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The hidden cost of continuity: leadership buffering, boundary erosion, and psychosocial risk in safety-critical systems

Michael Mayom Ajith [a,*,1], Andrei A. Lux [a,2], Michelle Striepe [b,3], Tim Bentley [a,4]

[a] Edith Cowan University, School of Business and Law, Perth WA 6027, Australia
[b] Edith Cowan University, School of Education, Perth WA 6027, Australia

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ABSTRACT

Psychosocial hazards can compromise more than worker wellbeing. In safety–critical systems, sustained workload and uncertainty can combine with reduced recovery to weaken the human and organisational capacities through which risks are recognised and controlled. This study develops a systems model of how psychosocial demands, leadership buffering, and boundary disruption can constrain sustained adaptation while operations continue. We examine these dynamics among middle-level leaders in Australia's mining, oil, and gas sector during the prolonged COVID-19 crisis. Positioned between executive decision-making and frontline operations, these leaders translated changing directives into operating practice while carrying responsibility for continuity and employee wellbeing. We conducted semi-structured interviews with 24 managers and eight general managers. Team-based thematic analysis was supported by a cross-case descriptive matrix of recurring conditions. Leaders described isolation and disconnection alongside work intensification and fatigue. Persistent uncertainty was often accompanied by anxiety. As organisational arrangements changed, leadership roles expanded and work–nonwork boundaries became more permeable. Middle-level leaders buffered competing organisational and workforce demands, helping operations continue while opportunities for recovery narrowed. Participants described growing difficulty sustaining adaptive effort. The model distinguishes adaptive performance from adaptive sustainability. Continued functioning may coexist with depletion of the resources that enable further adaptation. We extend safety science by conceptualising psychosocial risk as a dynamic organisational process and identifying middle-level leaders as potential sources of safety intelligence. Effective control requires organisations to address how work itself generates exposure, including the staffing and authority available to leaders. Boundary protection and recovery should sit alongside individual support.

1. Introduction

Psychosocial hazards arise from how work is designed, organised, managed, and experienced. Researchers commonly examine their consequences through employee stress, exhaustion, psychological distress, and other health outcomes. In safety–critical industries, however, the implications extend further. Safe performance depends on people remaining able to notice weak signals, interpret changing conditions, communicate concerns, coordinate interdependent work, and make sound decisions under pressure. Psychosocial demands can impair these capacities, particularly when high workload and uncertainty combine with fatigue or other work-induced states that diminish human performance. A systematic review by Derdowski and Mathisen (2023) found preliminary evidence linking psychosocial work factors to safety in high-risk industries. The review also found that the evidence base remains fragmented and weighted toward individual safety behaviour rather than system-level outcomes. Psychosocial hazards therefore warrant attention as conditions that can shape the reliability of the wider socio-technical system.

This systems perspective changes the problem being examined.

* Corresponding author.
E-mail addresses: majith@our.ecu.edu.au (M.M. Ajith), a.lux@ecu.edu.au (A.A. Lux), m.striepe@ecu.edu.au (M. Striepe), t.bentley@ecu.edu.au (T. Bentley).
[1] ORCID: 0000-0002-0996-0134X.
[2] ORCID: 0000-0002-3454-946X.
[3] ORCID: 0000-0003-0216-5805.
[4] ORCID: 0000-0002-3859-548X.

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Organisational arrangements produce psychosocial hazards, including workload allocation, role design, staffing, leadership expectations, social support, and the degree of control available to those performing the work. Strengthening individual coping alone cannot fully address the risks arising from these conditions. Job demands–resources (JD-R) theory similarly explains how persistent demands consume physical and psychological resources, particularly when workers lack sufficient authority, support, or recovery opportunities to offset them (Bakker et al., 2023). In a safety–critical system, the resulting strain can affect how operational information is processed and how effectively emerging risks are escalated or controlled. What initially appears to be an employee-wellbeing problem may consequently become embedded in the organisation's capacity to operate safely.

Existing perspectives explain important parts of this process, but they do not yet connect them fully. Job Demands–Resources theory explains how sustained demands deplete physical and psychological resources when adequate support, control, or recovery is absent (Bakker et al., 2023). Safety-science perspectives explain how ordinary organisational adaptations can accumulate into latent vulnerability when local performance is maintained at the expense of wider system margins (Rasmussen, 1997; Reason, 1993). The organisational pathway connecting these levels is less developed, particularly how psychosocial demands concentrate within roles responsible for sustaining adaptive performance.

Prolonged crises intensify this possibility. Acute emergencies demand rapid adjustment, but they usually retain some expectation of resolution and recovery. A prolonged crisis creates a different temporal problem. Organisations must continue operating while requirements change, uncertainty persists, and temporary responses become part of ordinary work. Adaptation keeps the system functioning. It can also redistribute unresolved pressures to the people who repeatedly compensate for staffing constraints, procedural change, disrupted communication, and growing workforce needs (Ajith et al., 2026a; 2026b). As those compensatory practices become normalised, continued performance may conceal the erosion of the resources that make further adaptation possible. This creates a distinction between maintaining adaptive performance in the immediate situation and sustaining the resources required for continued adaptation over time. This tension connects psychosocial risk to established safety-science accounts of organisational drift, in which local adjustments preserve immediate functioning while gradually narrowing the system's margin for safe performance (Rasmussen, 1997; Reason, 1993).

The COVID-19 pandemic made these dynamics visible across safety–critical industries. Australia's mining, oil, and gas organisations faced an especially demanding combination of operational continuity and prolonged disruption (Ajith et al., 2026a; 2026b). Their geographically dispersed operations, hazardous production processes, complex regulatory obligations, and reliance on fly-in/fly-out or drive-in/drive-out work already required close coordination across technical and human systems. During the pandemic, organisations continued operating amid border restrictions, quarantine requirements, labour shortages, changing health directives, and altered work arrangements (Ajith et al., 2025). These measures protected continuity and reduced infection risks, yet they also extended periods of separation, disrupted established social connections, and increased uncertainty for workers and their families (Ajith et al., 2025; Asare et al., 2021; Ayaaba et al., 2024). Research on organisational resilience in oil and gas has long recognised the importance of adaptation to disruption, although the relationship between resilience and safety remains conceptually uneven across the sector (Bento et al., 2021).

Middle-level leaders played a pivotal role in this response. Middle managers exert influence by mediating between organisational strategy and operational practice, particularly when their roles span organisational boundaries and require both upward and downward influence (Floyd & Wooldridge, 1997). Their contribution extends beyond transmitting executive decisions. They interpret strategic priorities, reconcile competing demands, coordinate local action, and help employees make sense of change (Maitlis & Christianson, 2014). Huy's (2002) account of emotional balancing further shows how middle managers can preserve operational continuity while attending to the emotional consequences of organisational disruption. These functions became especially pronounced during the COVID-19 crisis. Operational leaders in Australia's resources sector implemented changing health requirements, reorganised work, maintained communication, and expanded their attention to employee wellbeing as the crisis evolved (Ajith et al., 2025).

Middle-level leaders' intermediary position makes them analytically distinctive within safety–critical systems. They remain close enough to frontline operations to encounter workforce anxiety, fatigue, staffing disruption, interpersonal conflict, and operational variability as these conditions emerge. At the same time, they carry responsibility for interpreting organisational requirements, coordinating resources, reconciling competing priorities, and supporting employees while maintaining operational performance (Ajith et al., 2025). Their authority over the structural sources of those pressures may be considerably narrower. Staffing levels, production expectations, regulatory requirements, and broader organisational arrangements can sit partly or wholly beyond their control. Middle-level leaders may therefore manage the consequences of organisational pressures without having the authority to remove their source.

This combination of operational proximity, coordinating responsibility, and constrained structural authority becomes particularly salient in Australia's mining, oil, and gas sector. Geographically dispersed operations and extended onsite rosters place middle-level leaders in sustained contact with both workforce and production demands. During COVID-19, changing health requirements, staffing disruptions, altered team arrangements, and continuing operational needs intensified this intermediary work. Practices such as increased availability, employee support, local coordination, and procedural adjustment helped contain disruption and maintain operations. Yet repeated reliance on these practices could also expand leadership roles and reduce opportunities for psychological disengagement and recovery.

Middle-level leaders therefore provide more than a convenient occupational sample. They offer an analytical window into how system-level pressures are translated into everyday adaptive work. Their accounts let us examine whether operational continuity is supported by replenishable resources or increasingly depends on compensatory practices that absorb unresolved demands elsewhere in the organisation. From a safety-science perspective, this distinction matters because strong performance at one point in time does not necessarily mean the human capacity supporting continued adaptation remains sustainable.

Existing research leaves this process incompletely understood. Studies of psychosocial risk in mining and oil and gas have predominantly examined worker mental health, occupational exposure, or safety behaviour (Asare et al., 2021; D'Antoine et al., 2023; Derdowski & Mathisen, 2023). Crisis-leadership research shows how operational leaders adapt their responsibilities and behaviours to maintain continuity, yet it has paid less attention to the cumulative psychosocial consequences of sustaining those adaptations or their implications for system reliability (Ajith et al., 2025). This literature therefore identifies psychosocial hazards and documents adaptive leadership responses but provides limited explanation of how the two become connected over time. It remains unclear how middle-level leaders may simultaneously experience organisational demands, compensate for those demands to maintain operations, and experience progressive constraints on the resources required for continued safe adaptation.

We address this gap by examining how middle-level leaders in Australia's mining, oil, and gas sector experienced and managed psychosocial risks during the prolonged COVID-19 crisis. We ask: *How did psychosocial demands and boundary disruption shape middle-level leaders' perceived capacity to sustain safe operational adaptation during a prolonged crisis?* Our analysis focuses on participants' accounts of psychosocial conditions, changing work and role boundaries, and the leadership

practices through which organisational pressures were absorbed or redistributed.

The theoretical problem sits at the intersection of several established perspectives. Job Demands–Resources theory explains how sustained demands can deplete individual and work-related resources (Bakker et al., 2023). Reason's (1993) account of latent conditions and Rasmussen's (1997) model of migration toward system boundaries explain how vulnerabilities can accumulate within organisational systems, while resilience engineering highlights the adaptive work through which functioning is maintained under variability. Each perspective illuminates part of the process. Less clear is how sustained psychosocial demands, organisational adaptation, and resource depletion connect through actors whose work partly involves absorbing and reconciling system pressures.

We address this problem by developing an empirically informed systems model centred on middle-level leadership buffering and boundary disruption. The model distinguishes adaptive performance—successful adjustment that sustains functioning under current disturbance—from adaptive sustainability, which concerns whether sufficient human and organisational resources remain available for continued adaptation. This distinction extends resilience-oriented accounts without treating adaptation itself as problematic. Operational continuity may reflect well-supported adjustment, but it may also depend increasingly on expanded responsibilities, persistent availability, and diminishing recovery. By examining that difference, the study positions psychosocial risk as an organisational process with implications for system reliability and identifies middle-level leaders as a potential source of safety intelligence. Strain concentrated within these roles may reveal accumulating pressure before it becomes visible through conventional incident or compliance indicators.

2. Literature review

2.1. Psychosocial hazards as organisational safety conditions

Psychosocial hazards arise from the way work is designed, organised, and managed. They include excessive demands, low control, inadequate support, role ambiguity, and exposure to conflict or isolation. In this study, psychosocial hazards refer to these work-related conditions, whereas psychosocial risk refers to the potential for harm that develops through exposure to them. The distinction matters. Fatigue, anxiety, and psychological distress may arise from psychosocial hazards, but they are not interchangeable with the organisational conditions that produce them. The ISO 45003 standard similarly locates psychosocial hazards within work organisation and directs attention toward their identification and control as occupational health and safety concerns (International Organization for Standardization, 2021).

Research conducted during COVID-19 documented extensive exposure to psychosocial hazards across sectors. High workloads, uncertainty, isolation, disrupted social support, and rapidly changing work arrangements were associated with strain and deteriorating mental health, particularly among workers required to sustain essential services during prolonged disruption (Franklin & Gkiouleka, 2021; Koren et al., 2023; Lulli et al., 2021). This literature established the breadth of the problem. Much of it, however, centred on workers' psychological experiences and the interventions available to help individuals cope. Stress management, counselling, resilience development, and employee support can assist people facing demanding conditions. They leave the source of those conditions largely intact when workload, staffing, role design, or organisational expectations remain unchanged.

Safety science begins from a wider unit of analysis. In a safety–critical system, reliable performance emerges through coordination among human activity, technology, organisational processes, and regulatory controls. Hazards can therefore develop within the relationships connecting these system elements rather than residing in any single person or component (Carayon et al., 2014; Leveson et al., 2009). Psychosocial conditions enter this system by shaping the human capacities on which safe operation depends. Sustained demands can affect attention, judgement, communication, and the recognition or escalation of emerging risk. These effects matter because operational safety relies on people continuing to interpret incomplete information and coordinate interdependent work under pressure (Derdowski & Mathisen, 2023; Hockey, 2013).

The safety implications of psychosocial risk remain less developed than its health consequences. Derdowski and Mathisen's (2023) systematic review found evidence connecting psychosocial work factors with safety outcomes in high-risk industries, although the literature remained fragmented and heavily focused on individual safety behaviour. Multilevel evidence links a poorer psychosocial safety climate to psychological distress and turnover intentions (Bentley et al., 2021), while mining research links psychosocial safety climate to unsafe behaviour through work stress and burnout (Yu & Li, 2020). Taken together, this research establishes a plausible connection between psychosocial conditions and safety–critical performance. It offers less explanation of how those conditions become embedded in organisational functioning or how their effects travel through a socio-technical system.

A tension remains between how psychosocial hazards are conceptualised and how organisations often respond to them. Psychosocial hazards increasingly sit within occupational health and safety frameworks as conditions produced through work design and organisation, yet intervention can still place considerable responsibility on individuals to remain resilient, manage stress, seek support, or recover more effectively. Such responses may help people experiencing strain. They do less to alter the workload, authority structures, staffing arrangements, or availability expectations through which exposure is produced. The result is a partial displacement of responsibility. Organisational demands are recognised, but workers and leaders still carry the burden of adapting to them (Ajith et al., 2025; Leka et al., 2015).

One explanation for this persistence lies in the asymmetry between supporting people within existing arrangements and redesigning the arrangements themselves. Counselling or resilience initiatives can be added to established organisational systems without necessarily changing how work is allocated or how operational priorities are set. Primary prevention asks more of the organisation. It requires scrutiny of the decisions that generate and distribute psychosocial exposure, including whether workloads are sustainable and whether people have sufficient authority or recovery capacity to meet the demands attached to their roles. In this sense, individualised responses can coexist with formal recognition of psychosocial hazards because they address the consequences of exposure without requiring equivalent change to its organisational source (Leka et al., 2015; Schulte et al., 2024).

For safety–critical systems, that distinction extends beyond employee health. Continued functioning can make an individualised response appear adequate even when performance increasingly depends on people compensating for unresolved organisational pressures. Support directed toward coping may therefore preserve short-term functioning while leaving the conditions that require repeated coping intact. Primary prevention requires attention to the design and organisation of work, while individual support remains complementary rather than substitutive (Schulte et al., 2024). Under prolonged disruption, compensatory adaptation can become routine, allowing operational continuity and accumulating vulnerability to develop together.

2.2. Prolonged crisis, adaptation, and organisational drift

The temporal character of a crisis shapes the demands placed on organisational systems. Acute emergencies concentrate disruption within a comparatively bounded period, even when their consequences extend beyond the event itself. Prolonged crises present a different adaptive problem. Requirements continue to change while ordinary operations must be sustained, temporary arrangements remain in use,

and recovery cannot be organised around a clear endpoint. During COVID-19, organisations repeatedly adjusted to changing public-health restrictions, labour disruption, and operational uncertainty while continuing to function (Ajith et al., 2025). Adaptation therefore became part of ongoing work rather than a temporary departure from it.

Resilience engineering provides an established account of why such adjustment is necessary. Reliable performance under variable conditions depends partly on people adapting work to circumstances that procedures cannot fully anticipate (Hollnagel et al., 2006; Hollnagel, 2018). Workers and leaders interpret emerging conditions, reconcile competing demands, and develop local responses that keep the system operating. Adaptive performance is therefore integral to resilience. However, adaptation tells us more about how current functioning is maintained than about whether the resources enabling that adaptation can be sustained indefinitely.

Adaptive performance should therefore be separated from organisational drift. Pettersen and Schulman (2019) show that local adaptive action does not become problematic simply because work departs from prescribed arrangements; the wider question is whether those adjustments remain connected to organisational processes that monitor, resource, and protect reliable performance. Rasmussen's (1997) account of migration toward system boundaries similarly explains how repeated local adjustments can alter operating margins under persistent pressure. Reason's (1993, 2016) work on latent conditions locates vulnerability within ordinary organisational activity rather than only in visible failure, while analysis of the Pike River disaster shows how governance and production pressures can accumulate through normal operations before their combined consequences become apparent (Logan et al., 2025). Drift can therefore emerge through locally sensible responses whose cumulative effects remain difficult to observe.

Prolonged disruption makes this distinction especially relevant because compensatory practices can become routine. Extended availability, reduced recovery, informal role expansion, and dependence on discretionary effort may all support immediate continuity. None alone signals declining reliability. The concern arises when continued performance increasingly depends on resources that are not adequately replenished or redistributed. Operational indicators may remain stable while the human capacity supporting adaptation becomes progressively harder to sustain. Successful performance today can therefore provide incomplete evidence of the organisation's capacity to keep adapting under future variability.

We capture this temporal difference through two related concepts. Adaptive performance refers to successful adjustment that enables continued functioning under current disturbance. Adaptive sustainability refers to whether sufficient human and organisational resources are preserved or replenished to support continued safe adaptation over time. Neither concept positions adaptation as inherently beneficial or harmful. Instead, it focuses on the conditions under which adaptive work is performed and how its resource costs are distributed across the system.

On this basis, we use latent organisational vulnerability as a higher-order theoretical condition rather than an empirically demonstrated state of impending failure. It describes the possibility that observable performance can continue while the resources supporting repeated adaptation become increasingly constrained. Conventional indicators such as production, compliance, injuries, or incidents may reveal little about accumulating fatigue, reduced recovery, or dependence on sustained compensatory effort. Psychosocial conditions are therefore relevant to reliability because they can provide information about the human resources through which adaptive performance is being maintained. Whether those conditions actually degrade the system remains an empirical question rather than a model assumption.

2.3. Psychosocial risk in the Australian mining, oil, and gas sector

Australia's mining, oil, and gas sector provides a setting to examine psychosocial risk alongside safety–critical performance. Operations commonly combine hazardous production processes with complex technologies and geographically dispersed workforces. Safe performance depends on sustained coordination across organisational levels, often under substantial operational demands. Fly-in/fly-out and drive-in/drive-out arrangements add a distinctive temporal and social structure to this work through extended roster periods, remote living, interrupted recovery, and separation from family and community (Asare et al., 2022; Gilbert et al., 2023; Matamala Pizarro & Aguayo Fuenzalida, 2021).

This work embedded psychosocial demands before COVID-19. Research on remote resources employment has identified isolation, work–life conflict, long working periods, and limited access to support as recurring concerns. The pandemic intensified many of these conditions. Asare et al. (2021) documented substantial mental-health concerns among Australian fly-in/fly-out workers during COVID-19, while D'Antoine et al. (2023) identified a broad range of psychosocial hazards within offshore oil and gas work. These findings locate psychosocial exposure within the organisation of resources work rather than treating it solely as an individual response to adverse events.

Pandemic controls further altered those organisational conditions. Travel restrictions and quarantine arrangements changed roster patterns and workforce movement, while separated teams and evolving requirements increased the coordination burden associated with maintaining operations. Leadership work changed alongside these arrangements. Ajith et al. (2025) found that operational leaders in the Australian resources sector expanded their activities across crisis communication, workforce support, and organisational adaptation as the disruption continued. Operational continuity was therefore achieved partly through changes in how work was coordinated and how organisational demands were carried.

Read through a safety-science lens, the sector literature raises a question that extends beyond employee wellbeing. Mining, oil, and gas organisations depend on people to continue coordinating work and adapting to variability within hazardous socio-technical systems. Yet the psychosocial literature has more often documented exposure and health consequences than traced how those conditions affect the organisational processes that sustain adaptation. The unresolved issue is particularly acute for leaders positioned between formal organisational controls and everyday operations. Their work offers a way to examine how psychosocial demands enter the system's adaptive functioning.

2.4. Middle-level leaders as safety intermediaries and organisational buffers

Middle-level leaders connect strategic direction with operational activity. Their work involves translating organisational priorities into local action while carrying information, concerns, and alternatives upward through the hierarchy. Floyd and Wooldridge (1997) conceptualised this position as strategic mediation, and later synthesis showed how middle managers contribute to implementation and organisational adaptation across hierarchical boundaries (Wooldridge et al., 2008). Their influence therefore derives partly from where they sit in the organisation: close enough to operating conditions to encounter emerging problems, yet sufficiently connected to higher-level processes to interpret and enact broader organisational priorities.

Safety research shows how this intermediary position shapes operational safety work. Middle-level leaders move safety information and influence how competing operational requirements are reconciled in practice. In civil aviation, Callari et al. (2019) found that middle managers' safety work involved managing information, influencing stakeholders, and making decisions across organisational boundaries. Bieder and Callari (2020) subsequently showed how such work is shaped by interacting organisational and environmental conditions. Psychosocial safety climate research adds another dimension by linking managerial commitment and organisational priorities with employees' perceptions

of psychological health and safety (Fattori et al., 2022). Middle-level leaders are therefore neither passive channels for policy nor autonomous controllers of the system. They perform their safety work within relationships of authority, information, and operational constraint.

Crisis conditions intensify this intermediary work. Leaders must interpret incomplete or changing requirements while sustaining coordination among employees who are themselves experiencing uncertainty. Huy's (2002) account of emotional balancing shows how middle managers can facilitate organisational adaptation by supporting commitment to change while responding to its emotional consequences. During prolonged disruption, this relational work becomes intertwined with operational coordination. Leaders may have to explain ambiguous requirements, resolve local problems, maintain communication, and support employees while the wider source of the disruption remains unresolved.

We use leadership buffering to describe this adaptive work, in which middle-level leaders absorb, translate, or redistribute organisational and workforce pressures in ways that help local operations continue. Buffering can include interpreting changing directives, filling coordination gaps, resolving immediate problems, or containing pressures that would otherwise pass more directly between organisational levels. In doing so, buffering can stabilise work and preserve operational continuity. The analytical question concerns the conditions under which that buffering occurs. Where leaders have sufficient authority, staffing, organisational support, and opportunities for recovery, adaptive work can be distributed and replenished. Where those conditions are weak, continued buffering may concentrate unresolved demands within the leadership role itself (Ajith et al., 2025; Wittmers & Maier, 2023).

This distinction prevents the model from treating adaptive leadership as inherently costly. Flexibility, communication, and employee support can strengthen organisational response during disruption. What matters is whether the resources required to sustain those practices remain available. The same observable continuity can emerge from well-supported adaptive work or from prolonged compensation by particular actors. Existing safety scholarship has examined executive commitment and frontline safety behaviour more extensively than this intermediary process. Research on middle-level safety work establishes the importance of these leaders to communication and coordination but leaves the resource consequences of prolonged buffering less developed.

Boundary disruption provides the next part of that explanation. When buffering depends on extended availability or an expanding range of responsibilities, the boundaries governing leaders' roles and opportunities for recovery can become increasingly permeable. Section 2.5 therefore examines how work–nonwork boundary erosion and role-boundary expansion may connect prolonged organisational pressures with leaders' perceived capacity to continue adapting.

2.5. Boundary disruption and constrained adaptive capacity

Boundary theory helps explain how prolonged organisational demands enter leaders' everyday work. Boundaries organise transitions between roles and domains, shaping when work begins and ends, which responsibilities belong within a role, and how people move between occupational and nonwork life. These boundaries vary in permeability. Some individuals prefer greater integration, while others rely on stronger segmentation. Effective boundary management therefore depends less on a universally ideal arrangement than on whether people retain sufficient control over when and how work crosses those boundaries (Kreiner et al., 2009).

Recovery research clarifies why that control matters. Psychological detachment allows the cognitive and emotional systems activated by work to disengage during nonwork time. Sonnentag and Fritz's (2015) stressor–detachment model shows how high job demands can inhibit detachment, while restricted detachment is associated with greater strain and poorer wellbeing. In safety–critical leadership, recovery also has an operational dimension. Repeated engagement without sufficient recovery can reduce opportunities to restore the attentional and emotional resources required for judgement under uncertainty. Boundary conditions have also been linked directly to safety-related outcomes. Cullen and Hammer (2007) associated work–family conflict with lower safety compliance and participation, while Sexton et al. (2017) linked poorer work–life climate with weaker teamwork and safety climate.

Prolonged crises can destabilise boundaries through several organisational pathways. Remote work, extended rosters, altered staffing structures, and continuous communication can make work more spatially and temporally permeable. At the same time, leaders may acquire responsibilities for employee wellbeing, regulatory interpretation, and crisis coordination that extend beyond their prior role definition. COVID-19 research documented substantial work–home boundary violations and difficulty maintaining detachment when work entered domestic space or required sustained availability (Carvalho et al., 2021; Rapp et al., 2021).

We use boundary disruption as an umbrella term for two related leader-level processes. Work–nonwork boundary erosion occurs when temporal or psychological separation between work and nonwork becomes increasingly difficult to maintain. Role-boundary expansion occurs when the range of responsibilities attached to a leadership position grows without a corresponding adjustment in authority, capacity, or support. Structural reconfiguration—such as changed rosters, separated teams, or remote coordination—is treated as an organisational antecedent rather than as a third form of boundary disruption.

Leadership buffering can interact with both forms of disruption. Organisational reconfiguration may increase the pressures that middle-level leaders must interpret and coordinate, creating greater demand for local buffering. Buffering can preserve continuity by absorbing or redistributing those pressures, but it can also require extended availability and a broader range of responsibilities. Boundary disruption may therefore arise directly from changes in work organisation and indirectly through the adaptive practices leaders use to contain their consequences. These processes can occur together rather than as discrete stages.

As boundaries become more permeable, opportunities for psychological disengagement and recovery may narrow. Reduced recovery does not by itself establish declining safety performance, nor does expanded responsibility necessarily indicate that adaptation has become unsustainable. The analytical concern is whether repeated organisational demands and compensatory leadership work progressively constrain the resources available for continued adaptation. The empirical analysis therefore examines how structural reconfiguration, leadership buffering, boundary disruption, recovery, and perceived adaptive capacity were related within participants' accounts rather than treating them as a predetermined causal sequence.

The literatures reviewed above illuminate different parts of this process. Psychosocial-risk research identifies demanding organisational conditions and their consequences, resilience engineering explains the adaptive work through which functioning is sustained, and middle-management research clarifies how pressures are interpreted across organisational levels. Boundary and recovery research specify how sustained demands can enter leaders' roles and nonwork time. Bringing these perspectives together allows us to examine how adaptive work can preserve immediate continuity while simultaneously altering the conditions under which further adaptation must occur.

3. Materials and methods

3.1. Research design

We adopted a qualitative descriptive design to examine how middle-level leaders experienced and managed psychosocial demands during the prolonged COVID-19 crisis. Qualitative description is suited to research that seeks a comprehensive account of events while remaining close to participants' experiences and allowing patterned relationships

across accounts to be examined (Sandelowski, 2000). This design aligned with our aim of understanding how changing organisational conditions entered leadership work and how participants understood their capacity to sustain operational adaptation.

Interview data were examined using team-based thematic analysis. Braun and Clarke's (2006) six-phase procedure provided the broad analytical structure, moving from familiarisation and initial coding through theme development, refinement, and reporting. We use the term team-based thematic analysis because interpretation and theme refinement involved multiple researchers rather than a single analyst. This designation also recognises that thematic analysis encompasses methodologically distinct approaches and that its quality criteria should correspond to the analytical procedures actually used (Braun & Clarke, 2021).

The analysis combined inductive and abductive elements. Initial coding remained close to participants' accounts and did not require data to fit predetermined safety-science concepts. As relationships among experiences became clearer, later interpretation involved iterative movement between the empirical patterns and relevant theoretical ideas. Theory therefore operated as a sensitising resource for developing the analysis rather than as an a priori coding framework.

After establishing the thematic structure, we developed a supplementary cross-case descriptive matrix. The matrix recorded whether each final analytical category appeared in each participant's account and provided a transparent way to describe recurrence across the sample. These counts remained subordinate to the qualitative interpretation. They were not used for inferential testing, did not establish prevalence in the wider population, and did not make the study a mixed-methods design.

3.2. Study context

The study was conducted in Australia's mining, oil, and gas sector. Operations in this sector form safety–critical socio-technical systems in which reliable performance depends on coordination among people, technologies, organisational processes, and regulatory controls. Work is frequently distributed across geographically dispersed sites, including fly-in/fly-out and drive-in/drive-out arrangements, and is performed within hierarchical structures under substantial operational demands.

During the COVID-19 crisis, Australian mining, oil, and gas organisations continued operating while responding to public-health directives, border restrictions, quarantine requirements, workforce shortages, and disrupted labour mobility. Organisations changed rosters, separated teams, altered staffing arrangements, and expanded remote coordination as conditions evolved. These changes made the sector particularly suitable for examining how prolonged organisational disruption entered leadership work and how psychosocial demands interacted with the human capacities supporting adaptation (Ajith et al., 2025).

3.3. Participants and sampling

Participants were recruited through purposive and snowball sampling. Purposive sampling was used to identify leaders whose organisational position and experience of the COVID-19 crisis were directly relevant to the research question, while referrals provided access to additional eligible participants within a geographically dispersed and specialised industry (Palinkas et al., 2015). Initial recruitment was conducted through LinkedIn, Facebook, and organisational websites. Participants were also invited to identify colleagues whose roles and crisis experience met the study criteria.

Eligibility was verified before enrolment. Prospective participants received information about the study's purpose and were asked about their organisational position, responsibility for operational teams, reporting relationships, and leadership responsibilities during the COVID-19 period. This screening was necessary because managerial titles are not standardised across mining, oil, and gas organisations. Classification therefore depended on the organisational function performed rather than on job title alone.

Eligible participants had held a manager or general manager position in the Australian mining, oil, and gas sector during the COVID-19 crisis, carried direct responsibility for operational teams, and experienced organisational changes associated with the crisis. Middle-level leadership was defined functionally. Participants needed to operate between senior executive direction and frontline supervision, translating organisational requirements into operational practice while coordinating work and supporting employees. We included general managers only when their reporting relationships and operational responsibilities met these criteria and placed them between executive decision-making and operational management.

Executives, frontline supervisors, and non-managerial employees were excluded because they occupied different positions within the organisational system. Executives primarily established strategic direction and policy. Frontline supervisors worked closer to immediate task execution, while non-managerial employees experienced organisational and psychosocial demands without carrying the same responsibility for translating organisational responses across levels. Including these groups would have shifted the study from a focused examination of middle-level leadership to a multi-level analysis of the wider organisation.

Recruitment concluded with 32 participants comprising 24 managers and eight general managers. Sample adequacy was considered using the principle of information power rather than a claim that all possible meanings had been exhausted (Malterud et al., 2016). The research question was bounded, the sample was specific to the organisational position under investigation, participants had direct experience of the crisis conditions being examined, and the interviews generated detailed accounts of leadership and operational adaptation. These features supported the corpus's adequacy for the study's analytical purpose.

The sample included 26 men and six women. This composition reflected the male-dominated leadership profile of the Australian mining, oil, and gas sector but did not support representative gender comparison. Gender-related patterns are therefore reported as tentative observations within this sample and as directions for further inquiry rather than estimates of differences between women and men in the wider leadership population.

3.4. Data collection

Semi-structured interviews were conducted between June and August 2023 using Microsoft Teams or Zoom. The interview guide was developed from the research question and literature concerning crisis leadership, psychosocial risk, organisational adaptation, and boundary management. Questions addressed changes in work organisation and leadership roles, psychosocial and operational demands, work–nonwork and role-boundary disruption, employee and organisational support, and crisis-related practices used to sustain organisational functioning. The research team reviewed the guide for clarity and relevance to the research aim.

Open-ended questions invited participants to describe how their leadership responsibilities changed during the pandemic, the psychosocial and operational demands they encountered, disruptions to work and nonwork boundaries, the support available to them, and the practices they used to maintain organisational functioning. The semi-structured format ensured that the same core domains were addressed across interviews while allowing participants to develop experiences they considered consequential. Follow-up prompts traced how conditions changed over time and how participants responded. They also explored what those responses required.

Interviews lasted approximately 45–60 min and were conducted by the first author. With participants' informed consent, the researcher

audio-recorded interviews using an external digital recorder and transcribed them verbatim. The researchers checked each transcript against the corresponding recording and corrected transcription errors before analysis. Before coding, the researcher removed or replaced names of individuals, organisations, locations, and other potentially identifying contextual details with participant identifiers.

Because interviews included potentially sensitive reflections on workplace strain, mental health, and leadership during crisis conditions, participants retained control over the depth of their disclosure. They were reminded that they could decline any question, pause the interview, or withdraw without consequence.

3.5. Data analysis

3.5.1. Team-based thematic analysis

Analysis proceeded iteratively through the six broad phases described by Braun and Clarke (2006). The research team first familiarised itself with the dataset by repeatedly reading the transcripts. The first author then undertook initial coding across the full corpus, while the other authors reviewed the coded material and contributed to developing and refining candidate themes. These activities were recursive rather than strictly sequential; coding and thematic interpretation were revisited as relationships across accounts became clearer.

Initial coding remained close to participants' descriptions of their experiences and working conditions. Codes captured matters such as uncertainty, isolation, changing workload, fatigue, emotional demands, altered work arrangements, expanding responsibilities, opportunities for recovery, and the practices through which leaders supported employees or maintained operations. At this stage, participants' accounts were not required to fit the later concepts of leadership buffering, boundary erosion, organisational drift, or latent organisational vulnerability.

Theme development involved comparing coded material within and across interviews and examining how experiences related to the organisational conditions in which they occurred. Lower-level codes were progressively clustered where they formed a coherent patterned meaning relevant to the research question. For example, after-hours contact, sustained availability, difficulty disengaging from work, interrupted recovery, and work entering nonwork time contributed to the higher-order interpretation of work–nonwork boundary erosion. Accounts of expanded employee support, repeated interpretation of changing directives, coordination gaps, absorption of workforce concerns, and efforts to preserve operational continuity contributed to the later interpretation of leadership buffering.

The analysis also distinguished organisational conditions from participants' experienced responses. Work intensification, for example, was treated as an organisational demand, whereas fatigue was treated as an experienced consequence described by participants. Uncertainty was similarly distinguished from anxiety. Changes to rosters, staffing arrangements, and team structures were interpreted as organisational reconfiguration rather than as equivalent to work–nonwork boundary erosion or role-boundary expansion. These distinctions became increasingly important as the analysis moved from identifying recurring experiences toward explaining relationships among them.

Later theme development became more abductive. The research team moved iteratively between empirical patterns and relevant safety-science concepts, examining how prolonged organisational disruption, psychosocial demands, changing work and role boundaries, opportunities for recovery, and participants' perceived capacity for continued adaptation were related. Safety-science concepts concerning adaptation, latent organisational conditions, and organisational drift served as sensitising resources rather than predetermined coding categories. Their purpose was to deepen interpretation of relationships already evident in the data while leaving room for patterns that qualified or challenged existing theoretical accounts.

Theme refinement involved repeated comparison among coded extracts, complete participant accounts, and the dataset as a whole. The analysis attended to both divergence and recurrence. Accounts that contradicted, qualified, or complicated an emerging interpretation were retained and examined to determine whether the thematic structure or its boundaries required revision. Themes were retained where they captured a coherent patterned meaning relevant to the research question and could be distinguished analytically from adjacent themes. Frequency alone did not determine thematic significance.

We developed the systems model after establishing these thematic relationships. It represents an analytically derived interpretation of how the processes identified across participants' accounts may relate to one another; it is not a statistically tested or longitudinally demonstrated causal sequence. We therefore distinguish throughout the manuscript between conditions and relationships participants describe directly and the higher-order system implications developed through theoretical interpretation.

3.5.2. Cross-case descriptive matrix

We constructed a participant-by-category descriptive matrix only after the thematic analysis established the final analytical categories. Its purpose was to make recurrence across accounts visible and to support transparent cross-case comparison; it did not generate the themes or determine their analytical importance.

We coded each final category as present or absent within each interview. A category was marked as present when the final coded dataset contained explicit narrative material corresponding to its operational definition. Absence meant only that the interview did not include qualifying material. It should not be interpreted as evidence that the participant had never experienced the condition outside what was discussed during the interview. Each participant contributed no more than one count to a category, regardless of how often the experience appeared in their account.

The original matrix combined work intensification with fatigue and uncertainty with anxiety. These paired categories were retained in the descriptive tables so reporting remained faithful to the matrix constructed during the study. The thematic analysis, however, distinguished the organisational condition from the experienced response. This allowed the numerical summaries to remain transparent without collapsing analytically different processes into a single theoretical construct.

Matrix classifications were derived from the final coded dataset rather than from a separate frequency-oriented recoding of the transcripts. Where classification was ambiguous, the relevant coded extract and the participant's wider account were revisited and discussed by the research team before assignment. This procedure kept the descriptive matrix aligned with the qualitative interpretation rather than allowing the numerical representation to become an independent analytical layer.

The matrix was used to calculate simple counts for the full sample and selected participant groups. Numerical summaries can make expressions such as "many" or "most" more transparent and help readers see how patterns are distributed across qualitative cases (Maxwell, 2010; Neale et al., 2014; Sandelowski et al., 2009). Their limits are equally important. The counts do not measure exposure intensity or duration, causal importance, effect size, or population prevalence. They were not subjected to inferential testing and should not be read as estimates of statistical difference between participant groups.

The matrix therefore remained supplementary to the thematic analysis. Participant accounts, relationships among themes, and attention to divergent cases provided the basis for interpretation; the counts offered a descriptive view of recurrence. Quotations were selected to preserve context, illustrate variation, and show how a category was experienced in participants' working lives. Supplementary Table S1 provides the category definitions and an example of the participant-by-category coding structure so that readers can see how the descriptive summaries were generated.

3.6. Trustworthiness and reflexivity

Trustworthiness was supported through collaborative analytical review, attention to divergent cases, reflexive memoing, and an audit trail. The first author conducted the initial coding, while co-authors reviewed coded extracts, candidate themes, and the developing relationships among themes. The research team considered the final thematic structure and systems interpretation. These discussions were used to interrogate assumptions, consider alternative readings of the data, and refine thematic boundaries rather than to calculate inter-coder agreement. An audit trail documented coding decisions, changes to the thematic structure, and the development of the systems model across the analytical process (Shenton, 2004).

The team maintained reflexivity through memoing and discussion of how the researchers' disciplinary backgrounds, prior knowledge, and assumptions about leadership, psychosocial risk, and organisational adaptation could shape interpretation. These reflections became particularly relevant when the analysis moved from participants' descriptions of experience toward higher-order safety-system interpretation. The research team revisited these assumptions during theme development and examined accounts that contradicted or qualified emerging patterns rather than treating them as error or noise (Corlett & Mavin, 2018).

Credibility was supported through the fit between the research question and participant selection, transparent documentation of the analytical process, and close grounding of interpretation in participants' accounts. Multiple researchers provided opportunities for interpretive challenge and refinement without treating agreement as a proxy for analytical quality. Attention to divergent cases and the explicit separation of descriptive recurrence from higher-order theoretical inference further strengthened the analysis's transparency.

4. Results

The findings are reported through thematic interpretation supported by participant-level descriptive counts. The counts show how widely a category appeared across the interview corpus. They do not measure the intensity, duration, or causal importance of an experience, and they should not be read as estimates of population prevalence. The analysis remains grounded in participants' accounts and in the relationships identified across those accounts.

Four connected findings emerged from the analysis. Prolonged disruption first generated interlocking psychosocial demands, including isolation, work intensification, persistent uncertainty, interpersonal tension, and fatigue. At the same time, organisational responses to the crisis altered team structures and working arrangements, expanding leadership responsibilities and increasing the permeability of work and role boundaries. Middle-level leaders responded through practices that absorbed, translated, or redistributed organisational and workforce pressures, which we interpret as leadership buffering. These processes interacted rather than unfolding as discrete stages. Structural reconfiguration increased the need for buffering, while buffering itself could extend leaders' availability and responsibilities. As boundaries became more permeable, recovery opportunities narrowed and fatigue accumulated. Across accounts, constrained adaptation therefore emerged through the interaction of organisational demand, compensatory leadership work, boundary disruption, and diminished recovery while operational continuity was maintained.

4.1. Prolonged disruption generated interlocking psychosocial conditions

Every participant described at least one psychosocial condition or consequence associated with leading during the prolonged crisis. Isolation and disconnection appeared in 27 of the 32 accounts. Work intensification accompanied by fatigue appeared in 25, while persistent uncertainty accompanied by anxiety appeared in 24. Interpersonal tension and conflict were identified in 15 accounts, and 12 participants described longer-term mental-health effects.

Although Table 1 separates these categories to make their distribution visible, participants rarely experienced them independently. Across cases, isolation weakened access to informal support and communication; uncertainty increased cognitive and emotional demands; additional crisis responsibilities intensified workload; and reduced recovery amplified fatigue. These conditions therefore formed an interlocking pattern rather than a collection of discrete psychosocial exposures. Their accumulation increased both the volume and complexity of work middle-level leaders had to absorb. (See Table 2).

4.1.1. Isolation disrupted personal connection and operational coordination

Isolation extended beyond physical separation from family. Travel restrictions, quarantine requirements, and longer roster periods prevented many workers and leaders from returning home, often without a clear indication of when ordinary arrangements would resume, as demonstrated in the following participant account:

> *"The biggest impact on mental health was people not being able to go home to their families and not knowing when they could…" (p10)*

The significance of isolation was amplified because leaders experienced it themselves while simultaneously supporting employees exposed to similar conditions. Isolation therefore entered leadership work through two pathways: as a psychosocial demand on leaders and as an additional relational responsibility toward their teams.

Participants also described disconnection within the organisation. Split teams and remote coordination reduced informal contact between site-based and off-site groups. Informal exchanges that ordinarily supported local knowledge sharing, clarification of ambiguous information, and awareness of emerging operational conditions became harder to sustain. Leaders responded by increasing deliberate communication across fragmented groups. Isolation therefore became more than a personal wellbeing issue. It disrupted ordinary channels of collaborative sensemaking and created additional coordination work for middle-level leaders. One participant described the problem this way:

> *"Our planning team felt really disconnected… they'd ring up just to ask how things were going… because they weren't part of what was happening on site anymore…" (p12)*

4.1.2. Work intensification and fatigue accumulated as emergency responses became routine

Work intensification developed as crisis responsibilities were added to existing operational demands. Participants implemented health controls, interpreted changing directives, reorganised staffing, and responded to employee concerns while continuing to meet production and safety expectations. As the crisis continued, activities initially

Table 1
Distribution of recurring psychosocial conditions and consequences.

Cross-case category	Participants reporting category, n
Any psychosocial condition or consequence	32
Isolation and disconnection	27
Work intensification accompanied by fatigue	25
Persistent uncertainty accompanied by anxiety	24
Interpersonal tension and conflict	15
Longer-term mental-health effects	12

Note. $N = 32$. Values indicate whether each category appeared within a participant's interview account. They do not represent intensity, causal weight, statistical significance, or population prevalence. The original cross-case matrix paired work intensification with fatigue and uncertainty with anxiety; the thematic interpretation distinguishes the organisational conditions from their experienced consequences.

Table 2
Distribution of organisational reconfiguration and boundary disruption.

Organisational or boundary process	Participants reporting process, n
Any process listed below	29
Structural reconfiguration of work	23
Role-boundary expansion	24
Work–nonwork boundary erosion	26

Note. $N = 32$. Values indicate whether each process appeared within a participant's interview account. Structural reconfiguration is treated as an organisational antecedent rather than a form of personal boundary disruption. Counts are descriptive and do not indicate intensity, causal importance, statistical significance, or population prevalence.

treated as temporary emergency responses became routine. P15 recalled, *"I remember working 18-hour days… and not getting a lot of sleep. I didn't always get the basics right…"* Existing responsibilities remained while crisis-related coordination and communication piled on top of them. Long hours, changing procedures, and continuous availability progressively narrowed opportunities for recovery.

Participants located fatigue within the organisation of work rather than presenting it simply as an individual failure to cope. Several described tiredness becoming persistent, and some reported reduced concentration or declining confidence in their ability to maintain ordinary decision-making standards. P15′s observation that they *"didn't always get the basics right"* is especially relevant in a safety–critical context. The interviews do not establish that fatigue caused a safety failure, but they show that some leaders struggled more to sustain the cognitive demands of their roles while crisis responsibilities continued.

Fatigue also developed through the interaction of demands described elsewhere in the analysis. Longer hours were compounded by expanding responsibilities, sustained availability, emotional support work, and reduced psychological detachment. This connected work intensification to the later themes of boundary erosion and constrained adaptation. As opportunities for recovery narrowed, some participants found it harder to replenish the resources needed for continued leadership adjustment.

4.1.3. Persistent uncertainty increased cognitive and emotional demands

Uncertainty was persistent and multidimensional. Participants faced changing public-health requirements, quarantine rules, vaccination mandates, labour shortages, and concerns about operational continuity, often while making decisions before reliable information was available. P28 captured the cumulative character of this experience:

> "…there was so much unknown and so much change in such a short time… that it was always going to take a mental toll…"

Leaders were also required to manage uncertainty for others. They interpreted changing requirements, reassured employees, addressed job-security concerns, and attempted to maintain confidence while lacking certainty themselves. Emotional support consequently became part of operational coordination rather than an occasional response to individual distress.

Interpersonal tension further intensified this work. Participants reported frustration, misinformation, disagreement over organisational or public-health controls, and conflict that required managerial intervention. Leaders therefore had to interpret policy, preserve relationships, and maintain team functioning at the same time. Some women managers additionally described aggressive behaviour and reduced psychological safety in remote accommodation, indicating that the social consequences of disruption were not experienced uniformly across the sample.

P17 described conflict arising from frustration and misinformation that required managerial intervention:

> *"You definitely got different psychosocial incidents… frustration, misinformation… and they needed to be resolved."*

P10 captured the asymmetry of managing uncertainty for others:

> "…people were worried about their jobs, and as leaders we still had to reassure them *even when we didn't have the answers ourselves."*

Longer-term mental-health effects appeared in 12 accounts. Importantly, these effects were not consistently described as post-crisis outcomes. For several participants, they developed while organisational demands were continuing. This temporal overlap between ongoing exposure and emerging strain made recovery increasingly consequential.

Taken together, isolation, persistent uncertainty, work intensification, fatigue, and interpersonal tension increased both the volume and complexity of the demands leaders were carrying. These pressures also generated additional coordination and relational work. As organisations altered rosters, staffing patterns, team structures, and communication practices, psychosocial demands became increasingly entangled with changes to the organisation of work. The next theme therefore concerns how crisis adaptation altered leaders' responsibilities and the boundaries within which they performed those responsibilities.

4.2. Organisational reconfiguration disrupted role and work–nonwork boundaries

Organisations changed how work was structured to continue operating. Participants identified split teams, extended rosters, quarantine arrangements, altered staffing patterns, and remote coordination in 23 accounts. These adaptations generated additional leadership work. Role-boundary expansion appeared in 24 accounts, while work–nonwork boundary erosion appeared in 26. At least one of these processes was identified in 29 interviews.

Structural reconfiguration, role expansion, and work–nonwork erosion are related but conceptually distinct. Structural reconfiguration concerns change to the organisation of work. Role expansion concerns what leaders became responsible for doing. Work–nonwork erosion concerns when and where those responsibilities entered leaders' lives. Across accounts, organisational reconfiguration frequently generated the conditions under which the latter two processes developed.

4.2.1. Structural reconfiguration increased coordination demands

Organisations modified rosters, separated teams, changed staffing arrangements, and introduced new supervisory practices to meet public-health requirements. These adaptations supported operational continuity but simultaneously increased coordination complexity. Leaders managed dispersed teams, communicated across altered reporting structures, implemented repeatedly changing procedures, and reconciled local operational requirements with organisational directives. Organisational adaptation therefore extended beyond formal changes to rosters or procedures. Middle-level leaders became the point at which those changes had to be translated into workable local arrangements. They interpreted general requirements, managed implementation, and responded to confusion or workforce concerns generated by altered arrangements. Structural reconfiguration consequently changed not only where and how work was performed, but also the coordination work required from middle-level leaders:

> *"We changed rosters, extended swings, split teams…it all added pressure." (p18).*

4.2.2. Role boundaries expanded around wellbeing, communication, and crisis coordination

Role-boundary expansion reflected the increasing range of responsibilities attached to leadership. Participants described assuming duties relating to employee wellbeing, mental-health support, regulatory interpretation, workforce planning, crisis communication, and interpersonal conflict alongside established operational responsibilities, as captured in the following quotations:

"…you became the central point of contact… for everything." (p07)
"There was a lot more care and wellbeing expected from leaders… than there ever was before." (p11)

Participants generally regarded these additional responsibilities as necessary. Employees required reassurance, changing requirements needed interpretation, and disrupted teams needed coordination. The difficulty arose when responsibilities expanded without corresponding increases in authority, staffing, time, or organisational support.

Crisis work that had previously been distributed across functions such as workforce management, health and wellbeing, communication, and operational coordination increasingly converged within middle-level leadership roles. Leaders could manage the local consequences of organisational decisions without necessarily having authority to change their structural source. Role-boundary expansion therefore represented more than additional task volume. It changed the range of demands for which middle-level leaders became locally responsible.

4.2.3. Work–nonwork boundaries eroded as availability became normalised

Work–nonwork boundary erosion was the most widely reported of the three organisational and boundary processes. Participants described longer hours, remote work, and continuous accessibility outside established working periods, as one participant explained:

"There's not really that delineation anymore between home and work… and that's a good thing and a bad thing…" (P05)

Increased permeability had an adaptive benefit. Accessibility allowed leaders to act swiftly, communicate and assist geographically dispersed personnel. However, it also made psychological disengagement increasingly difficult. Continuous availability developed not solely from individual preference but through repeated organisational demands, rapidly changing information, and the possibility that workforce or operational concerns could arise at any time, as one participant explained: *"…people feel like… they need to be available all the time…"* (p. 30). As work entered evenings, leave periods, and domestic spaces, opportunities for detachment and recovery narrowed. Participants connected this condition with fatigue and emotional exhaustion, and some described growing difficulty sustaining concentration over time.

Boundary disruption therefore did more than accompany organisational adaptation. It was one route through which changed working arrangements and compensatory leadership practices became sustained personal demands. Structural reconfiguration increased coordination requirements, while leadership buffering often required greater availability and an expanding range of responsibilities. Both processes could make work more difficult to contain within established temporal or role boundaries. As this occurred, opportunities for detachment and recovery narrowed. Boundary erosion and role expansion were therefore linked to the growing fatigue described across the interviews, helping explain why adaptation that remained operationally effective could become harder for some leaders to sustain.

4.3. Leadership buffering supported continuity while concentrating unresolved pressures

Participants repeatedly described occupying an intermediary position between organisational decision-making and workforce experience. They implemented changing requirements, maintained operational and safety expectations, responded to employee concerns, interpreted incomplete information, and addressed coordination problems created by altered working arrangements. P07 summarised this position:

"You became the link between the company and the workforce… everything came through you…"

These practices went beyond routine managerial coordination when leaders compensated for pressures that remained unresolved elsewhere in the organisation. We interpret this recurring pattern as leadership buffering: adaptive work through which middle-level leaders absorbed, translated, contained, or redistributed organisational and workforce pressures so that local operations could continue.

Buffering took different forms across accounts. Leaders translated evolving directives into local action, reconnected groups separated by changed work arrangements, resolved immediate coordination problems, supported distressed employees, and managed conflict generated by uncertainty. These practices created a relatively stable interface between organisational change and frontline operations. Their immediate function was adaptive. They helped maintain communication and made changing organisational arrangements workable.

Buffering did not necessarily remove the pressures being managed. In many accounts, it relocated part of their operational, cognitive, or emotional cost into the leadership role. Participants remained responsible for ordinary operations while taking on additional work driven by staffing constraints, changing requirements, workforce concerns, or incomplete information. Their capacity to alter the structural source of those pressures was often limited, making personal availability and discretionary effort important resources for maintaining local continuity. Emotional regulation illustrates this concentration of demand. One participant explained:

"…you had to keep everyone else calm even though you were dealing with the same uncertainty yourself." *(P22)*

Leaders could therefore experience a demand while simultaneously being responsible for containing its effects on others. Participants described managing uncertainty while reassuring employees and sustaining coordination while themselves fatigued. Their own need for support or recovery could be displaced by the immediate demands of the teams for which they were responsible.

The relationship between buffering and boundary disruption became more visible as this work continued. Sustained buffering often required extended accessibility and an expanded range of responsibilities. These requirements made psychological detachment more difficult and reduced opportunities for recovery. Buffering could therefore preserve operational continuity while also increasing the demands on the resources needed to continue buffering.

Across accounts, leadership buffering, boundary disruption, fatigue, and reduced recovery formed an interconnected pattern rather than separate consequences of crisis leadership. Practices that enabled short-term continuity could remain sustainable when demands were distributed, and recovery remained available. Where compensatory work continued without adequate redistribution or replenishment, participants increasingly described difficulty sustaining the same level of adaptive effort.

4.4. An integrated pattern of constrained adaptation

Read across the themes, participants' accounts described constrained adaptation as an interaction among organisational demands, structural change, leadership buffering, boundary disruption, and recovery. Prolonged disruption generated uncertainty and additional work while weakening established social and organisational connections. Organisations responded by changing rosters, staffing arrangements, team structures, and coordination practices. These adaptations helped maintain operations but also transferred additional interpretive and coordinating demands to middle-level leaders.

Leaders responded by translating directives into local practice, reconnecting disrupted teams, supporting employees, resolving immediate problems, and absorbing pressures that could not readily be addressed elsewhere. These buffering practices contributed to continuity, but they also increased availability and expanded the range of responsibilities leaders carried. Boundary disruption therefore emerged not simply as a consequence of crisis, but as a pathway through which the demands associated with organisational adaptation extended across

leaders' role and work–nonwork boundaries.

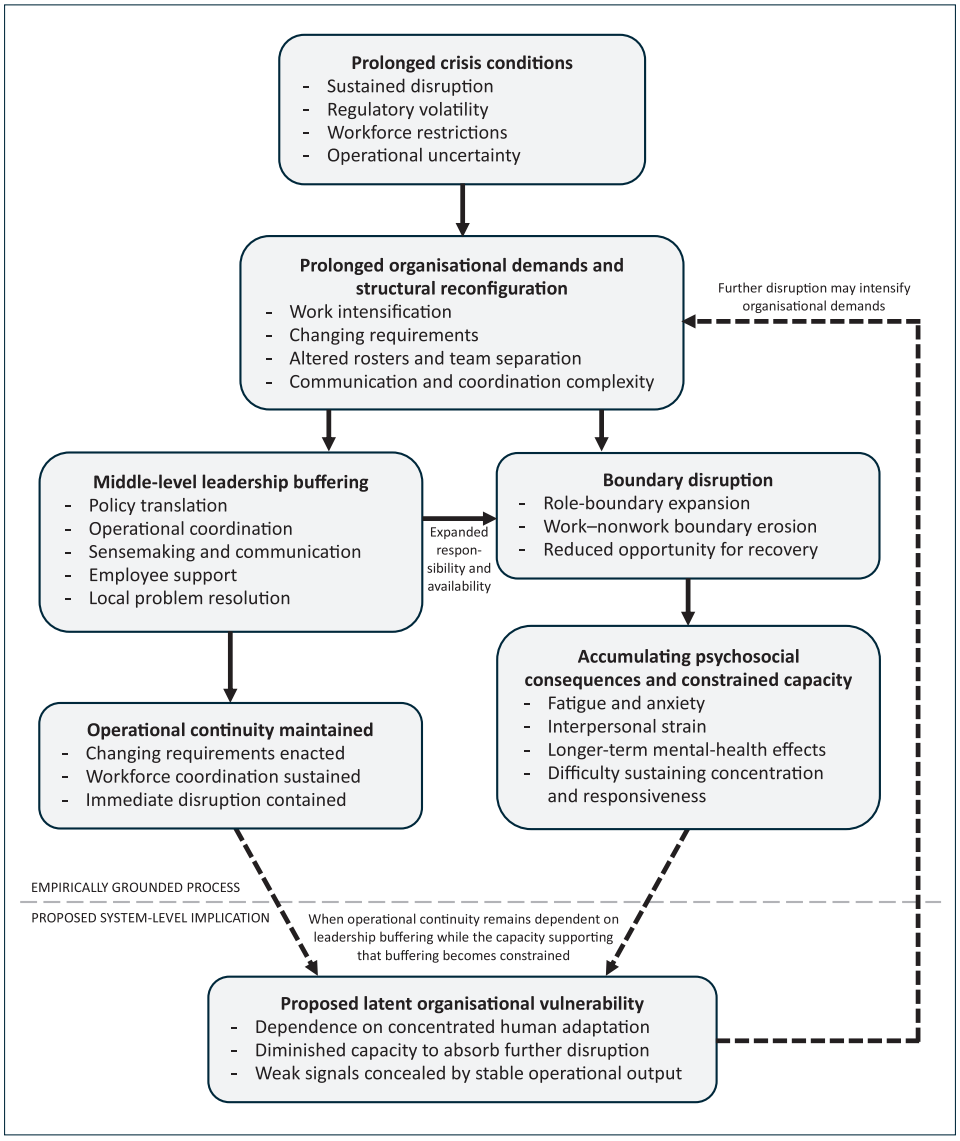
Reduced recovery connected these processes with participants' accounts of constrained capacity. As work extended across established temporal and role boundaries, opportunities for psychological detachment narrowed. Participants associated this reduced recovery with persistent fatigue, emotional exhaustion, and, in some cases, difficulty sustaining concentration or perceived performance. The empirical pattern can therefore be summarised as:

Prolonged disruption → interlocking organisational and psychosocial demands → structural reconfiguration → interacting leadership buffering and boundary disruption → reduced recovery and fatigue → constrained adaptive capacity.

This representation is analytical rather than causal. The interviews do not establish a fixed temporal sequence, demonstrate that psychosocial strain reduced objective system reliability, or show that these processes caused safety incidents. Several processes occurred concurrently and may have reinforced one another. The model instead synthesises patterned relationships across participants' accounts while preserving the distinction between reported experience and theoretical interpretation.

We use constrained adaptation to describe the empirical condition in which leaders continued adjusting successfully while perceiving that the resources required for further adaptation were becoming increasingly difficult to replenish. Continued operational performance and psychosocial strain could therefore coexist. Observable continuity demonstrated that adaptation was occurring; it did not establish that the human resources supporting repeated adaptation remained sustainable.

This distinction also clarifies the role of leadership buffering. Where



Note. Prolonged organisational demands and structural reconfiguration increased the buffering work undertaken by middle-level leaders and disrupted role and work–nonwork boundaries. Buffering supported operational continuity, while boundary disruption narrowed opportunities for recovery and constrained participants' perceived capacity to sustain adaptation. The convergence of continued performance and constrained adaptive capacity provides the basis for the proposed condition of latent organisational vulnerability. Solid arrows represent relationships grounded in participants' accounts and the thematic analysis. Dashed arrows represent system-level implications proposed through theoretical interpretation. Latent organisational vulnerability was not directly measured.

Fig. 1. Psychosocial risk accumulation model during a prolonged crisis.

leaders had sufficient authority, staffing, organisational support, and opportunities for recovery, buffering could support continuity without necessarily constraining future adaptive capacity. Where these resources were limited, similar buffering practices could depend increasingly on expanded availability, role enlargement, and continued expenditure of personal resources. The findings therefore indicate that the consequences of buffering depend on the organisational conditions under which adaptive work is performed rather than implying that buffering is inherently depleting.

Fig. 1 integrates these relationships into an analytically derived systems model. Relationships grounded directly in participants' accounts are distinguished from the higher-order proposition of latent organisational vulnerability. The model proposes that operational continuity may coexist with accumulating vulnerability when repeated adaptation increasingly depends on leadership buffering, permeable boundaries, and diminishing recovery. Latent organisational vulnerability remains a theoretical inference and was not directly measured in this study.

4.5. Descriptive patterns differed across the sampled leadership groups

The cross-case matrix showed variation among the three participant subgroups represented in the available coding structure. Table 3 reports counts rather than percentages because the groups are small and unevenly sized. These categories do not provide independent comparisons of gender and organisational level. The manager groups are divided by gender, whereas the general-manager group is not gender-disaggregated. Any interpretation must therefore remain descriptive.

Managers described close exposure to staffing changes, remote coordination, disrupted teams, and employee distress. Their proximity to everyday operations placed them at the point where organisational changes had to be interpreted and enacted. General managers also reported psychosocial demands, but their accounts emphasised coordination across sites, organisational decision-making, and business continuity. The distinction therefore concerned the location and form of exposure rather than the simple presence or absence of demanding work.

All six women managers described work intensification accompanied by fatigue, while four described longer-term mental-health effects. Several accounts also raised expectations surrounding care, employee support, and emotional availability. These observations warrant attention, but the sample cannot establish whether they arose from gendered expectations, operational role, organisational position, other working conditions, or their intersection. They are best treated as directions for future research.

Isolation and uncertainty remained widespread across the sampled groups. Middle-level leadership should therefore not be treated as a uniform experience. Organisational position shaped the pressures leaders encountered, and the forms of compensatory work required, while individual and social circumstances shaped how those pressures were experienced. This variation does not displace the integrated pattern identified above; rather, it shows that constrained adaptation could develop through different configurations of organisational and psychosocial demand.

Table 3
Descriptive distribution of psychosocial categories.

Cross-case category	Managers—men (n = 18)	Managers—women (n = 6)	General managers (n = 8)
Isolation and disconnection	16	5	6
Work intensification accompanied by fatigue	13	6	6
Persistent uncertainty accompanied by anxiety	13	5	6
Interpersonal tension and conflict	9	3	3
Longer-term mental-health effects	6	4	2

Note. $N = 32$. Values represent numbers of participants whose interview accounts included each category. The groups combine gender and organisational level and should not be used to infer independent gender or role effects. The gender composition of the general-manager subgroup was not disaggregated in the cross-case table. No inferential comparisons were conducted.

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5. Discussion

This study examined how middle-level leaders in Australia's mining, oil, and gas sector experienced and managed psychosocial demands during the prolonged COVID-19 crisis. Participants described more than a collection of individual stressors. Prolonged uncertainty, work intensification, disrupted social connection, and organisational reconfiguration converged in leadership work. Middle-level leaders responded by translating changing requirements, coordinating altered operations, and supporting employees through sustained uncertainty. These practices helped organisations continue functioning. They also expanded leadership roles, increased availability, and narrowed recovery opportunities.

The findings develop a process account of psychosocial risk in safety–critical systems. Organisational demands generated psychosocial consequences through the work required to contain them. Middle-level leadership formed the critical connection. Participants buffered disruption where strategic direction met operational reality, preserving continuity while carrying pressures that remained unresolved elsewhere in the system. The resulting systems model therefore explains how operational continuity can coexist with latent organisational vulnerability when adaptation increasingly depends on concentrated human effort while the resources supporting that effort become progressively constrained.

5.1. Psychosocial risk as an interacting system process

Psychosocial-risk research has established that demanding working conditions affect employee health and behaviour. In high-risk industries, evidence also connects psychosocial factors with safety outcomes, although this literature remains fragmented and weighted toward individual exposure and safety behaviour (Bergh et al., 2014; Derdowski & Mathisen, 2023). The present findings add an organisational process account. Isolation affected communication and access to informal support. Persistent uncertainty increased interpretive and emotional work, while work intensification reduced recovery opportunities. These conditions interacted through leadership work rather than operating as independent exposures.

This interaction matters for safety–critical performance because reliable operations depend on more than the capacities of isolated individuals. Information must move across organisational boundaries, changing conditions must be interpreted, and interdependent work must remain coordinated. Participants described disruption to these processes as teams were separated and organisational requirements changed. Middle-level leaders responded by increasing communication, interpreting ambiguous requirements, and supporting employees experiencing uncertainty. Psychosocial demands therefore became organisationally consequential partly through the additional adaptive work required to sustain coordination.

This process account develops Reason's (1993, 2016) treatment of latent organisational conditions. Latent conditions can remain embedded within ordinary structures and routines while observable performance continues. Psychosocial demands may acquire a similar organisational character when extended hours, continuous accessibility, or compensatory coordination become normal features of operation. The relevant issue is not simply whether leaders experience strain. It is whether continued functioning increasingly depends on forms of human compensation that conventional operational indicators struggle to

capture.

Participants' accounts provide evidence of that possibility without demonstrating objective system degradation. They described fatigue, restricted recovery, and difficulty sustaining concentration while operations remained intact. Such experiences can therefore be treated as potential sources of safety intelligence: they reveal where adaptive functioning may be drawing heavily on human resources even before incidents, injuries, or compliance failures become visible. The inference remains bounded. The study identifies a plausible organisational pathway rather than showing that psychosocial strain caused a safety failure.

This interpretation also specifies the limits of individualised intervention. Counselling, wellbeing programmes, and resilience development can support people experiencing strain, but they exert limited control over hazards generated through work intensity, staffing arrangements, role design, or expectations of continuous availability. Primary prevention therefore requires attention to the organisation of work as well as support for individuals experiencing its consequences (D'Antoine et al., 2023; Derdowski & Mathisen, 2023). This distinction becomes especially important when operational continuity depends on employees and leaders continuing to compensate for unchanged conditions.

5.2. Boundary disruption as a pathway from adaptation to constrained capacity

The second contribution concerns boundary disruption. Research on work–family conflict, boundary violations, and psychological detachment has largely examined these processes through their consequences for individual strain. The present findings connect them to organisational adaptation. Changes to rosters, staffing arrangements, and team structures increased the coordination work required from middle-level leaders, while crisis response expanded responsibility for communication and employee support. Role-boundary expansion and work–nonwork erosion emerged as ways in which those organisational changes entered leaders' everyday work.

Structural reconfiguration and boundary disruption are analytically distinct. The former refers to changes in how work is organised; the latter concerns how work extends across established role, temporal, or psychological boundaries. Changed rosters or separated teams do not, by themselves, constitute boundary erosion. They can, however, create additional coordination requirements and availability expectations that make established boundaries harder to maintain. Leadership buffering provides a second route. When leaders compensate for unresolved organisational pressures by remaining accessible or taking on responsibilities beyond their prior role, adaptive work can itself increase boundary permeability.

Recovery connects these processes to sustained adaptive capacity. Psychological detachment allows work-related activation to recede during nonwork time, whereas high demands can make that detachment more difficult (Sonnentag & Fritz, 2015). Participants described reduced opportunities for recovery alongside persistent fatigue and growing difficulty remaining attentive or emotionally available. The contribution here is therefore not to recast recovery as an individual wellbeing outcome alone. Recovery also represents one of the processes through which the human resources supporting continued adaptation are restored.

Boundary disruption is consequently treated as a proposed pathway rather than a statistically tested mediator. Organisational reconfiguration and leadership buffering can both increase the permeability of work and role boundaries. Where this occurs repeatedly, opportunities for detachment and recovery may narrow. The theoretical significance lies in how these processes connect organisational adaptation with the resources available for further adaptation, rather than in any claim that structural change or flexibility is inherently harmful.

This interpretation refines the relationship between adaptation and resilience. Resilience engineering appropriately emphasises adjustment to variability that cannot be fully anticipated (Hollnagel et al., 2006; Hollnagel, 2018). Pettersen and Schulman (2019) further distinguish adaptive action from reliability drift by asking whether local adjustments remain connected to wider organisational capacities that monitor and protect reliability. The present findings identify boundary integrity and recovery as part of that organisational context. Local adaptation may remain operationally effective while becoming harder to sustain when the temporal and psychological resources required for repeated adjustment are not restored.

The central issue is therefore not flexibility itself, nor the mere fact that leaders extend effort during disruption. Exceptional effort may be entirely functional when it remains bounded and recoverable. The concern arises when exceptional availability becomes an operating expectation and expanded responsibility persists without corresponding resource replenishment. At that point, short-term adaptive success and the sustainability of continued adaptation become analytically separable.

5.3. Leadership buffering and the concealed costs of continuity

The third contribution concerns the buffering role of middle-level leaders. Existing research shows that middle managers contribute to safety through decision-making, information management, and influence across organisational boundaries (Callari et al., 2019). Their capacity to perform this work depends partly on the organisational and environmental conditions surrounding them (Bieder & Callari, 2020). The present findings extend this literature by showing how middle-level leadership can become the organisational location through which persistent disruption is translated into workable local responses.

Buffering combined operational and relational work. Participants interpreted changing requirements and coordinated altered arrangements while also responding to employee concern and uncertainty. Huy's (2002) account of emotional balancing captures part of this process: middle managers can support organisational continuity by attending to the emotional consequences of change. Research on healthcare middle managers during crises similarly shows substantial coordination and team-support work under constrained conditions (Golfenshtein et al., 2026; Mackay et al., 2022). In the present study, however, this work persisted across a prolonged disruption rather than remaining attached to a discrete episode of organisational change.

The systems implication concerns what happens to pressures that local adaptation contains but does not remove. Leadership buffering can stabilise operations by absorbing or redistributing uncertainty, coordination gaps, or workforce concerns. Yet the underlying demand may remain elsewhere in the system. Participants often carried additional cognitive or emotional work without equivalent authority to change the structural conditions generating it. Buffering therefore describes both an adaptive contribution and a location at which unresolved organisational pressures can become concentrated.

We distinguish supported buffering from extractive buffering to specify the organisational conditions surrounding that adaptive work. Supported buffering occurs when leaders have sufficient authority, information, staffing, and opportunities for recovery to manage variability without repeatedly drawing down the resources required for future adaptation. Organisational support can attenuate the effects of crisis-related work intensification and emotional demands, reinforcing the importance of these surrounding conditions (Wittmers & Maier, 2023). Extractive buffering occurs when comparable continuity depends increasingly on extended availability, discretionary effort, or repeated compensation for demands that remain structurally unresolved.

Operational continuity alone cannot distinguish between them. Both forms of buffering may produce effective short-term performance. They differ in how they distribute and replenish the costs of adaptation. Supported buffering spreads adaptive work across organisational resources and preserves opportunities for recovery. Extractive buffering

concentrates more of that work within particular leadership roles and relies more heavily on resources that must themselves be restored.

This distinction also avoids treating buffering as inherently beneficial or inherently depleting. The same leadership practices may operate differently depending on the conditions surrounding them. Additional communication or employee support can be sustainable when responsibility is matched by authority and capacity. The same practices can become increasingly difficult to sustain when they are layered onto existing work without redistribution or recovery.

Middle-level leader strain may therefore indicate how adaptive work is being resourced. Persistent fatigue, boundary erosion, or role overload can reveal where formal organisational arrangements are being supplemented by compensatory effort that conventional performance indicators do not capture. This does not reduce middle-level leaders to passive recipients of system pressure. Their judgement and adaptive capability remain important sources of resilience. The theoretical question is whether the organisation preserves those capabilities while relying on them.

5.4. Adaptive performance, adaptive sustainability, and latent organisational vulnerability

The model's central theoretical contribution is to distinguish successful adaptation in the present from preserving capacity for further adaptation. Resilience engineering explains how socio-technical systems sustain functioning by adjusting performance under conditions that cannot be completely anticipated (Hollnagel et al., 2006; Hollnagel, 2018). The present findings support the importance of that adaptive work. They also expose a separate analytical question about whether the human and organisational resources through which repeated adjustment is accomplished remain available as disruption continues.

We describe these two dimensions as adaptive performance and adaptive sustainability. Adaptive performance refers to successful adjustment that enables a system to continue functioning under current disturbance. Adaptive sustainability concerns whether sufficient human and organisational resources are preserved or replenished to support continued safe adaptation under subsequent variability. Successful adaptive performance therefore demonstrates that adjustment is occurring; it does not, by itself, establish how that adjustment is being resourced or whether the capacity supporting it can be sustained.

The distinction extends resilience-oriented analysis by adding a temporal and distributive lens to adaptive performance. The contrast is complementary rather than oppositional. Resilience engineering focuses on how systems adjust to variability; our model also asks where the resource costs of that adjustment are borne and whether those resources are restored. Two organisations may display comparable operational continuity while relying on very different adaptive conditions. In one, additional demands may be distributed across adequate staffing, authority, support, and recovery. In another, continuity may depend increasingly on sustained compensatory effort by a comparatively small group of organisational actors.

The distinction between supported buffering and extractive buffering gives this difference organisational form. Supported buffering occurs when adaptive leadership work is adequately resourced, distributed, and replenished. Extractive buffering may produce similar observable short-term continuity while drawing repeatedly on leaders' temporal, cognitive, emotional, and recovery resources. The distinction does not classify adaptation itself as beneficial or harmful. It identifies whether the organisational conditions surrounding adaptation preserve or progressively constrain the capacities on which further adjustment depends.

Latent organisational vulnerability describes the higher-order condition proposed when operational continuity increasingly depends on adaptive resources that are becoming harder to replenish. The concept does not imply that failure is imminent, inevitable, or already occurring. Nor does the present study demonstrate objectively declining system reliability. Vulnerability remains latent because conventional indicators may still appear satisfactory while other signals such as persistent fatigue, expanding role demands, restricted recovery, or dependence on discretionary effort suggest growing reliance on concentrated human compensation.

This interpretation adds a psychosocial pathway to established accounts of organisational drift. Rasmussen (1997) explains how locally rational adjustments can move organisational activity incrementally toward system boundaries, while Pettersen and Schulman (2019) distinguish adaptive action from reliability drift by examining whether local adjustments remain connected to wider organisational capabilities that protect reliable performance. The present model locates psychosocial experience and middle-level leadership within that problem. It proposes that fatigue, boundary erosion, and restricted recovery may indicate whether the organisation continues to support the adaptive work on which its performance depends.

Fig. 1 represents these relationships without treating them as a fixed causal sequence. Prolonged disruption generates organisational and psychosocial demands while structural reconfiguration changes how work must be coordinated. Middle-level leaders respond through buffering, which can support immediate continuity but may also expand role demands and availability. Boundary disruption can arise from structural changes and from the adaptive work used to manage them, reducing opportunities for recovery when those demands persist. These empirically grounded relationships culminate in constrained adaptive capacity; latent organisational vulnerability is the higher-order theoretical inference that emerges from their interaction.

The model also proposes a possible feedback process. If adaptive capacity becomes increasingly constrained, subsequent disruption may be harder to absorb, potentially generating greater demand for compensatory buffering from the same organisational roles. This feedback relationship was not tested longitudinally and should therefore be treated as a proposition for future research rather than an empirical finding of the present study.

Middle-level leaders occupy a distinctive position within this model because they sit at the organisational interface where strategic requirements, operational variability, and workforce concerns must be reconciled. Their adaptive work contributes directly to continuity, but their experiences may also reveal how that continuity is being produced. Persistent role expansion, boundary erosion, fatigue, or reliance on discretionary effort can therefore provide safety-relevant information about the resource conditions beneath apparently successful performance. The model does not replace established resilience perspectives; it makes the sustainability of adaptive capacity an explicit object of analysis alongside adaptive performance itself.

The ideas emerging from this study are components of the same systems process, not independent constructs. Leadership buffering describes the adaptive work through which middle-level leaders absorb, translate, and redistribute organisational pressures to preserve functioning. Boundary disruption identifies a pathway through which repeated buffering can extend work across role and work–nonwork boundaries, reducing opportunities for recovery. Adaptive sustainability concerns whether the human and organisational resources supporting this adaptation remain sufficiently protected or replenished for adaptation to continue. When operational continuity increasingly depends on buffering while these resources become constrained, latent organisational vulnerability may develop. Safety intelligence describes the diagnostic value of leaders' experiences in this process: fatigue, persistent role expansion, reduced recovery, and repeated compensatory work may reveal emerging organisational pressures before they appear in conventional safety indicators. Together, these concepts explain how apparently successful adaptation can conceal a declining capacity to sustain it.

Adaptive sustainability can be assessed through a combination of organisational and experiential indicators. Relevant organisational indicators include persistent after-hours availability, interrupted or

inadequately protected recovery time, sustained role expansion, recurring staffing shortfalls or workarounds, concentration of coordination responsibilities in a small number of leaders, mismatches between responsibility and decision authority, and continued dependence on discretionary effort. Complementary experiential indicators include fatigue, psychological detachment, and perceived capacity to manage further disruption. Future research can combine these indicators with roster, workload, leave, communication, staffing, and operational data to examine when successful adaptive performance is being sustained through resources that are becoming increasingly difficult to replenish.

6. Practical implications

The findings point to four practical priorities for safety–critical organisations. These implications follow from participants' accounts and the analytically derived systems model; they should be understood as organisational design and governance priorities rather than as interventions whose effectiveness was tested in this study.

6.1. Integrate psychosocial hazards into operational safety governance

Organisations should incorporate psychosocial hazards into the processes used to identify, assess, control, and review safety risks. Employee assistance programmes, counselling, and resilience development can support individuals experiencing strain, but they exert limited control over hazards generated by work intensity, inadequate staffing, unclear responsibilities, or sustained expectations of availability. Primary prevention therefore requires attention to how work is designed and how organisational decisions create or redistribute psychosocial demands (International Organization for Standardization, 2021; Leka et al., 2015; Schulte et al., 2024).

This consideration is especially important during substantial operational change. Crisis plans, roster modifications, workforce restrictions, and structural reconfiguration can alter workload and coordination requirements while changing the opportunities available for recovery. Their psychosocial implications should therefore be considered alongside their production, compliance, and operational objectives. In the present study, middle-level leaders frequently became the point at which changing arrangements had to be translated into workable local practice. Assessing where additional coordination or relational work will fall can help organisations identify demands that might otherwise become dependent on repeated compensatory effort.

Safety reviews can also draw on indicators that reveal how adaptive work is being sustained. Fatigue, persistent availability, communication overload, expanding responsibilities, and restricted recovery do not establish that safety performance has deteriorated. They can, however, indicate that continued functioning is placing increasing demands on the human capacities supporting it. Treating such conditions as safety-relevant information broadens psychosocial-risk governance beyond managing individual distress after exposure.

6.2. Treat leadership buffering as an organisational resource

The distinction between supported and extractive buffering provides a practical way to examine how organisations resource middle-level adaptive work. Supported buffering is characterised by sufficient authority, information, staffing, organisational support, and opportunities for recovery. Extractive buffering relies more heavily on extended availability or discretionary effort while the underlying source of demand remains unresolved. Both may sustain short-term continuity, but the former better preserves the resources needed for continued adaptation.

Organisations can use this distinction when assigning additional crisis responsibilities. When middle-level leaders take on new coordination, communication, or employee-support work, organisations should also consider which existing responsibilities can be removed, delegated, or temporarily suspended. Decision authority should match the responsibilities being assigned, with clear escalation routes for local leaders when demands exceed their authority or available resources.

Additional capacity can also reduce dependence on a small number of individuals. Deputy arrangements, cross-training, temporary staffing, or planned rotation may distribute crisis work, although this study did not evaluate their effectiveness. More generally, senior leaders can assess whether local continuity is sustained through formal organisational capacity or recurring personal compensation. Persistent reliance on the latter should prompt review of workload, authority, staffing, and role design.

6.3. Protect boundaries and recovery during prolonged disruption

Treat recovery as part of the resource conditions supporting sustained performance, not solely as a discretionary wellbeing benefit. Crisis operations may require periods of unusual accessibility, but difficulty arises when exceptional availability becomes an enduring operating expectation. Organisations can reduce continuous attachment to individual leaders by establishing clear arrangements for out-of-hours contact, escalation, handover, and decision coverage.

Workload and roster reviews should consider cumulative exposure, not just scheduled hours. Consecutive periods of availability, interrupted leave, continuing responsibility during nominal time away, and the emotional demands attached to workforce support can all limit opportunities for detachment. Protected recovery periods therefore require corresponding operational arrangements; formal time away offers little restoration if leaders remain informally responsible for unresolved decisions or continuing contact.

Role boundaries warrant similar attention. Responsibilities for employee wellbeing, crisis communication, regulatory interpretation, or other functions added during disruption should be made visible within role design rather than remaining informal extensions of existing work. Formal recognition makes it possible to allocate resources, clarify authority, distribute responsibility, and periodically reassess whether crisis-related duties remain necessary as conditions change. These practices align with the study's broader distinction between achieving adaptive performance and preserving the capacity required to keep adapting.

6.4. Treat middle-level leaders as sources of safety intelligence

Middle-level leaders can provide safety-relevant information that may not be visible in conventional reporting systems. Their intermediary position gives them visibility of workforce concerns, coordination problems, ambiguous directives, and the compensatory work required to make organisational arrangements function locally. Structured opportunities to capture these experiences can therefore complement incident, compliance, and production data rather than waiting for operational failure to make underlying pressures visible. This information can function as an early warning signal of emerging organisational strain, particularly where conventional safety indicators remain stable.

Such inquiry should extend beyond whether operational objectives were achieved. Organisations can ask what additional work continuity required, which responsibilities expanded, where recovery was compromised, and which recurring problems depended on local compensation. Structured debriefs, workload reviews, confidential pulse assessments, and post-change evaluations can gather this information. Recurring patterns such as repeated staffing workarounds, escalating after-hours availability, unresolved coordination problems, deferred recovery, or persistent role expansion can then be incorporated into safety reviews and change-management processes as leading indicators of adaptive strain. Their value depends on the organisation using what it learns to examine work design and resource allocation rather than turning psychosocial surveillance into another demand on individual leaders.

The practical significance of middle-level leader experience lies in what it may reveal about the wider adaptive system. Fatigue, persistent role expansion, boundary erosion, or repeated compensatory effort should not automatically be read as deficiencies in individual resilience. Together, they may indicate that apparently successful continuity relies heavily on human adaptation that is becoming harder to sustain. The purpose of safety intelligence is therefore not to monitor individual resilience, but to identify where organisational functioning is becoming increasingly dependent on compensatory human effort. Middle-level leaders can therefore contribute not only to operational adaptation but also to organisational understanding of the conditions under which that adaptation occurs.

7. Limitations and future research

Several limitations define how the findings should be interpreted. First, the study examined middle-level leadership in Australia's mining, oil, and gas sector during the COVID-19 crisis. This setting provided access to prolonged disruption within safety–critical operations, but it also contained distinctive features, including geographically dispersed work, mobile workforces, border restrictions, and extended roster arrangements. The transferability of the findings to other industries, national contexts, and forms of prolonged disruption therefore requires empirical examination.

The interviews were conducted between June and August 2023 and asked participants to reflect retrospectively on experiences that had unfolded across the pandemic. Their accounts provide insight into how leaders made sense of those experiences, but they may also have been shaped by memory, subsequent events, and participants' later interpretations of what occurred. The study did not include contemporaneous observation, clinical health measures, operational performance data, or safety records. It therefore cannot determine whether the psychosocial processes described produced measurable changes in safety outcomes or system reliability. As self-reported accounts, the interviews may also reflect role identity, hindsight, and social desirability.

The study further relied on accounts from a single organisational level. Middle-level leaders could describe the pressures they encountered, the practices they enacted, and the consequences they experienced, but the data do not independently establish how executives, frontline supervisors, or employees understood the same events. Multilevel research is needed to examine how organisational demands move across hierarchical levels and whether leadership buffering absorbs, redistributes, or amplifies psychosocial pressures elsewhere in the system.

The cross-case descriptive matrix also has clear limits. It shows recurrence within the interview corpus but does not measure exposure intensity, duration, temporal order, or causal importance. Its paired categories combined work intensification with fatigue and uncertainty with anxiety. Future studies could separate these conditions analytically and examine their temporal relationships more directly. The subgroup structure likewise prevents independent assessment of gender and organisational level. The small number of women managers and the absence of gender-disaggregated general-manager data mean that subgroup differences should remain exploratory rather than being interpreted as evidence of gender effects.

Purposive and snowball sampling may also have favoured participants who were especially willing to discuss leadership and psychosocial experience. The sample is therefore information-rich rather than representative of the wider leadership population. Broader recruitment strategies could examine whether leaders who experienced less strain, disengaged from their roles, changed positions, or left the industry describe different patterns of adaptation and recovery.

Finally, Fig. 1 represents an analytically derived model rather than a tested causal structure. The interviews support interpretation of patterned relationships among prolonged demands, structural reconfiguration, leadership buffering, boundary disruption, reduced recovery, and constrained adaptive capacity. They do not test mediation, causal direction, system-level outcomes, or the proposed feedback relationship. Adaptive sustainability is therefore a theoretical distinction developed from the findings rather than a directly measured system property, while latent organisational vulnerability remains a higher-order inference rather than an observed state of declining reliability.

Future research should test these propositions prospectively. Longitudinal studies could follow leaders before, during, and after prolonged disruption to examine whether changes in workload, buffering, boundary permeability, recovery, and fatigue precede changes in perceived or objectively measured adaptive capacity. Multi-level designs could combine interviews or surveys with roster data, workload measures, safety-climate indicators, operational disruptions, and safety outcomes. Such designs would help determine whether the relationships proposed here remain visible across organisational levels and whether psychosocial indicators provide useful information about emerging constraints on adaptation.

Comparative research across aviation, healthcare, emergency services, transport, energy, and other resource settings could clarify which elements of the model are specific to the Australian mining, oil, and gas context and which extend across safety–critical systems. Future studies should also examine supported and extractive buffering directly, including whether authority, staffing, recovery protection, and senior-management support alter the consequences of buffering for leaders and organisations. Intervention studies could then evaluate changes to role design, escalation pathways, crisis staffing, and recovery arrangements rather than assuming that these practices improve adaptive sustainability.

8. Conclusion

This study shows how psychosocial risk can become embedded in the adaptive work that sustains safety–critical operations during prolonged disruption. Middle-level leaders in Australia's mining, oil, and gas sector responded to the COVID-19 crisis by interpreting changing requirements, coordinating altered work arrangements, supporting employees, and resolving emerging operational problems. These practices supported continuity, but participants also described expanded responsibilities, greater availability, disrupted boundaries, reduced recovery, and persistent fatigue.

The distinctive contribution lies in the organisational position from which these processes were observed. Middle-level leaders are neither detached strategic decision-makers nor simply recipients of organisational demands. They operate at the interface between strategic requirements, operational variability, and workforce experience, where organisational pressures must be translated into workable local action. Leadership buffering describes the adaptive work performed at this interface. It can stabilise operations by absorbing or redistributing unresolved pressures, while also revealing where continued functioning depends on concentrated human effort.

The systems model distinguishes adaptive performance from adaptive sustainability. Adaptive performance concerns whether the organisation continues functioning under current disturbance; adaptive sustainability concerns whether the human and organisational resources required for further adaptation are preserved or replenished. The interviews do not demonstrate declining system reliability or establish latent organisational vulnerability as an observed outcome. Rather, they show that operational continuity can coexist with participants' reports of boundary erosion, reduced recovery, fatigue, and constrained adaptive capacity. Latent organisational vulnerability is the higher-order theoretical possibility that arises when successful adaptation becomes increasingly dependent on resources that are difficult to replenish.

This distinction has direct implications for safety practice. Psychosocial-risk governance should address the organisational conditions that shape workload, staffing, authority, role design, boundary permeability, and recovery rather than relying on individual support

alone. Middle-level leaders should also be treated as sources of safety intelligence. Their accounts of persistent role expansion, fatigue, boundary erosion, or repeated compensatory effort can reveal how operational continuity is being produced and where adaptive work may be drawing heavily on human capacity.

The broader implication is that resilience should be evaluated not only by whether a system continues to adapt, but also by whether it preserves the capacity required to adapt again. Middle-level leaders make that distinction visible because they both enact organisational adaptation and experience its resource demands. Understanding the conditions under which their buffering is supported, distributed, and replenished therefore provides a way to examine the sustainability of adaptive capacity before successful continuity is mistaken for evidence that the resources beneath it remain intact.

9. Ethical considerations

Ethical approval for the study was granted by the Edith Cowan University Human Research Ethics Committee (Approval No. 2023-04264-AJITH). The approved study materials included the participant information sheet, informed-consent form, recruitment materials, and semi-structured interview guide. Before participation, prospective participants received written information explaining the study purpose and interview procedures, the voluntary nature of participation, expected topics of discussion, confidentiality and data-handling arrangements, and their right to withdraw. Informed consent was obtained before each interview, including consent to audio recording and the use of anonymised quotations in research outputs.

Specific safeguards were incorporated because participants were discussing potentially sensitive experiences of leadership, psychosocial strain, workplace conflict, and organisational responses during the COVID-19 crisis. Participants were informed that they could decline any question, pause the interview, request that particular comments not be used, or terminate the interview without consequence. The interviewer monitored participants for signs of discomfort and avoided pressing for disclosure where participants appeared unwilling to elaborate. Participants were also provided with information about appropriate support services should the interview raise concerns or distress.

Confidentiality required particular attention because the Australian mining, oil, and gas leadership community is relatively specialised and participants could potentially be identifiable through combinations of job title, organisation, location, or operational circumstances. Names of individuals and organisations were therefore removed from transcripts, participant identifiers were used during analysis and reporting, and potentially identifying contextual details were generalised or omitted from quotations. Recordings and transcripts were stored on password-protected/encrypted institutional systems accessible only to the research team. These procedures were intended to minimise psychological, professional, and reputational risks while allowing participants to discuss their crisis-leadership experiences openly.

10. Declaration of Generative AI in Scientific Writing

During the preparation of this work, the first author used 'Grammarly AI' to improve the readability and language of some sentences and abstract. After using this tool/service, the first author reviewed and edited the content as needed and takes full responsibility for the content of the published article.

CRediT authorship contribution statement

Michael Mayom Ajith: Writing – original draft, Software, Resources, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Andrei A. Lux:** Writing – review & editing, Supervision. **Michelle Striepe:** Writing – review & editing, Supervision. **Tim Bentley:** Writing – review & editing, Supervision.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ssci.2026.107573.

Data availability

The data that has been used is confidential.

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