

British Academy of Management Conference 2025
Decision Making Under Uncertainty Track: Developmental Paper

Emergency Management Decision Making

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This research is funded by Natural Hazards Research Australia

Summary

This developmental paper is based on an ongoing study of emergency management decision making, by a joint research team from Australia and the UK (funded by Natural Hazards Research Australia). The need for effective decision making in emergency management applies to first on-scene responders, incident command teams, or strategic teams supporting a tactical response. The project was designed to examine current doctrine, training and the tools and systems available to develop and support incident commanders' decision making during emergencies. The study involves a literature review, a questionnaire survey and interviews with experienced incident commanders from the emergency services in Australia and the UK. In this presentation, the aims and method for the research project will be outlined along with selected findings that have particular relevance for industrial managers and operational staff who may have to make decisions in uncertain conditions, such as an emergency situation.

Word Count 1361

Introduction

This developmental paper is based on an ongoing study of emergency management decision making, by a joint research team from Australia and the UK (funded by Natural Hazards Research Australia). The need for effective decision making in emergency management applies to first on-scene responders, incident command teams, or strategic teams supporting a tactical response. In this presentation, the aims and method for the research project will be outlined along with selected findings that have particular relevance for industrial managers and operational staff who may have to make decisions in uncertain conditions, such as an emergency situation.

Background

The emergency services are expected to prepare their incident commanders so they can make effective decisions for challenging situations that may be uncertain, dynamic, time-pressured and involve high-stakes. Skill in this type of decision making under uncertainty may also be required for industrial site managers, especially those in the higher risk sector and in remote locations, such as offshore energy installations. Industrial disasters in the UK, such as the loss of the *Piper Alpha* oil and gas platform in 1988 have demonstrated that managerial competence in emergency decision making may be deficient (Flin, 1996). In some industries, such as aviation and maritime, front line operational staff, such as airline pilots, must also be able to take rapid decisions in high risk, uncertain situations. The investigation into the Air France (AF447) mid-Atlantic crash in 2010 resulted in a renewed focus on pilots' abilities to make critical decisions in non-normal conditions (Oliver et al, 2017).

Effective emergency decision making requires sound and timely decisions based on an adequate understanding of the situation; a suitable decision making approach and the appropriate involvement of others in the decision process (Hayes et al., 2021). Four main types of decision making approach have been identified (see Flin et al, 2025) that are applied in emergency management: intuitive decision making based on pattern recognition; analytical decision making based on choosing between optional course of action; rule-based decisions based on following a protocol or algorithm; and creative decision making based on the generation of novel solutions to problems (Penney et al., 2022; 2024b). Most emergency decision making can be categorised as either intuitive or analytical, with rule-based and creative decision making used only rarely, although it should be noted that decisional strategies are not necessarily distinct but may merge and co-occur (Reale et al., 2023).

The broader environment that higher risk industries and the emergency services operate in continues to evolve. Macro-forces such as new technologies (Chen et al., 2019; Misra, 2020), and the adverse impact of climate change on the frequency, scale and complexity of incidents (Bosomworth et al., 2017; Mach et al., 2016) are now creating a particularly challenging decision making environment. Recent UK events (e.g. Manchester Arena Inquiry (2023) and Grenfell Tower Inquiry (2019), as well as research into breakdowns in coordinated decision making (e.g., Bearman et al., 2015) have highlighted the challenges of making decisions in emergency management and the need to enhance decision making capability. Hence the commissioning of this project.

Project Aims

The research aims are to develop greater knowledge and understanding of key aspects of emergency decision making and thus enhance emergency management decision making training through the development of a set of prototype training and learning products that support the needs of decision makers operating in a variety of decision making environments.

In addition, a skills acquisition framework will be produced that can assist organisations, teams and individuals to be more cognisant and skilled in what, when and how they apply suitable decision making practice and tools. These products will be based on an analysis of the current practice and future requirements of decision making. This enables organisations to build capacity for strategic and operational decision making; increase their knowledge of decision making contexts and to develop decision making skills more quickly.

The method and preliminary findings are outlined below.

Method

Literature Review

During the initial phase of this project, a set of literature reviews was undertaken examining emerging issues (Butler et al, 2024), use of cognitive aids (Penney et al, 2024a) and emergency management decision making training (McLennan et al, 2024).

Online Survey

Questionnaire surveys of incident commanders in the emergency services have been conducted in Australia and in the UK. For the UK, support was secured from the National Fire Chiefs Council (NFCC), National Police Chiefs Council (NPCC) and Association of Ambulance Chief Executives (AACE). To date, 200+ responses have been received from the UK and Australia (from the fire service, police and ambulance plus other emergency responders) All four levels of command are represented.

Interviews

The final question of the survey invited respondents to volunteer to be interviewed. The one hour, online interviews focused on developing an understanding of decision making training, guidance and practices. To date 35 interviews have been conducted with UK incident commanders in the UK and 36 in Australia. This samples have representation from all the emergency services and in the UK, from each of the four nations. The interviews have been recorded and transcribed for analysis which is currently in progress.

Preliminary Findings

Emergency management organisations have developed doctrine, training and various systems to develop and support decision making during emergencies. Whilst there is good practice, tools and training for decision making in this sector, there is much unevenness in capability within and between organisations. Practitioners tend to learn mainly about incident management, with limited content focused on decision making. Effective mentoring /coaching were important in helping some interviewees practise and build key decision making skills, but typically informally arranged. Practitioners had reasonable comfort with their decision making but some recognition that they may not consider strengths/ limits of different decision making approaches. Some practitioners shared information on the checklists and tools they had developed to help them make decisions.

Gigerenzer (2023) has argued that intuition is a powerful form of unconscious intelligence and that its value has been seriously underestimated. In particular, he indicates that the focus on identifying heuristics and biases has led academics to over-focus on mistakes rather than how people often get things right. As part of the project, participants' views on their use of intuition and other methods of making decisions in emergencies are being collected.

One aspect of emergency decision making which seems to be attracting more attention is time estimation which has at least two aspects. The first is time to make a decision and it is notable that some of the large airlines have now amended their decision making acronym (DODAR), to T-DODAR (see Gogalniceanu et al 2022) which emphasises the initial time estimation component. The second aspect is estimating the time to be allocated to allow your strategy to work, as illustrated by this quote from an experienced fire commander, “*And here's where the balancing act goes on. You have to give a strategy enough time to work and at the same time you have to know when that time has ended, when that strategy is not working and something else has to happen and it's seldom black and white. There are so many grey areas in firefighting where no one's going to tap you on the shoulder and say, '7½ minutes are up, you have to change your strategy'. It is obviously a very subtle decision.*”

The way that emergencies are managed is also evolving as information technology provides new opportunities for improved decision support and enhanced training systems. While new technology has considerable potential to enhance emergency management, it can also bring problems for the human users. Some of the human factor challenges associated with new technology are being explored, e.g. trust in the technology; not understanding the limits of the technology; and the need to interpret the outputs of the technology in the context of the ongoing emergency. It is important to understand the way that the demands for emergency decision makers may change in the future, to foresee some of the potential problems and to develop decision making practice and training that take them into account.

Implications from our emerging findings for decision making under uncertainty for industrial managers and their operational staff will be developed for presentation and discussion at the conference.

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