organisational guidance during their long career with an EM agency:

*"I used to have some very clear operational doctrine, and support in order to allow it to provide guidance to us in the form of procedures and standing orders. And then there's the XXX Act and the regulations ... Yeah, provides the authorising environment for us to do what we do. I've seen over time an erosion of those many of those things. So and I guess it's in part, probably some value shift by society in general, maybe different generations have different approaches to it.* [Our EM agency], *as a product of numerous public inquiries learns very slowly from those things. But when it does, it's okay. Well, we need to do this stuff. And so it endeavours to do that. One of things that has done to itself is, I think we've tied ourselves in knots in regard to some of this. So what used to be standing orders to me is standing order. But now it's no, it's more of a guide really is. Well, hang on a minute. It can't be a standing order if you if you say it's a guide."*

## How do people make decisions?[1]

Nearly 70 per cent (69.48 per cent) of survey participants said they mostly or always knew the right decision to make when they arrive at an incident, indicating that they are using an intuitive or recognitional decision strategy. However, as one of the interview participants pointed out, making decisions only on the basis of intuition can lead to rigid decision making:

*"So, a lot of these people have that experience over time. But again, it comes back to, you know, if if that works last time, we'll just do that again rather than you know. Let's explore other options."*

It can also lead to problems. As one participant stated:

*"You can get, well, into a false sense of security. Where…we'll just do the same thing. And then suddenly, you'd miss something."*

The participant tries to guard against this by saying, *"don't get comfy, it could be something else."*

[1] The interview data on how people make decisions and the tools they use was reported in an extended abstract for the AFAC 2024 Conference.

Intuitive decision making can be supported by analytical decision making using a more structured process. As one of the interview participants stated:

*"Incidents are very dynamic. You need to be fluid and reactive, but reactive with thought."*

78.57 per cent of the survey participants reported that they mostly/always consider and weigh up different options before making a decision. Few of the survey participants write down a list of options for decision making (*mostly/always* 23.38 per cent) but most do make a mental list (*mostly/always* 79.87 per cent). In the interviews, participants reported that structured decision making was more likely to occur where there was more time or where the decision was critical. Some participants reported using more structured analytical decision-making processes than others and structured analytical decision making was more likely to occur in incident management teams rather than on scene. While structured analytical processes can be used to make better decisions, sometimes these analytical processes are just used to validate rather than challenge plans (a form of confirmation bias). As one of the interview participants said:

*"I do know from time-to-time people might use it like, like some incident controllers or commanders, might use it to support their own bad idea."*

Another interview participant explained that they tended to initially use intuitive or recognition primed decision making in the initial stages although they were mindful of the need to analyse the situation carefully to ensure they weren't caught out. An analytical approach was used as the incident progressed and for problem solving larger and more complex incidents:

*"Well, I probably use the thing called recognition prime. I think it is recognition prime decision making where I'll look at something from previous experience and think, okay, this is what we need to do with this particular fire. This is what we need to do to achieve the objectives. I think that is reasonably intuitive. But having said that, you have to be careful that you don't get drawn into the trap of not fully looking at what you're dealing with. So that's when the analytical part of it comes into it. And that probably starts happening as the incident becomes more developed during the initial stages is probably when the intuitive decision happens, because if I pull up at a job the first thing I'm going to say is, have we got water going onto this fire and without even looking at it. To me, that's the most important thing. And then we start thinking more about it and analysing it."*

While some participants clearly have some level of insight into their decision-making processes, most reported that they do not understand the strengths/limitations of the different types of decision making.

## What are the pressures that can lead to poor decisions?

Survey participants identified a number of situations or factors that make operational decision making particularly challenging. The pressures that were experienced with the highest *frequency* (rated *mostly/always*) were lack of time (36.43 per cent), lack of information (36.43 per cent), large volumes of information (32.48 per cent), poor quality information (29.46 per cent), distressed community members/response (20.93 peer cent) and options hampered by lack of resources (20.93 per cent).

The pressures that had the highest *impact* on decision making (rated very/extremely) were lack of information/lack of situation awareness (71.32 per cent), poor quality information (66.67 per cent), conflicting information (62.02 per cent), interference in decision making from government department or politicians (60.47 per cent), having to make particular decisions to serve political or reputational concerns (58.91 per cent), conflict between EM organisations or with government over how to proceed (56.59%).

35.06 per cent of survey participants reported being *mostly/always* affected by time pressure; 23.38 per cent by stress; and 18.18 per cent by fatigue. 51.95 per cent of survey participants reported that their decision-making ability was *moderately/severely/extremely* affected by time pressure, 50.00 per cent reported that their decision-making ability was *moderately/severely/extremely* affected by fatigue and 37.01 per cent reported that their decision-making ability was *moderately/severely/extremely* affected by stress.

## What tools do people use to help them make decisions?[1]

Participants identified 183 tools that were provided by their organisations to assist decision making (some participants identified multiple tools). Using the coding scheme for cognitive aids proposed by Penney et al. (2024): 44.26 per cent of these tools were standard operating procedures (SOPs), 18.58 per cent were standard operating guidelines (SOGs), and 24.04 per cent were checklists. While 68.83 per cent of participants thought that decision making tools provided by the organisation were clear and easy to use, a number of problems with such tools were identified, such as: not applying in most situations (30.52 per cent), they take too long to use (28.57 per cent), and they are too difficult to use (22.27 per cent). There was also a high rating for other reasons for not using organisational tools (38.13 per cent) with participants citing various reasons such as sometimes there was no suitable tool available, outdated tools, tools not readily at hand, tools slow and clunky, don't need to access fancy tools to get the job done, lack of training to support tool use, lack of people resources compromises ability to use tools, tools often too generic for the situation, challenge to remember all the tools and doctrine, accessing online tools difficult in some locations, and use of the tool distracts from managing the incident. Nearly a quarter of participants (23 per cent) had difficulty accessing decision-making tools when they needed them.

A third of survey participants (33.3 per cent) regularly use decision-making tools or procedures that are not officially sanctioned by the organisation (i.e., non-official) and 37.66 per cent of survey participants have encouraged their colleagues to use non-official tools or procedures. Just under half (44.81 per cent) have been trained in the use of non-official tools or procedures. These non-official tools and procedures came from other workplaces (32.47 per cent), a mentor, trainer or supervisor (31.17 per cent), a colleague (28.57 per cent) an online video or resource (27.92 per cent) or were previously used by their current organisations (17.53 per cent). These non-official tools were used because they were considered to be more appropriate (35.06 per cent), there was no tool recommended by the organisation for that application (31.82 per cent), the non-official tool is easier to use than the official tool (27.72 per cent), the non-official tool is quicker to use than the official tools (24.68 per cent) and the non-official tool is easier to remember (16.23 per cent).

## Other observations on EM decision making

The interviews provided the opportunity to further explore some of the broader issues that influence the development of decision-making expertise. These reflections covered participants' personal experiences of developing decision-making skills and observations about how their organisation influences the development of decision-making capability for large scale incidents, regional and state level roles.

Some of the interviewees when discussing their own journey to becoming skilled decision makers talked about crucible experiences. For example, one participant talked about a very unusual and demanding incident response they led:

*"And so that to me was one of the first times I was really confronted with the ... this is out of the box. This is one right out of left field. How do you because everything else has been. It's pretty routine. You can anticipate what you're going to be confronted with. For some, the majority of the day-to-day routine events that happen in operations, you know, your standard fires, just car accidents, EMR events. You can sort of anticipate most of that. But when you're confronted with something like that, and there's no one around you. It's just you and a team who aren't, who are looking to you because you're the expert…"*

These moments helped the participant to clearly recognise that resolving the incident at hand largely lay with them as the key decision maker, and that they had the skills and ability to figure out a workable solution to resolve the incident. It appears that this 'aha' moment helped contribute to a degree of self-efficacy that assisted them subsequently to successfully manage more challenging incidents.

A further theme that became obvious from the interviews were the differences between participants in how they engaged in ongoing professional development. Some participants were very active in continuing to build their decision-making skills and knowledge. When asked about what other activities they did to improve their decision making they would outline an array of different informal activities, readings, podcasts and personal research they were undertaking. One participant commented:

*"Read a lot of reports from fires that are happening overseas, especially in New York. Other places as well. Like London. I try and read journals like fire engineering and talk to other colleagues about their experiences. I do a lot of research of the fires that we have here in XXX and find out. You know what occurred at those fires and what worked and what didn't work and those sorts of things. Yeah, I'll just try and read as much as I can from different fire departments about different types of fires. And I'm really looking for the command decisions that were made that were effective."*

There were also other practitioners who appeared less energetic in their endeavours to build their decision-making skills and knowledge beyond that which was prescribed for them by their organisation.

A further theme that became clear from the interviews was that challenges of decision making were somewhat different between city, regional and rural locations. For some rural locations, the duty officer would need to make decisions about whether they should attend an incident that might be 2+ hours' drive away or stay put and support the responding crews remotely. One participant described this extra layer of decision making:

*"…the nature of the incident. the scale of the incident. So if it's and because I have such a long distance to travel. I've got to make that decision early on, you know. Is this incident going to still be going in 4 or 5 or 6 hours, or one or two days, and if so, I'll get on the on the road and have a presence there, or is it something that's something, gonna be, you know, secure in 2 or 3 hours. Can I manage it remotely, which is often part of what I do."*

Regional and rural EM practitioners also felt that compared to their metro colleagues, they had less opportunities to participate in training and development opportunities. One participant described this:

*"Look, to be honest with you it's the training and development opportunities that are relatively limited are one of the difficult things for me in regional Ops. And you gotta. And I guess there's probably value in talking to me with the fact that I come from Regional Ops, because it's a very different beast to Metropolitan Ops, where you know, Metro Ops. The guys there work a 24-hour roster. There's a lot more availability of training and teaching and stuff like that. Guys can do it on their days off, whereas with me I'm working 5 days a week every second weekend on call. There's a reluctance to release you to do training, because then, you know, you're creating a gap for someone else to fill."*

One of the participants interviewed highlighted that their EM organisations doctrine assumed resourcing that was not available in some of the more remote parts of the state and the challenges for decision making this caused them:

*"Yes, yep, that it doesn't work within [this region], because we have very limited resources. But that is the decision making. That's the stuff that I'm talking about. So basically, kind of it's got a set of expected actions. … And I often don't do that and have to justify my decisions to the better and that's because as you're pointing, for instance, [in this region] you can be very skinny on resources. And so that's the resources can be a real impediment to following through what the doctrine might otherwise suggest. [things like] Distance, resources, ability, capability, all of that type of stuff. … And the leaning [of my EM agency] is towards go early, go big. Go early to the combat of risk within the state at the moment. So, the decision making against that is quite fraught from a political point of view. Yeah. So, there's all that type of stuff to go with it and to understand the nuances of what they're asking. And to get away with your decisions is a big one."*

## Summary

In summary, the data shows that:

1. There is a clear opportunity to enhance emergency management decision-making training. While the majority of participants felt that the general training they had received from their organisation had improved their ability to make safe and effective operational decisions, it was clear that the majority of participants also felt that the approach to operational decision making taught during any training was sometime or mostly ineffective.
2. The large majority of participants follow their organisations' rules and procedures, however there can sometimes be a mismatch between what the rules and procedures say and the best decision based on participants' knowledge, experience and training. This and lack of resources were major reasons why participants sometimes didn't follow organisational policies and procedures.
3. EM decision makers generally use a combination of recognitional and analytical processes to make decisions. While some participants identified problems with using recognitional and analytical processes, most seem to be unaware of the strengths and limitations of the different types of decision making and how they work together to create decisions.
4. While the majority of participants thought that decision-making tools provided by their organisation were clear and easy to use, a number of problems with such tools were identified (such as taking too long, being difficult to use and not applying in most situations).

# Discussion

This report presents a summary of three literature reviews and the broad findings from survey and interview studies on decision making. The results of the survey and interview studies in Section 4 will be discussed together with the key themes that emerged from the literature reviews in Section 3.

Over half of the participants had received formal training on decision making. While the majority of participants felt that the general training they had received from their organisation had improved their ability to make safe and effective operational decisions, it was clear that the majority of participants also felt that the approach to operational decision making taught during any training was sometimes or mostly ineffective. Also of concern is that nearly a third of the survey participants stated that the training they had received on decision making rarely or never changed their on-the-job practice. These findings clearly show that an opportunity exists to enhance EM decision-making training.

Decision-making training was acquired through a wide range of methods (such as exercises, simulations and/or scenario-based practice; on-the-job supervision; lectures, videos webinars and podcasts; as part of operational debriefing and through case studies in decision making). Participants expressed a preference for decision-making training through exercise, simulation and/or scenarios; followed by job supervision; case studies; and lectures, webinars, video and podcasts.

The literature review by McLennan et al. (2024) (Section 3.3) highlights that although there is a wide range of training methods for EM decision making described in the literature, relatively few of these methods have been adequately evaluated. This observation raises the concern that there is little published evidence for EM organisations to draw on for the planning and review of their decision-making training and development programs. This is not to say that EM organisations do not have some degree of understanding of what works in terms of training, but it does highlight the need to develop an evidence base for training so that informed decisions can be made.

A number of interview participants highlighted the value of informal mentoring or coaching in helping to support the development of their decision-making skills and knowledge. Several Australian states and territories have adopted the Center for Creative Leadership's 70:20:10 model of learning (Johnson et al., 2018; McCall, 1988). This model proposes that 10 per cent of learning is achieved through formal training (e.g., classroom and online), 20 per cent results through learning from others (e.g., peer feedback, coaching, mentoring and lessons learned), and 70 per cent is learning on-the-job through practise and problem-solving exercises. This model puts an emphasis on coaching and mentoring and without adequate resourcing in this area, adequate learning is unlikely to be obtained. Moreover, findings from the coaching and mentoring literature highlight the learning opportunities that coaching and mentoring can offer. Hayes (2018) discusses four meta-analytic studies that provide robust evidence that coaching and mentoring can support the improved performance of personnel (i.e., De Meuse et al., 2009; Theeboom et al., 2014; Sonesh et al., 2015; Jones et al., 2016).

While the large majority of participants follow their organisation's rules and procedures, it seems that there can sometimes be a mismatch between what the rules and procedures say and the best decision based on participants' knowledge, experience and training. This and the lack of resources were major reasons why participants didn't follow organisational policies and procedures. To some extent there is always a mismatch between a procedure and the situation in which it needs to be applied which must be bridged by the decision maker, so finding a mismatch between what the procedures say and what the participant thinks is the best decision is perhaps not surprising. The extent to which decision makers have flexibility to interpret organisational policies and procedures is the balance between constrained and managed behaviour (Morel et al., 2008). Constrained behaviour being the policies and procedures that constrain a person's behaviour, while managed behaviour is the ability people have to manage a system within the confines of the constraints (Morel

et al., 2008). Some organisations allow their members to exercise operational discretion, which permits them to override certain policies and procedures where there are reasonable grounds to do so. This issue has been the subject of recent UK research that found EM practitioners may at times inappropriately adhere to or depart from organisational guidance (Butler et al., 2021). Some of the participants in the present study reported the additional issue of having no organisational guidance available for the particular situation they were managing. This lack of guidance has been recognised in the wider decision-making literature (Alison et al., 2022). There appears to be a gap in the doctrinal and training resources for helping EM organisations and practitioners to navigate these difficult issues.

The data shows that people use a combination of recognitional (intuitive) and structured analytical (deliberative) decision-making processes. This is consistent with dual process models of decision making (such as Evans, 2019; Evans & Stanovich, 2013; Gyles & Bearman, 2024b) and previous EM decision research (e.g., McLennan et al., 2001; Steigenberger et al., 2017). Some interview participants highlighted problems with using recognitional and analytical processes, but most seem to be unaware of the strengths and limitations of the different types of decision making and how they work together to create decisions.

There were a number of factors that made decision making particularly challenging. Problems of information (not enough, too much or poor quality) and lack of time were cited as mostly or always a challenge by over a third of survey participants. Other frequent challenges cited included lack of resources, stress, fatigue and distressed community members. The problems of information, time pressure and fatigue were considered to have a high to very high impact on decision making. Other factors having a high impact on decision making were stress and managing political interference. The literature review by Butler et al. (2024) (Section 3.1) shows that stress and fatigue are perennial challenges for EM decision making. Stress and fatigue further exacerbate other challenges for EM decision making, such as ensuring interoperability and dealing with the ethical dimensions of an incident. In the case of fatigue, Yung et al. (2021) and Dawson et al. (2021) observe that cultural change across the emergency services was necessary to understand fatigue as a high-risk phenomenon needing to be managed.

While the majority of participants thought that decision-making tools provided by the organisation were clear and easy to use, a number of problems with such tools were identified (such as not applying in most situations, taking too long and being difficult to use). In addition, about a quarter of participants had difficulty accessing cognitive aids when they needed them. This may be why a third of participants regularly used cognitive aids that are not officially sanctioned by the organisation (i.e., non-official). There doesn't seem to be any restriction in most organisations about using non-official cognitive aids. However, using non-official cognitive aids means that these are not formally being managed by the organisation and may lead to unforeseen or unintended consequences. An investigation of non-official cognitive aids provides an organisation with an opportunity to collect examples of best practice, better manage the process and enhance their support of operational decision making.

The literature review of cognitive aids by Penney et al. (2024) (Section 3.2) highlights that most EM organisations need to consider how these aids are being used by their workforce to ensure that there is suitable training provided to select and use these aids effectively. Importantly, there is a difference between the way tools are applied between novices and experts, with novices tending to adhere strictly to defined steps and protocols while experts apply greater discretion in how they apply the cognitive aid based on the unfolding situation (Penney et al., 2022; Launder & Penney, 2023).

# Implications for training

The survey, interviews and literature reviews yielded a wide range of insights and we have highlighted some of the broad findings in this report. In this final section implications of this research for training are discussed.

The data showed that there is a clear opportunity to enhance EM decision-making training. While the majority of participants felt that the general training they had received from their organisation had improved their ability to make safe and effective operational decisions, it was clear that the majority of participants also felt that the approach to operational decision making taught during any training was sometimes or mostly ineffective. Also of concern is that nearly a third of the survey participants stated that the training they had received on decision making rarely or never changed their on-the-job practice. It is important then for researchers and educators to develop enhanced EM decision-making training. One of the outputs of the project that has already been agreed on is the development of a skill acquisition framework. This is a tool that aims to complement how we think about training and the development of decision making. Some suggestions about how to improve specific aspects of decision-making training are made below.

The survey and interviews showed that people generally use a combination of intuition and analytical processes to make decisions. While some participants identified problems with using recognitional and analytical processes, most seem to be unaware of the strengths and limitations of the different types of decision making and how they work together to create decisions. This suggests that EM practitioners would benefit from additional training content so that they can become more attuned to the assumptions, requirements, strengths and limitations of the decision-making processes they are employing. It is possible that a number of strategies could be developed that maximise the strengths and minimise the limitations of each process. It is likely that this content will need to be gradually introduced to people through their training so that the fundamentals are outlined early on and progressively consolidated so that by the time they undertake more senior roles they are familiar with this content and able to reflect on how it may influence their decision-making practice.

While the majority of participants thought that decision-making tools provided by the organisation were clear and easy to use, a number of problems with such tools were identified (such as not applying in most situations, taking too long, and being difficult to use). In addition, about a quarter of participants had difficulty accessing cognitive aids when they needed them. This suggests that there is an opportunity for organisations to provide more guidance on how to make operational decisions by developing sets of cognitive aids that better support operational decision makers. With a few exceptions there has been very little validation or evaluation of many common cognitive aids, which is a gap that needs to be addressed. Given that a third of participants are using sets of unofficial cognitive aids, part of the training could be based on how and when to use cognitive aids and their strengths and limitations.

While the large majority of participants follow their organisation's rules and procedures, it seems that there can sometimes be a mismatch between what the procedures say and the best decision based on participants' knowledge, experience and training. This and the lack of resources where major reasons why participants didn't follow organisational policies and procedures. Writing doctrine that effectively constrains people's behaviour while giving them appropriate license to make decisions to better manage the system is difficult and is often done without an awareness of these competing pressures, which should be addressed. For the operational decision maker, more awareness and training on how to exercise appropriate operational discretion needs to be considered (Butler et al., 2021).

Many of the survey and interview participants highlighted how coaching and mentoring had enabled them to develop and refine their decision-making practice. However, it was also noted that formal coaching or mentoring from the organisation was often not available and that participants had made their own informal arrangements to obtain mentoring. Several excellent resources already exist that support how to set up and run coaching and mentoring programs (for example, Hayes, 2018) and it seems there is little to add to these

existing resources. Enhancing opportunities for coaching and mentoring appears to be an organisational issue rather than a research problem.

Several ideas about options that can be used to enhance EM decision-making training and practice are proposed in Figure 3. The next stage of this project is to work with our Project Development Team to identify which of these options are feasible and should be selected and developed in more detail. It is intended that the development of the products will be undertaken using the human-centred design method (Bearman et al., 2018), which is essentially an iterative cycle of development, evaluation and modification in combination with end-users (in this case the members of the Project Development Team).

Figure 3. *Initial ideas for tools and resources that may be developed by this project*

| Area of improvement | Resource or tool |
|---|---|
| Decision-making practice | Guidance on the strengths and pitfalls of different decision-making approaches<br>Evaluation of tools<br>Guidance on how to select and use tools to support decision making |
| Organisational policies, procedures and guidance | Guidance on operational discretion |
| More general training and skill development | Develop the skill acquisition framework concept |

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