An operator's guide to SPAR(CD): a model to support decision-making

Peer reviewed

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Introduction

Penney *et al.* (2022) described a study of over 10,000 English-language studies on threat assessment, sense-making and critical decision-making in the fields of police, military, ambulance and firefighting. The study resulted in the improvement of the SPAR decision framework (Launder & Perry 2014) used in urban fire service operations in Australia (e.g. the South Australian Metropolitan Fire Service Operational Decision-making Model – SAMFS, 2019). The enhanced framework, known as the S(CD)PAR framework (Launder & Penney 2023), is an all-encompassing decision-making approach applicable to emergency management. It consists of 6 constructs: Situation Awareness, Context Assessment, Decision-making, Planning, Action and Review. These constructs were identified through the review of high-risk industries and, while they are typically followed sequentially, they can be used flexibly depending on the situation.

In this paper, and building upon the theoretical roots presented in Launder & Penney (2023), a concise and practical version of the S(CD)PAR framework called the SPAR(CD) model (Figure 1) is presented. The SPAR(CD) model is equally suitable for frontline novices and experienced controllers in emergency services organisations as well as in business contexts.

The SPAR(CD) model, derived from the S(CD)PAR framework, retains the main themes identified in the research but is presented in a visually simplified form. This simplification enhances its practicality for operational use, such as procedure development, training and post-incident review. The naming convention has been simplified using the acronym SPAR(CD) instead of S(CD)PAR to make it easier to remember and communicate. The SPAR(CD) model aligns with the theoretical foundation of the original framework while being accessible and practical.

The tailored version for practitioners simplifies the language and provides guidance instead of descriptive terms used in the framework. The model uses visual imagery to make it memorable for users. For example, the Situation, Plan, Actions and Review domains are colour-coded with supporting text using the same colours to enhance visibility.

Abstract

In order to explore the commonalities and differences in decision-making across emergency services organisations, a systematic literature review of over 10,000 peer reviewed English-language studies was undertaken looking at sense-making and critical decision-making in police, military, ambulance and firefighting contexts. The insights gained and lessons learnt from this research enabled the development of the Situation, Context, Decision, Plan, Act, Review or S(CD)PAR framework. The new framework is hazard and service agnostic, not only incorporating complexity analysis and contextual factors but also being applicable to the full spectrum of emergency management operations. This paper presents the operational translation of the theoretical S(CD) PAR framework into a multi-sector end-user decision SPAR(CD) model that can guide operational decision-making as well as the development of policy, procedures and learning and assessment tools. While the S(CD)PAR framework and SPAR(CD) model have been developed based on research in high-consequence and low-time emergency services and military environments, they are equally applicable in other environments including business contexts and boardrooms wherever decisions are made. This research and subsequent model are important as it supports a common approach to decision-making and also provides a foundation for teaching and assessing evidence-based decision-making across multiple contexts.

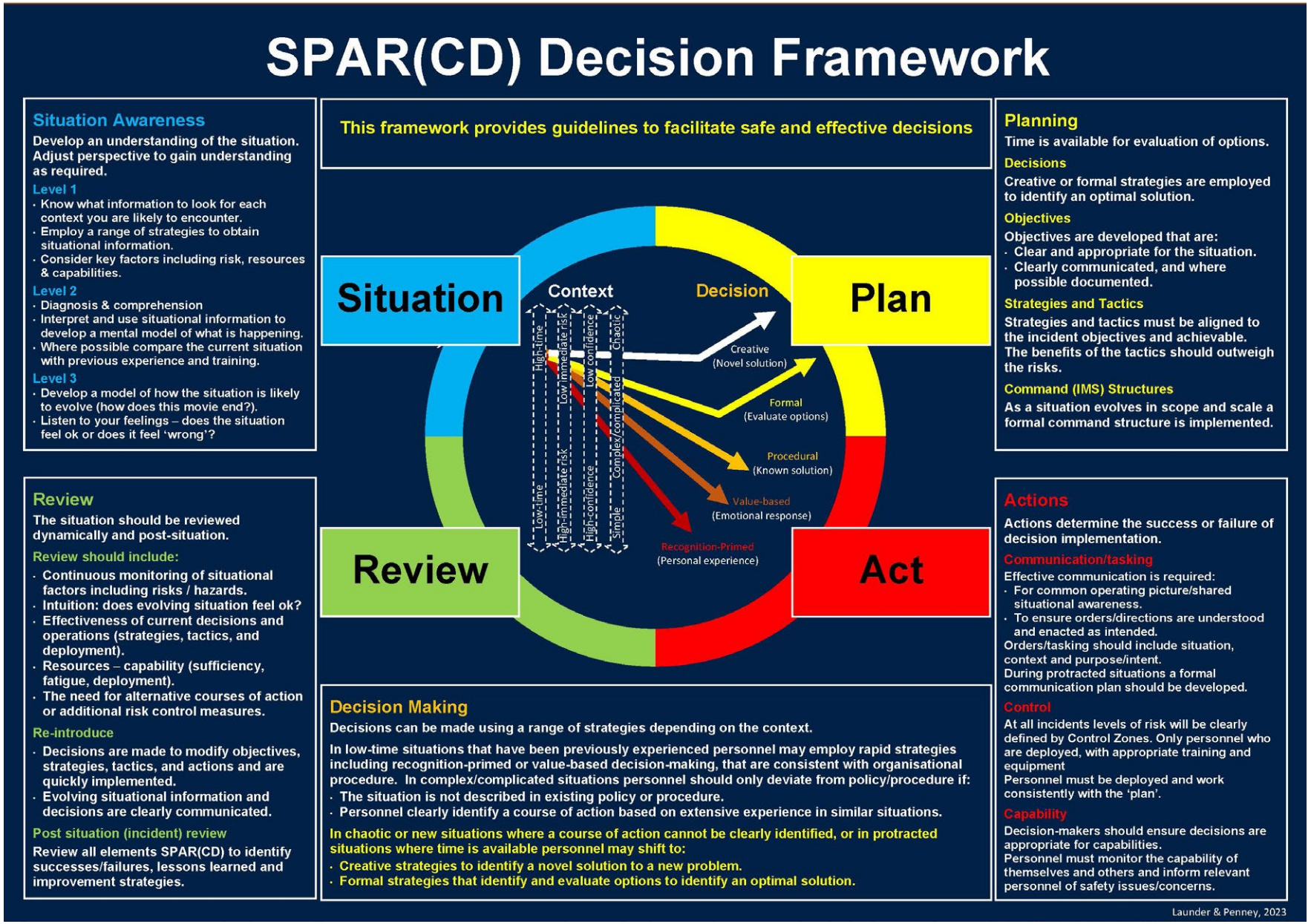

Figure 1: The operational all-hazards SPAR(CD) Decision Model in an end-user version of the S(CD)PAR Framework.

The Context domain is represented by vertical continuums, simplified to avoid overwhelming information. Additionally, 5 decision-making situations are represented with distinct colours and brief descriptions. The model also includes text to guide decision-making and emphasises the importance of considering context, prior experience and deviating from procedures only when necessary and when the decision-maker(s) have successfully managed similar situations before.

In this paper, the key elements of the simplified SPAR(CD) model are presented as well as their potential applications of developing doctrine and procedures, creating learning and assessment resources and conducting post-incident reviews.

Situation awareness

The initial phase of decision-making involves the decision-maker comprehending their surroundings by gathering and interpreting important information (Penney *et al.* 2022). While terms like 'assessment', 'threat assessment' (Martinez-Fiestas *et al.* 2020, Penney, 2019), 'perception' (Moffat & Witty 2002), 'orientation' (Bryant 2006) and 'situation assessment' (Cohen-Hatton & Honey 2015) were identified, Endsley's (1995, 2015), situation awareness was found to be the most commonly mentioned term and the one with the most applicability.

The model's description of situation awareness, although simplified, serves as the foundation for both common and industry-specific language and training. For instance, while gathering and interpreting information is necessary in any industry, there are distinct differences in the nature of the information, its meaning and how it is gathered. Paramedics, for example, seek patient symptoms to understand the extent of trauma and predict the likelihood of survival and the need for immediate hospital transfer (Gunnarson & Stomberg 2009, Ryan & Halliwell 2013). Firefighters develop situation awareness through 'size-up', which involves assessing visual cues like smoke density, colour and movement to determine the risk of flashover, survivability and structural collapse (Launder & Perry 2014). Police may engage in 'threat assessment', considering factors such as incident type, location, number of individuals involved, public visibility, suspect characteristics and behaviour to assess personal and public risk (Bonner 2018, Harris *et al.* 2017). Similarly, military personnel gather intelligence through surveillance and intercepted communications taking into account terrain, enemy disposition, morale and logistical movements to develop situation awareness (Shortland, Alison & Barrett-Pink 2018). While these examples are simplistic, they highlight the common process of understanding the relevance of industry-specific information, learning methods to obtain it and, most importantly, building experiential knowledge for interpretation, schema development and prediction.

Context

Review of the literature identified an additional set of factors that may affect the development of situation awareness. These factors include time and risk factors identified by Crichton and Flin (2002), decision-maker confidence (Launder & Perry 2014) and 'contextual' domains identified in the Cynefin framework (Snowden 2002). The importance of context to the development of situation awareness and subsequent decision-making is recognised by the inclusion of the 'C' in the S(CD) PAR framework and SPAR(CD) model. The complexity of the operating environment is a significant factor for decision-makers. The Cynefin framework (Snowden 2002) categorises context complexity into domains: Complex, Complicated, Clear, Chaotic and Confused. These domains correspond to different levels of situation complexity and, in emergency operations, there is a potential to transition through these domains based on operational tempo, influences and changes. The perception of complexity may vary depending on an individual's perspective. For example, a large chemical warehouse fire may be rightly perceived as chaotic by someone fleeing, while an experienced fire services incident controller may view it as complicated. Experienced decision-makers must avoid becoming overly confident in their understanding of the situation as they may fail to anticipate or recognise potential changes that can cause chaos in the environment.

The connections between assessing the context type and selecting decision approaches are crucial, especially in developing personnel for such environments. Therefore, all these contextual factors, including time, risk, confidence (affective domain) and the Cynefin domains, are incorporated into the S(CD)PAR framework and the SPAR(CD) model. These factors are presented as linear spectrums representing a gradient between low and high, illustrating how this gradient corresponds to the selection of a decision. For instance, low-time, high-risk situations require the use of Type 1 (or naturalistic) decision strategies (Klein 1998), but this may pose challenges if the decision-maker lacks confidence or experience. To maintain visual simplicity, the SPAR(CD) model does not include text descriptions of these gradients and combines confidence and experience into a single continuum, with the understanding that additional information would be provided in explicit training and procedural resources.

Decision-making (Type 1)

The S(CD)PAR framework and SPAR(CD) model (see Figure 1) present a spectrum of decision approaches ranging from fast and intuitive Type 1 (naturalistic) to Type 2 formal strategies, as proposed by Crichton and Flin (2002). After reviewing various models in the literature, 5 strategies were frequently cited and widely applicable in emergency services and military contexts. The framework summarises these models, starting with those closest to the naturalistic end of the spectrum.

In all service contexts, the fastest decision strategies used in low-time, high-risk situations include recognition primed, intuitive, value-based or heuristics-based decisions. These approaches are commonly classified as naturalistic or Type 1/System 1 decisions (Kahneman & Klein 2009; Klein 1993; Klein, Calderwood & Clinton-Cirocco 2010) and are employed by firefighters, police, paramedics and military personnel in such settings (Bakken & Gilljam 2003; Jenkins *et al.* 2010; Cohen-Hatton, Butler & Honey 2015; Harman, Zhang & Greening 2019; Klein 1993, 1998; Klein, Calderwood & Clinton-Cirocco 2010; Cohen-Hatton & Honey 2015; Okoli *et al.* 2016; Pripoae-Serbanescu 2012; Murdoch 2019;

Reay *et al.* 2018). In situations with severely limited decision time, these strategies may be the only ones that can succeed.

The next type of decision strategy is 'value-based', which relies on the decision-maker's ethical or moral values or their perception of right and wrong in a given situation. While these strategies were found to facilitate rapid decision-making, they also have the potential to introduce decision errors and biases (Ferguson 2002; Kahneman, Slovic & Tversky 1982). Additionally, concerns exist that values, whether cultural or organisational, can consciously and unconsciously influence risk perception and appetite. When responders are required to participate in or make operational decisions that conflict with their own values, it can lead to long-lasting and damaging moral injury (Lentz *et al.* 2021).

The third Type 1 decision strategy is 'procedural' decisions, which are predetermined decision solutions derived from known and previously resolved situations, risks and problems. The literature indicates that inexperienced personnel are expected to closely follow documented procedures (e.g. Perona, Rahman & O'Meara 2019; Reay *et al.* 2018; Seiler, Fischer & Ooi 2010), while more experienced personnel use procedures as operational guidelines, particularly for recurrent or routine aspects of tasks (Okoli *et al.* 2016). One coronial review emphasised the importance of procedures providing simple and accurate guidance and being complemented by the teaching and practice of other decision-making strategies (Torrie 2012).

Decision-making (Type 2)

Formal decision strategies involve considering multiple options to develop optimal or innovative solutions. The literature supports the use of formal decision strategies in situations where there are risks of decisions being questioned (Seiler, Fischer & Ooi 2010) and in complex and uncertain high-risk industries. These strategies are also applicable in stabilised situations, allowing for confirmation or disconfirmation of initial Type 1 decisions as well as in complex situations where multiple decision-makers must handle extensive situational information over a prolonged period (McLennan *et al.* 2006). Formal decision strategies can be used as a training approach aligned with procedural solutions for beginners until they gain enough experience to employ faster intuitive strategies (Banks, Gamblin & Hutchinson 2020). This represents the transition from Type 2 to Type 1 thinking as discussed by Kahneman (2011).

Plan

In the sectors examined, the concept of 'planning' is well-established and widely implemented. The literature identifies common elements of planning behaviours, which include setting objectives, considering options, selecting appropriate strategies and tactics and establishing organisational or command structures to ensure coordination and logistical functions in developing the plan. The term 'planning' encompasses both the preparation for a future situation and the process of deciding on an optimal strategy.

In the SPAR(CD) model, a plan is defined as a formalised course of action resulting from conscious consideration of options through formal decision-making. Planning includes behaviours such as objective setting and the establishment of aligned strategies and objectives, which are fundamental elements in operational doctrine and practice across these industries. These behaviours are documented in frameworks like the National Incident Management System[1] in the USA and the Australasian Interagency Incident Management System.[2]

Act

In the sectors examined, the implementation of decisions, regardless of the decision-making process, was found to be a crucial factor in determining success or failure. In the original SPAR model, this phase was referred to as the 'Act' phase. The literature indicates that in situations requiring rapid Type 1 decisions, success relies on the technical and interpersonal expertise of decision-makers and their immediate team members. They must effectively manage the cognitive and emotional demands of the situation. This means that personnel on the front line need to possess situational awareness, make satisfactory and safe decisions and have the technical and emotional abilities to perform necessary actions under pressure. However, the responsibility for enacting decisions also falls on senior officers in larger incidents, where the effectiveness of plan execution is strongly linked to translating decisions into timely and effective actions.

Coronial investigations (e.g. Torrie 2012; Teague, McLeod & Pascoe 2010; BBC 2023) have highlighted the failure to employ these action or plan implementation behaviours as contributing factors to fatalities, community loss and incident management failures. Therefore, these behaviours are explicitly incorporated in both the S(CD)PAR framework and SPAR(CD) model. The framework defines actions as the behaviours used to carry out decisions by the decision-maker or those directed by them. In contrast, the model simplifies this definition and explicitly describes 4 actions that determine the success or failure of decision implementation: communication, coordination, control and capability. Specific instructions are provided for each of these behaviours in line with the findings of the literature review.

Review

The literature highlights that across the sectors examined, the effectiveness of decisions and their implementation is monitored, evaluated and adjusted as needed. The term commonly used to describe this process, and subsequently adopted in both the framework and model, is 'review.' Personnel first deployed to these high-risk environments may dynamically and intuitively review the initial situation awareness, decisions and deployments and their effectiveness. As situations become larger, more complex and higher-risk, there is a need to shift towards formal decision strategies involving higher-ranking personnel and the formalisation of planning, communication, coordination and control. Experienced individuals are more likely to recognise this

1. National Incident Management System, at www.fema.gov/emergency-managers/nims.
2. Australasian Interagency Incident Management System, at www.afac.com.au/initiative/aiims.

need earlier and take corrective actions promptly. In declared emergencies and military operations, regular and structured reviews are conducted through situation reports and briefings. These formal reviews allow for the confirmation, disconfirmation or overriding of initial intuitive decisions or decisions implemented by personnel acting on orders from senior officers through deliberative and analytical thinking. In longer incidents where decisions are made in a series, the review process enables decision-makers to implement a decision, learn from the outcome and make corrections before making new decisions.

Application of SPAR(CD) beyond incident response

Doctrine

The literature identified strengths and weaknesses of doctrine, policy and procedure across the sectors. Doctrine is most frequently identified in the literature in the military context as a set of principles that overarch policy and procedure.

Whereas the failures of prescriptive policy and procedure were documented in the literature (e.g. Sarna 2002, Manne 2009) the need for a balanced and flexible approach to policy and procedure were also identified (e.g. Launder & Perry 2014). Therefore, the decision theory elements identified in the literature may form the basis for the development of fundamental principles that may be adopted as common elements of doctrine, policy and procedure while providing implicit and explicit guidance for how intelligent and informed decision-making can be developed and applied. For example, although the SPAR(CD) model is theoretically non-linear, it can form the basis of a multi-situational process consisting of:

1. establishing situation awareness
2. making an appropriate decision (for the context)
3. putting immediate decisions into 'action'
4. reviewing initial decisions, their implementation and the evolving situation
5. formalising operational 'planning' including objectives, strategies, tactics and management structures
6. formalising coordination, control and capability systems as scope and scale increase
7. repeating these processes dynamically until the situation is normalised
8. undertaking a post operational review of each element.

Under this proposed model, the broad approach (doctrine) is generalisable. However, for each specific situation and context, enough specific information would be required to provide clear 'rules' for novices and guidance for experienced personnel. For example, an operational structure fire procedure may provide explicit guidance on the situational information to be gathered and interpreted and how this information may be obtained. It might then specify immediate actions that must be taken to ensure firefighter safety and guidance on appropriate strategies and tactics based on what has been determined to have been effective in previous 'like' situations. However, even well-constructed doctrine, policy and procedure are unlikely to be effective without additional explicit and implicit teaching of these underpinning decision-making principles and behaviours (Torrie 2012). Furthermore, these links between explicit principles of doctrine and the provision of learning are implicit in the definition that 'doctrine means "that which is taught"' (Australasian Fire Authorities Council 2016).

Learning and assessment

One of the findings of this study was the contention that these high-risk sectors should include implicit and explicit teaching of decision-making to personnel (e.g. Torrie 2012). Therefore, decision theory should form an explicit part of the curriculum taught across these sectors—not as a standalone element, but as a key embedded component of the development of expertise and mastery. The SPAR(CD) model is particularly compatible with contextualised learning and assessment strategies where increasingly complex simulated environments are used to develop expertise.

First, learning environments should contain and require learners to identify and understand situational factors they will encounter requiring the application of theoretical understanding. Next, they should require learners to determine a working course of action and put this into action applying technical skills and capabilities. These environments should include the requirement to reflect on decisions and actions taken and where opportune the provision of feedback and coaching. The SPAR(D) model has been applied within the fire sector as the basis for assessment of incident management competence. This includes the development of assessment rubrics for each of the model's constructs.

While the primary scope and length of this article prevents full discussion of these assessment rubrics, an example rubric element for the situation construct is provided in Table 1. In the example provided, a sliding quantitative scale supported by evidence-based objective behaviour measures enables situational awareness to be captured. With subsequent rubrics for each of the SPAR(CD) elements, the components of decision-making can be assessed separately within a single holistic training simulation (or used in real-world real-time incident mentoring and validation). Development of each of the associated rubrics in full is identified as a body of future work by the authors.

Post-situation/incident review

The SPAR(CD) model provides a framework for the consistent review and analysis of critical factors following the deployment of personnel in complex, high-risk situations. The application of a consistent cross-industry 'lens' will produce consistent findings with common constructs and terminology to ensure emerging risks and operational successes and failings are likely to be shared. An example of the application of the SPAR(CD) model for post-incident review is provided and some key findings are summarised of the Grenfell Tower fire (Moore-Bick 2019).

The Grenfell Tower fire in West London of 14 June 2017 resulted in the loss of 72 lives. The fire started in a refrigerator in an apartment on the fourth floor of the building. The fire 'flashed

Table 1: Example rubric assessing the Situation domain of the SPAR(CD) model.

Situational awareness	1 2 3	4 5 6	7 8 9	10 11 12	13 14 15
Uses appropriate strategies to establish Level 1, Level 2 and Level 3 Situational Awareness (Gathers the right incident information, develop a clear and accurate model of the incident and its likely progression that Includes accurate risk vs benefit assessment)	Situational Awareness is flawed: · unstructured (misses key strategies/ sources) and untimely · fails to identify or understand risks, generic or critical incident factors · inaccurate prediction of the incident progression and consequences · projections flawed/high-risk.	Situational Awareness is incomplete: · uses a limited range of information strategies · untimely (delayed or rushed) · misses critical factors or requires prompting · situational factors/risks are misinterpreted · does not verbalise an accurate model.	Situational Awareness is satisfactory: · gathers key information within required time · includes key strategies (inner/ outer, inspection) · identifies crucial generic or critical factors · verbalises an accurate model includes key (obvious) factors and risks · outlines a probable incident progression.	Situational Awareness is effective: · information gathering is efficient · rigorous, includes key strategies (inner/outer, inspection) · identifies all key and critical factors · consistent with procedure · verbalises a clear and accurate model of the incident addressing key factors and risks · outlines a logical progression of incident.	Situational Awareness is highly effective: · information gathering is prompt and efficient · comprehensive, including key strategies · identifies all key information · consistent with procedure · promptly articulates a comprehensive and accurate model of the current and future incident addressing all key factors and risks.

over' breaking the apartment windows and igniting combustible aluminium composite panel cladding fixed to the tower.

The fire displayed behaviour that had not been previously observed by firefighting personnel in attendance. The fire spread was faster than previously witnessed, driven by a combination of highly combustible aluminium composite panels and a wind-driven (pressure-differential) effect and an eventual heated air column. A lack of previous experience with the materials burning, the speed of fire spread and misunderstanding of temperatures generated by the fire led to flawed situational awareness. Furthermore, personnel were unaware that some of the tower stairwells were compromised and access and egress was reduced. Initial decisions were made following organisational procedure. Primarily, this involved informing building occupants to remain in their premises until rescued. Firefighters would then ascend the building and clear each floor. It is noted that executing this procedure would require considerable time and resources.

Next, the deployment of personnel and the status of plan execution was severely compromised by the partial failure of communication systems (radios) and the reduced stairwell access. The failure of communication systems affected the dynamic incident review and incident commanders did not have correct awareness of the rate of progress of occupant evacuation. It was not recognised early that the heat generated by the aluminium composite panels and air column had caused the failure of external windows. This led to 'flashover' in apartments and rapid increases in the speed of fire spread. Under these hostile conditions, the initial decisions and plan to withdraw personnel had no chance of success. However, past experience had resulted in public injuries when unsupervised evacuations were implemented. Tragically, the fire behaviour encountered at the Grenfell Tower had been observed previously with as many as one equivalent scale, albeit without the number of fatalities (Thompson 2023). Enhanced cross-industry collaboration using consistent constructs and terminology is important to develop professional wisdom and improve decision-making in such high-consequence events. We posit the SPAR(CD) model and its associated outputs supports this.

Conclusion

The modified SPAR(CD) framework describes the common constructs and concepts found in the literature regarding decision-making in these sectors and the broader field of psychology. Its purpose is to establish a foundation for enhanced communication and collaboration among these sectors by identifying shared constructs and contexts. The goal is to achieve greater consistency in the terminology used to describe decision-making. By employing a common framework, it is anticipated that cross-sector learning can be facilitated that allows for a consistent examination of high-risk, time-sensitive decisions and the identification of common decision errors. This framework can improve decision-making through initiatives such as learning and development programs, policy and procedure design and implementation. Although developed for high-consequence emergency services and military settings, the SPAR(CD) framework can be applicable in other contexts, including business environments and boardrooms.

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