



Stewardship for Disaster and Emergency Management: A Complex Adaptive System Governance Framework

Todd Miller¹ · Loic Le De¹ · Katherine Hore¹

Received: 30 March 2026 / Accepted: 22 August 2026
© The Author(s) 2026

Abstract

Disaster and emergency management (DEM) systems are increasingly characterized by distributed authority, multi-agency interdependence, and complex hazard environments. While prior research has reframed DEM as a complex adaptive system, less attention has been given to how coherence, adaptive coordination, and legitimacy are sustained across decentralized networks where no single actor holds complete mandate or authority. This study examines system stewardship as a meta-governance function capable of addressing this gap. Drawing on constructivist networked grounded theory, the study analyzes 38 semistructured interviews with 40 practitioners across Aotearoa New Zealand's DEM system. The analysis revealed four themes: governing a distributed system; enabling coordination through trust and inclusive participation; sharing information and sustaining learning; and sustaining capability over time. The study integrates these findings into a three-pillar framework of system stewardship comprising relational, informational, and institutional dimensions, each representing a distinct but interdependent set of enabling conditions for adaptive coordination. The study argues that sustaining DEM performance requires moving beyond episodic leadership during events toward the deliberate sustaining of these enabling conditions across the system as a whole. In doing so, it contributes a complexity-informed governance framework applicable to DEM systems operating under conditions of decentralization, uncertainty, and compound risk.

Keywords Adaptive coordination · Complex adaptive systems · Disaster and emergency management · Governance · Meta-governance · System stewardship

1 Introduction

Disaster and emergency management (DEM) is a distributed system of interdependent actors collectively engaged in mitigation, preparedness, response, and recovery (Miller et al. 2025a, b, 2026). Disaster and emergency management involves central and local government agencies, emergency services, Indigenous partners, civil society organizations (CSOs), and private sector entities whose roles, responsibilities, and relationships shift as hazard conditions evolve. While phase-based frameworks such as the disaster management cycle may provide a sense of administrative clarity to DEM policymakers and practitioners, hazard complexity, cascading failures, and compound events blur these

boundaries, exposing the limitations of static, command-and-control paradigms (Hodges and Larra 2021).

The empirical focus of this study is Aotearoa New Zealand's DEM system. It operates through a nationally enabled but locally delivered governance model in which statutory responsibilities are distributed across central government agencies, local authorities, emergency services, and other actors. While statutory responsibilities are formally defined (New Zealand Government 2015), effective DEM depends upon sustained collaboration across organizational, jurisdictional, and sectoral boundaries. This creates a governance environment in which no single organization possesses sufficient authority, capability, or information to coordinate the system independently.

Consequently, strengthening DEM requires governance approaches capable of supporting coordination across decentralized and interdependent networks of actors. Although contemporary scholarship has advanced understanding of collaborative governance, systems leadership, and network coordination, comparatively limited attention has been given

✉ Todd Miller
Dxy8114@autuni.ac.nz

¹ Faculty of Health and Environmental Sciences, Auckland University of Technology, Auckland 1142, New Zealand

to how these diverse actors collectively steward the conditions that enable coherent, adaptive, and legitimate system performance over time. Existing leadership models largely remain centered on individual leaders or organizations, providing limited explanation of how governance is sustained across distributed systems where authority, accountability, and operational responsibility are shared.

Although complexity theory, systems leadership, collaborative governance, and stewardship have each informed the governance of distributed public systems, little scholarship has integrated these perspectives to explain how DEM systems are collectively stewarded over time. As a result, stewardship remains underdeveloped as a system-level governance capability within the DEM literature.

This study addresses that gap by examining stewardship within Aotearoa New Zealand's DEM system. Drawing on qualitative findings generated through constructivist networked grounded theory (CNGT), this study develops an empirically grounded framework explaining how relational, informational, and institutional stewardship collectively support coordination, learning, legitimacy, and adaptive capability across a decentralized DEM system.

2 Theoretical Background

This section establishes the theoretical foundations for examining system stewardship within disaster and emergency management. It first considers the relevance of complex adaptive systems theory to understanding coordination across decentralized, multi-actor environments, before examining the evolution of leadership and governance approaches towards system-level perspectives. It then introduces stewardship as a complementary governance capability through which the conditions supporting coordination, learning, accountability, and adaptation can be cultivated and sustained.

2.1 Complexity and Disaster and Emergency Management

Disaster and emergency management has increasingly been examined through a complexity-informed perspective, with scholars drawing on complex adaptive systems theory to better explain the decentralized authority, emergent behaviors, and interplay of formal and informal relationships that characterize contemporary DEM systems (Comfort and Resodihardjo 2013; Hodges and Larra 2021; Miller et al. 2025a, b). Within this perspective, system performance is not determined by formal authority or structural design alone; rather, it emerges from the quality of relationships, the flow of information, and the capacity of diverse actors to self-organize under conditions of uncertainty and complexity

(Zafari et al. 2020; Miller et al. 2025a, b). Empirical research demonstrates that DEM systems operate through densely interconnected networks connected by brokerage positions, with adaptive capacity embedded in trust, shared learning, and cross-boundary collaboration rather than hierarchical control (Kapucu and Garayev 2013; Nowell and Steelman 2015; Miller et al. 2026).

Three characteristics of complex adaptive systems are particularly relevant to DEM: self-organization, nonlinearity, and emergent behavior. First, self-organization enables actors to coordinate and reconfigure autonomously as conditions evolve—a dynamic observed during the 2011 Tōhoku disaster in Japan, where local actors improvised coordination networks independent of collapsed formal command structures (Hayashi and Soo 2012). Second, nonlinearity means that disruptions can interact and propagate in ways that produce nonsequential consequences disproportionate to their initial cause. Perrow's (1984) analysis of complex, tightly coupled systems demonstrates how multiple interacting failures can propagate across interconnected systems in an unexpected manner. Third, emergent behavior arises from the interactions among actors rather than from prescribed plans, meaning that system performance cannot be fully anticipated or controlled in advance (Comfort et al. 2010; Miller et al. 2025a, b). Collectively, these characteristics illustrate why a complex adaptive system-informed perspective is relevant to DEM: coordination can self-organize as conditions change, disruptions can propagate nonlinearly across interconnected systems, and patterns of collective action can emerge beyond those anticipated through formal plans and structures.

Viewing DEM through a complex adaptive system-informed perspective has important implications for governance because it shifts attention from controlling organizational performance towards cultivating the relational and institutional conditions through which adaptive coordination emerges. Frameworks premised on centralized leadership and organizational control are structurally misaligned with systems characterized by decentralized authority, emergent behavior, and nonlinear disruption (Comfort et al. 2010; Hodges and Larra 2021). Leadership scholarship has evolved considerably, from early trait-based theories toward relational, situational, and transformational models; yet despite this trajectory, the field has remained predominantly anchored within the organizational unit rather than the interorganizational system (Uhl-Bien 2006; Walker 2025). Even as situational, transformational, and systems-oriented approaches progressively recognize relational dynamics, these approaches retain a largely leader-centric orientation, privileging the individual actor as the primary "locus of control" (Devitt and Borodzicz 2008, p. 209) and remain insufficient for such environments (Canyon and Morrison 2010; Westover 2025).

The limitations of the leader-centric orientation are particularly visible in disaster contexts. Following Hurricane Katrina (2006), post-event analysis identified significant failures of individual leadership alongside structural fragmentation, unclear cross-agency mandates, and inadequate mechanisms for aligning distributed actors towards shared objectives (Comfort 2006; Select Bipartisan Committee to Investigate the Preparation for and Response to Hurricane Katrina 2006; Comfort and Okada 2013). Similarly, the 2010 Haiti earthquake demonstrated how leadership capacity interacted with pre-existing institutional weakness, fragmented international coordination, and limited relational networks across governmental and humanitarian actors (Nolte et al. 2012; Altay and Labonte 2014). These cases demonstrate the limitations of explaining disaster performance through leaders alone.

2.2 Leadership and Governance in Disaster and Emergency Management Systems

As governance challenges increasingly span organizational and institutional boundaries, leadership scholarship has expanded toward system-level perspectives, recognizing that no single organization possesses the mandate, resources, or knowledge to govern complex risk environments independently (Rietsema and Watkins 2012; Cousin 2019; Cairney and Toomey 2025). Meta-leadership offers one such framework, emphasizing connectivity across institutional silos and the capacity to generate shared purpose through leading down, up, and across organizational hierarchies simultaneously (Marcus et al. 2007; Marcus et al. 2009). Complexity leadership theory extends this system orientation by distinguishing administrative, adaptive, and enabling leadership functions, thereby locating adaptive capacity within interactions among interdependent actors rather than solely within the capabilities or authority of designated leaders (Uhl-Bien et al. 2007; Baltacı and Balcı 2017).

Broader systems leadership models foreground humility, convening capacity, and facilitative governance over directive authority, rejecting the heroic model of the individual leader in favor of collective facilitation within polycentric systems (Boin and Hart 2003; Cairney and Toomey 2025). During the 2010–2011 Ōtautahi Christchurch earthquake sequence, this dynamic was observable; sustained recovery depended not on centralized direction, but on the boundary-spanning actors maintaining relational connections and shared situational awareness across an extended multi-hazard environment (Stevenson 2014). Yet while systems leadership models move closer to the realities of interorganizational DEM governance, they consistently stop short of articulating how systemic authority, accountability, and adaptation are coherently supported across time. This limitation is particularly significant in devolved environments

where no single actor holds mandate over the whole system; it is within this gap that stewardship theory offers a complementary governance perspective (Bugaj and Sulyma 2022).

2.3 Stewardship as a System Governance Capability

Stewardship theory emerged as a counterpoint to agency theory's assumption that actors are self-interested and require monitoring and incentive alignment to perform (Davis et al. 1997); it conceptualizes actors instead as fundamentally motivated to pursue collective goals when organizational identification and value alignment are strong (Contrafatto 2014; Martin and Butler 2017; Ahola 2023). Unlike leadership theories, which primarily focus on influencing followers or organizational performance, stewardship is fundamentally concerned with sustaining the conditions that enable collective system performance over time (Contrafatto 2014). In practice, decentralized actors operating with greater autonomy—such as regional DEM organizations functioning within national frameworks—are more likely to coordinate effectively when shared purpose, professional norms, and trusted relationships are actively cultivated rather than when compliance is enforced through surveillance and sanction alone (Stephenson Jr and Schnitzer 2006).

When extended to the system level, stewardship becomes a governance paradigm oriented toward shaping the system's "goals, rules, feedback, and response" (Hallsworth 2011, p. 35), establishing shared purpose, performance standards, and accountability mechanisms while enabling decentralized adaptation (Lockwood 2010; Denny and Veillard 2015; Cairney and Toomey 2025). This approach has been applied across natural resource governance (Lertzman 2009; Lockwood 2010), public health system management (Denny and Veillard 2015), and complexity-informed public policy (Cairney and Toomey 2025) as a means of sustaining collective performance across distributed, autonomous actors. Operationalizing this within formal public sector accountability frameworks presents practical challenges that the empirical findings of this study address. Within complex adaptive system-informed perspectives, stewardship fosters the conditions for adaptive behavior towards shared objectives (Bebbington and Rubin 2022; Stokka and Falkner 2022; Koliba and Koppenjan 2023). Stewardship, in this sense, is a collective governance capability concerned with cultivating the conditions under which coordination, learning, and legitimacy can emerge—shaping the goals, rules, feedback mechanisms, and relational conditions within which actors coordinate (Hallsworth 2011; Martin and Butler 2017). By emphasizing trust, shared values, relational brokers, and iterative learning, stewardship offers a conceptual bridge between governance, leadership, and complexity in ways that prior models have not (Tidball et al. 2010; Avery 2025). Despite growing prominence in adjacent governance fields,

system stewardship has not been systematically examined within DEM, where the combination of distributed authority, multi-agency interdependence, and hazard environments that are inevitably nonlinear makes it particularly relevant.

3 Methods

This study examines system stewardship within Aotearoa New Zealand's DEM system. The overarching research sought to understand how coordination and collaboration could be strengthened across Aotearoa New Zealand's DEM system. While the broader research explored participants' experiences of coordination, collaboration, and the operation of the DEM system, stewardship was not established as a predetermined analytical construct. Rather, the conceptualization of system stewardship presented in this article emerged inductively through participants' descriptions of the relational, informational, and institutional conditions that enabled—and constrained—coherence, adaptive coordination, and system legitimacy.

Constructivist networked grounded theory (CNGT) combines Charmaz's (2014) constructivist grounded theory and social network analysis to examine both the relational structure of the DEM system and participants' experiences and interpretations of operating within it. Within the broader research program, network analysis was used to examine the DEM system's relational structure, patterns of connectivity, and relationships between actors. Consistent with constructivist methodology, the lead researcher's positionality as a practitioner within Aotearoa New Zealand's DEM system was explicitly acknowledged throughout the research, informing sampling decisions, reflexive interpretation, and ongoing consideration of researcher influence during analysis. Building on the wider research, this article focuses specifically on system stewardship, examining how participants described the relational, informational, and institutional conditions through which coordination, coherence, and legitimacy are cultivated across the DEM system.

Data were collected between August 2024 and June 2025 from across Aotearoa New Zealand's DEM system. Participants were purposively recruited across system participants through national forums, professional networks, and targeted engagement with emergency services, territorial authorities, civil society organizations, and private sector actors to ensure representation across the breadth of the DEM system. Eligibility criteria required participants to be over 18 years of age, to hold organizational consent where appropriate, and to be actively engaged in DEM-related functions. Ethics was granted by the Auckland University of Technology Ethics Committee (24/37). As analysis progressed, theoretical sampling guided additional recruitment to further explore emerging concepts and relationships, resulting in a total of

40 participants (Table 1) across 38 semistructured interviews, including two joint interviews.

Interviews ranged from 43 to 96 minutes (mean approximately 60 minutes). Twenty interviews were conducted virtually and 18 in person. All interviews were conducted in English (mainly Aotearoa New Zealand English), which is the most widely used and most common professional language of Aotearoa New Zealand's three official languages. Interviews explored participants' experiences of operating within the DEM system, including relationships, opportunities, and barriers to participation. Rather than being explored directly, stewardship emerged through iterative initial and focused coding as participants consistently discussed system alignment, authority, relationships, institutional frictions, and adaptive coordination. Stewardship provided a way of bringing these themes together, capturing the governance orientation—concerned with enabling conditions rather than directing outcomes—that participants described across diverse contexts.

Analysis followed Charmaz's (2017) constructivist grounded theory procedures, employing iterative coding, constant comparison, and progressive category refinement grounded in participants' accounts. Coding progressed through repeated comparison of interviews, developing categories, and emerging conceptual relationships, allowing interpretations to evolve throughout the analytical process. Throughout analysis, particular attention was given to the relationships between organizations, authority, information exchange, and coordination across the wider DEM system. System stewardship progressively emerged as the integrative category that explained how participants understood the conditions through which coherence, legitimacy, learning,

Table 1 Participant demographics

Characteristic	Sector	Number
Role	Emergency services	5
	Health	4
	Central government	12
	Local government	12
	Civil society organization (CSO)	4
	Private sector	3
Age group	18–29	1
	30–39	7
	40–49	11
	50–59	12
	60+	9
Gender	Female	15
	Male	25
	Total	40

and adaptive coordination were collectively sustained across organizational boundaries.

Reflexive engagement with researcher positionality was maintained through systematic memo-writing and member checking, thereby enhancing transparency and interpretive rigor. Analysis continued until additional interviews contributed conceptual refinement rather than substantively new theoretical insights, indicating theoretical saturation consistent with constructivist grounded theory.

4 Results

Our analysis identified four interconnected themes describing how participants understood the conditions that enable or constrain effective DEM across Aotearoa New Zealand. Although presented separately for clarity, the themes are highly interdependent and collectively provide the empirical foundation from which the system stewardship framework was developed.

4.1 Governing a Distributed System: Mandate, Authority, and System Boundaries

Participants discussed responsibility and authority as a fundamental feature of the DEM system. In an environment where mandate, capability, and decision-making authority are distributed across multiple organizations, accounts described fragmented authority, limited system-level oversight, and recurrent tension between national direction and local autonomy.

4.1.1 Ambiguous System Responsibility—Who Is Accountable for the Whole?

Participants described uncertainty regarding who holds overarching responsibility for Aotearoa New Zealand's DEM system—not merely in terms of leading response, but in maintaining conditions across the system over time. While formal arrangements identify lead agencies relative to specific hazard types and define statutory roles, accounts suggested that system-level oversight was perceived as partial or bounded rather than comprehensive. When asked about system-level responsibility, one participant responded, “I would say NEMA is but only related to the natural environment or consequences” (P39).

This framing positioned national oversight as limited to particular hazards rather than extending across the full breadth of interagency coordination. The ambiguity extended beyond mandated scope to day-to-day leadership and decision making. As one participant observed of their experience during a complex response, “it’s almost like we’re not sure who’s leading things sometimes, so we

just make decisions and get on with it” (P04), implying an expectation of coordinative leadership that, when absent, prompted autonomous action rather than system-level alignment. Responsibility was described as distributed across agencies with defined but bounded mandates, without a consistently recognized focal of overarching coordination authority across the system as a whole.

4.1.2 National Direction and Local Autonomy—The Alignment Problem

Participants described recurrent misalignment between nationally designed arrangements and local operational realities. Reflecting on Cyclone Gabrielle which affected Te Ika-a-Māui, Aotearoa New Zealand's North Island, in February 2023, one participant—the mayor of a unitary authority with extensive response experience—described how nationally imposed requirements constrained locally-informed decision making, “that stuff that sometimes works nationally doesn’t work locally... we saw that during Gabrielle... Our community knows exactly what to expect” (P03).

This account highlighted the friction generated when nationally prescribed processes override locally embedded knowledge and established community relationships. Participants described a structural basis for this tension: national guidance, in the absence of legislative force, cannot be required to be followed. As one national-level participant observed, “our [national] guidance does not have to be listened to... it’s not legislated. So, they will do what they want, what they are funded for, what is shiny to them” (P05).

Several participants across regional and local roles also described being excluded from the national-level conversations that shaped system direction. As one local practitioner reflected, “what is annoying is that they often have these conversations at a national level, but they’re not asking us what we think at a local level” (P17). National unity was described by several participants as shared strategic direction and collective coherence rather than centralized operational control. Local decision making was positioned as essential for contextual responsiveness and community legitimacy—a distinction that participants characterized as the central governance design challenge facing the DEM system.

4.1.3 Defining Who Is Part of the System—Boundaries, Inclusion, and Legitimacy

Participants described uncertainty regarding which actors were recognized as legitimate contributors to the DEM system. Although statutory arrangements define a formal framework of agencies and authorities, accounts indicated that the operational system extends well beyond these prescribed structures, and that ambiguity about system boundaries had

practical consequences for coordination, inclusion, and capability. One participant [Local Government] described the gap between relational and formal conceptions of the system, “the network of networks and the relationships at the local level aren’t visible to national, they just push things down [from national to local] and think it’s done” (P29).

Participants described the DEM system not as a fixed set of prescribed organizations but as a fluid network whose effective boundaries depend on context, relationships, and recognition. The absence of a consistently shared understanding of who constitutes the system in any given context—and therefore with whom coordination is both possible and expected—was perceived as constraining both operational coordination during events and the inclusivity of preparedness planning.

These findings demonstrate a structural alignment problem in which statutory responsibilities remained bounded, decision-making authority was distributed unevenly, and the operational boundaries of the system extended beyond those actors formally recognized within governance arrangements.

4.2 Enabling Coordination Through Trust and Inclusive Participation

Participants identified relational conditions—trust, sustained interpersonal relationships, and inclusive participation across actors and communities—as foundational to effective coordination within the DEM system. Without established relational infrastructure, coordination during events depended on improvisation rather than activated capacity.

4.2.1 Investing in Trust and Relationships

Trust and interpersonal relationships were widely described as the way that coordination operates across the DEM system. Participants emphasized that the quality of pre-existing relationships between individuals and organizations was a more reliable predictor of coordination effectiveness than formal arrangements or statutory roles.

Participants noted that individuals occupying coordination roles were often expected to actively develop and maintain these relationships as a core function of their work, “you’ve got to be the sort of person that can go forth and develop and maintain those relationships across a wide range of agencies” (P40).

Trust was described as developing gradually through repeated interaction, informal engagement, and demonstrated reliability—not through formal mechanisms alone, “You need to build a relationship over eight cups of coffee... before you can start asking for something” (P04). This developmental quality of trust was significant. Participants described the investment of time in relationship-building during periods of nonemergency activity as directly enabling

the quality of coordination when events occurred. Conversely, participants described how high personnel turnover disrupted established relational networks, requiring the reinvestment of time and trust with new contacts before effective coordination could resume.

4.2.2 Inclusive Participation and Recognizing Diverse Actors

Participants described meaningful inclusion as both a practical requirement for effective coordination and a persistent challenge within the DEM system. Accounts indicated that the system’s operational effectiveness was closely linked to the breadth of actors engaged in preparedness and response, yet participation was described as uneven, with some sectors and communities consistently peripheral to formal coordination structures.

The role of CSOs was described as substantial but under recognized within formal system definitions. Participants noted that these actors often provide relational networks and community intelligence through which effective local response is sustained. One CSO participant shared, “so it might be that within one of our teams, we have people who will know that up that driveway, there’s not just one house... [the occupants] won’t ask for help, but they’re likely to have high needs. Now that information is golden” (P19).

Indigenous partnership was identified as a distinct and significant dimension of inclusive participation. In Aotearoa New Zealand, Māori are the Indigenous people of the country, and their relationship with the Crown—the New Zealand state—is shaped by Te Tiriti o Waitangi (the Treaty of Waitangi), signed in 1840, which provides an enduring basis for partnership and Māori participation in governance (Te Tiriti o Waitangi 1840). Within this context, participants described the quality of engagement as directly influencing both the legitimacy and operational effectiveness of the DEM system. Where engagement was sustained and embedded in genuine partnership, it strengthened the system’s reach into communities and its responsiveness to locally held knowledge. One Māori participant described this principle directly, “don’t do it for us. Walk alongside us and support us to do it” (P08).

However, over half of the participants noted that the quality of Treaty-based partnership varied significantly across the country, with some regions having embedded iwi¹ representation within governance and operational structures while others had not yet developed meaningful engagement (P22). The absence of consistent and authentic partnership was described as weakening both

¹ Iwi are Māori tribal groups, recognized as Indigenous communities and Treaty partners in Aotearoa New Zealand, with enduring governance and cultural roles.

the cultural legitimacy and the operational capability of the DEM system in those regions.

These results indicate that effective coordination was understood by participants as fundamentally relational. Trust, sustained interpersonal relationships, and meaningful inclusion were described as essential conditions through which coordination across a distributed DEM system becomes possible.

4.3 Sharing Information and Supporting Learning

Participants identified information flow and organizational learning as critical conditions for effective coordination across the DEM system. Two related challenges emerged: the difficulty of establishing and maintaining shared situational awareness; and the tendency for learning identified through events and exercises to be lost over time rather than being systematically captured and applied.

4.3.1 Shared Situational Awareness and the Limits of a Common Operating Picture

Effective coordination was widely described as dependent on timely, reliable, and shared information. Participants emphasized that when agencies operate with different information, coordination becomes fragmented and decision making is compromised. The concept of a common operating picture was widely referenced but characterized as aspirational rather than operational. As one participant observed, “the only common thing around a common operating picture is the word common” (P39).

Participants attributed this gap to several compounding factors. Information systems across agencies were described as incompatible and insufficiently integrated. One senior practitioner described the current landscape as a fragmented proliferation of platforms—some providing good situational reporting but lacking coordination functionality, others enabling tasking but not shared picture—with no coherent architecture connecting them, “there’s just this real dyslexic approach to what this [information] system will or won’t be and what it needs to do... we’re getting bogged down in a solution for everything” (P01).

Participants noted that these barriers were not purely technical. In several accounts, organizations described withholding information as a product of institutional protectiveness rather than legitimate security concerns. The consequence was a degraded collective intelligence—a system theoretically capable of shared sensemaking but operationally fragmented across institutional boundaries.

4.3.2 Learning, Feedback, and Institutional Memory

Participants consistently emphasized the importance of sustained learning as a condition for system improvement over time. The DEM system faces repeated events that generate significant operational experience; however, participants described a recurring pattern in which insights gained through response activities faded as operational urgency declined, personnel changed, and attention shifted to the next cycle of preparedness activity, “we’re very quick to forget our learnings or outcomes from responses... as time goes on we sort of forget it” (P37).

This observation was reinforced by accounts of personnel turnover as a systemic barrier to institutional memory. Several participants described investing significant time in developing shared understanding and working relationships with counterpart agencies, only for those connections to be disrupted when key individuals moved roles or left the sector, “you find the right person to talk to and then—oh, that person’s left, we don’t do that anymore” (P17). The consequence was practical and recurring. Relationships had to be rebuilt, shared understanding renegotiated, and the groundwork of coordination re-established—often repeatedly—as personnel moved through the system.

The findings highlight that effective coordination depends on the system’s capacity to generate, share, retain, and apply knowledge over time.

4.4 Sustaining Capability and Legitimacy

Participants described the long-term sustainability of the DEM system as dependent on three interconnected institutional conditions: appropriate resourcing, a capable and stable workforce, and governance arrangements that sustain public trust and accountability.

4.4.1 Fair and Reliable Resourcing

Resourcing was consistently described as a fundamental condition shaping the capacity of the DEM system to operate effectively. Participants noted that funding, personnel, and operational support were unevenly distributed across jurisdictions, influencing both preparedness activities and the ability of organizations to participate in broader system initiatives. Several participants described operating with limited resources, “We’re pretty much doing this on a shoestring budget, having to fight for every dollar” (P36).

The structural basis of this inequality was identified as the reliance on locally generated revenue—primarily ratepayer funding—to support functions with national significance. Participants described this as producing a “postcode lottery” of capability, where an organization’s capacity to fulfill its DEM responsibilities reflected local financial circumstances

rather than hazard exposure or statutory obligation. Participants were specific about structural reforms they believed were necessary. Several described the need for a central government funding model, drawing analogies with the funding architecture of the police, health system, or education sector (P10, P18).

Resourcing constraints also shaped recovery arrangements. Several participants described the fragmented and burdensome funding landscape encountered during recovery from major events, where multiple national agencies each arrived with different reporting requirements, separate funding criteria, and distinct administrative obligations.

4.4.2 Supporting the Workforce Over the Long Term

Workforce sustainability emerged as a significant concern within the data. Participants ($n = 31$) described the cumulative pressures associated with preparedness, response, and recovery activities, particularly where DEM responsibilities were undertaken alongside other roles. Burnout, illness, and recruitment delays were described as undermining organizational continuity, “People leave, you know, they burn out. They leave, or they get sick, not filling vacancies fast enough” (P04).

Participants consistently linked these workforce pressures to broader capability challenges. Entry pathways varied considerably, professional standards and training were described as inconsistent, and no centralized repository existed for qualifications or ongoing competency requirements, “there’s no centralized repository... there’s a couple of hundred controllers supposedly qualified, but no currency requirements for maintaining that skill set. I would describe current arrangements as fractured and inconsistent” (P01).

Interviewees argued that capability should be systematically developed and maintained rather than relying on individual experience or organizational practice. As one participant observed, “a level of competency has to be met and then maintained. We aren’t there yet” (P24).

Frequent emergency activations and sustained operational demands further compounded these challenges. Participants described experienced personnel leaving the sector or taking extended leave, reducing institutional knowledge and increasing the time required to rebuild capability across the system.

4.4.3 Accountability, Legitimacy, and Public Trust

Participants emphasized the importance of accountability and public trust in sustaining the legitimacy of the DEM system. In a multi-agency governance environment, public confidence was seen as closely linked to perceptions of coordination, transparency, and communication during disasters. Participants noted that governance interventions

could occasionally disrupt established processes. One participant described how political involvement altered recovery arrangements, “and then Minister [redacted] got involved and wanted to set up this whole new structure. So, the momentum that we normally would have got under our normal recovery protocols and processes turned into this massive thing” (P08).

The fragmentation of recovery governance across multiple national agencies—each with their own engagement criteria, reporting requirements, and mandates—was similarly described as undermining coherence and public trust, particularly when communities experienced inconsistent messages and unclear lines of responsibility.

Consistent and credible communication was described as particularly important in maintaining trust, especially when misinformation or competing narratives circulate during events. One participant described how sustained multi-channel messaging during Cyclone Gabrielle had actively strengthened public confidence despite deliberate attempts to undermine it, “our trust and confidence with the public had actually grown as a result [of consistent multi-channel messaging], despite the fact that there were those trying to kneecap and undermine and really draw our credibility into question” (P19).

Participants described accountability not only in terms of public communication but also in terms of assurance mechanisms within the system itself. Several noted the absence of a robust assurance function—one capable of holding organizations to agreed standards and providing meaningful oversight of system performance across jurisdictions. Without such mechanisms, accountability was described as diffuse, with responsibility distributed across agencies in ways that made systemic underperformance difficult to identify, attribute, or address.

These findings demonstrate that the long-term effectiveness of the DEM system depends upon interconnected institutional conditions extending beyond individual organizations. Equitable resourcing, workforce capability, accountability, and public legitimacy collectively sustained coordination, adaptation, and system coherence.

5 Discussion

The discussion interprets the findings in relation to the wider literature on disaster governance, complex adaptive systems, and interorganizational coordination. It considers how the conditions identified through the analysis contribute to system coherence and adaptive coordination across a decentralized, multi-actor disaster and emergency management system, before drawing these insights together through the concept of system stewardship as a meta-governance function.

5.1 Three Pillars of Meta-Governance for Disaster and Emergency Management System Stewardship

The findings support interpreting DEM through a complex adaptive system-informed perspective in which coordination, learning, and collective capacity emerge through interactions between distributed actors rather than formal organizational structures alone. While previous scholarship has characterized DEM systems as exhibiting the properties of complex adaptive systems (Comfort 2007; Hodges and Larra 2021; Miller et al. 2026), this study extends that literature by identifying the governance conditions through which coherence is deliberately cultivated across decentralized systems.

The findings suggest that the central governance challenge is one of maintaining coherence when authority, capability, and accountability remain distributed. Existing governance theories explain aspects of this challenge through collaborative governance, network governance, and systems leadership; however, participants consistently described a broader coordinating function concerned with sustaining the conditions that enable adaptive coordination over time.

Consistent with systems scholarship that distinguishes between managing organizational components and governing whole systems (Churchman 1971), the findings suggest that coherence within DEM emerges through the stewardship of interactions between actors rather than through optimization of individual organizations.

Through iterative engagement with the study's findings, three interdependent dimensions emerged: relational stewardship, concerning the trust, boundary-spanning networks, and inclusive participation through which coordination becomes possible; informational stewardship, concerning the shared situational awareness, data transparency, and feedback-informed learning through which actors align action and adapt; and institutional stewardship, concerning the equitable resourcing, workforce capability, and

accountability mechanisms that sustain capability and legitimacy over time.

The three dimensions are interdependent—weakness in one degrades the others, while alignment across all three creates the conditions for sustained adaptive performance—and collectively constitute a meta-governance function oriented not toward controlling the system but toward enabling it (Fig. 1).

The importance of interorganizational relationships, communication, and collaborative coordination is well established across disaster scholarship (Dynes 1969; Dynes and Aguirre 1979; Quarantelli 1988; Kapucu 2005). The present findings extend the field by suggesting that these relationships should not simply be viewed as desirable coordination enablers but also as relational conditions requiring deliberate stewardship across the wider system. Rather than emerging incidentally through repeated interaction, trust, boundary-spanning relationships, and inclusive participation were consistently described by participants as conditions that must be actively cultivated and sustained if distributed coordination is to remain effective over time.

This encompasses regular joint planning, engagement forums, and collaborative exercises—investments needed for coordination under pressure. It also requires sustained investment in Treaty-based partnerships with iwi, where the quality of engagement shapes both the legitimacy and the operational reach of the system within communities (Kaiser and Kenney 2025). Such partnerships are strengthened when engagement extends beyond transactional inclusion towards shared authority and sustained participation in system governance.

The findings also highlight that relational stewardship must address personnel turnover as a structural threat to network integrity. When individuals who hold brokerage positions leave their roles, the cross-boundary ties they maintained frequently dissolve with them, requiring reinvestment of time and trust before effective coordination can resume

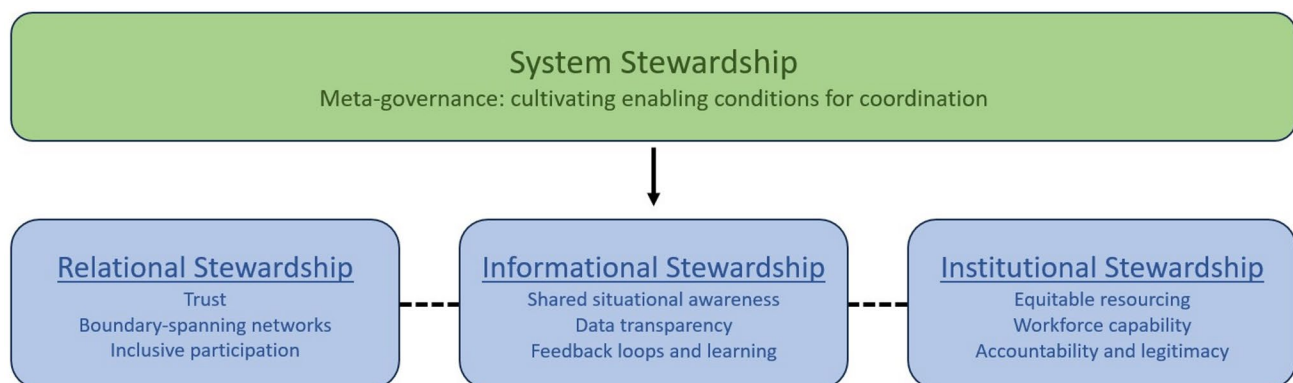


Fig. 1 Disaster and emergency management system stewardship

(Kapucu and Garayev 2013). Building relational connections into organizational arrangements rather than the individual level—through formalized partnership arrangements, documented engagement processes, and shared governance structures—is therefore a component of relational stewardship that the findings suggest is currently underdeveloped within the Aotearoa New Zealand DEM system (Nowell and Steelman 2015).

The findings also extend existing understandings of information management within DEM. Previous studies emphasize shared situational awareness and information exchange as prerequisites for adaptive coordination (McDaniel 2008). Participants similarly identified these as essential, but further highlighted stewardship of institutional memory and cross-boundary learning as equally important conditions for long-term system adaptation.

The aspiration of a “common operating picture”—widely endorsed across participant accounts—was characterized as persistently unachievable in practice. Platform fragmentation, incompatible information systems, institutional protectiveness over data, and the absence of transparent data-sharing arrangements each contributed to a condition in which the system is theoretically capable of shared sensemaking but operationally fragmented along institutional boundaries. The consequence is what complexity scholars would recognize as a feedback deficit—a system unable to generate the iterative, cross-boundary learning that enables adaptive refinement over time (Morin 1992; Uhl-Bien et al. 2007; Abbas and Miller 2025).

The learning dimension of informational stewardship is equally significant. The pattern described by participants—insights gained through events and exercises fading as operational urgency declines and personnel change—reflects a system whose institutional memory resides in individuals rather than in organizational systems and processes (Walsh and Ungson 1991). This renders learning sporadic rather than cumulative, leaving the system dependent on periodic shock to prompt reform rather than generating continuous improvement (Boin et al. 2010). The creation of the National Emergency Management Agency (NEMA) resulted from the Technical Advisory Group’s Report and subsequent government response after the 2016 Kaikōura earthquake and the 2017 Port Hills fires (New Zealand Government 2018). Participants’ accounts suggest that this pattern persists—reform remains event-driven, and the conditions that produced the gaps NEMA was created to address continue to be reported as features of the current system.

Informational stewardship therefore involves both technical and cultural dimensions. Technically, it requires investment in compatible information management, transparent data-sharing frameworks, and systematic lessons management processes. Culturally, it requires creating the conditions under which learning is treated as a shared system function

rather than an individual responsibility. This includes normalizing after-action reflection, ensuring lessons circulate vertically across national, regional, and local levels as well as horizontally across agencies, and institutionalizing feedback mechanisms that operate between events rather than only following them.

The findings reinforce longstanding concerns regarding resourcing, capability, and accountability within disaster governance, while extending previous scholarship by demonstrating how these institutional conditions shape the effectiveness of relational and informational coordination across the wider system. Three institutional conditions emerged as central to sustaining adaptive coordination across the wider system. First, the reliance on locally generated revenue to fund DEM produces structural inequality in system capability—“a postcode lottery,” in the words of participants, whereby organizational capacity reflects local circumstances rather than hazard exposure or statutory responsibility. This inequality undermines system coherence by creating uneven preparedness across jurisdictions and constrains the relational and informational stewardship functions; organizations with insufficient staffing cannot sustain the engagement, learning, and information management that those pillars require. The absence of a central funding model, consistently identified by participants across national and regional roles, represents a structural gap that reforms to policy, standards, or mandate cannot resolve without addressing the underlying resourcing.

Next, the absence of consistent professional standards, training pathways, and career structures within the DEM workforce produces variability in decision making and coordination performance that is, as one participant described, both fractured and inconsistent. This positions workforce development as a system coherence issue. Where capability varies significantly between practitioners and organizations, the reliability of the relational and informational conditions that stewardship depends upon is compromised (Nowell and Steelman 2015). Professional standards serve as a governance mechanism—they create shared expectations, reduce variability, and establish the baseline of common capability that enables distributed actors to coordinate without having to negotiate from first principles in every interaction (Jensen and Ferreira 2023).

Third, the absence of a robust assurance function—one capable of providing meaningful oversight of system-level performance across jurisdictions—leaves accountability thin and systemic underperformance difficult to identify or address. The findings suggest that accountability in the current system operates primarily through post-event inquiry rather than through ongoing assurance of preparedness and coordination quality. This reinforces a reactive rather than adaptive orientation, consistent with what Hallsworth (2011) described as the limitation of governance systems that lack

feedback mechanisms capable of detecting and responding to system-level drift before crisis conditions emerge (Koliba and Koppenjan 2023).

Institutional stewardship therefore involves establishing governance and resourcing arrangements that align capability, authority, and accountability across the DEM network—not to eliminate decentralization, but to ensure that distributed actors operate within a coherent structural framework that enables rather than constrains their coordination. The findings suggest that this requires simultaneous attention to funding architecture, professional standards, and assurance mechanisms; reforms to any single dimension, in the absence of the others, are unlikely to produce durable system improvement.

The three pillars reveal stewardship as a form of meta-governance—a governance function concerned with cultivating and sustaining the enabling conditions within which coordination and adaptation occur (Hallsworth 2011; Cairney and Toomey 2025). This distinguishes stewardship from both command-and-control models, which seek to govern through directive authority, and from *laissez-faire* network governance, which relies on self-organization without coherence. System stewardship occupies the governance space between these orientations: it sets direction, maintains standards, and sustains conditions.

Operationally, the framework provides a governance lens through which organizations and policymakers can evaluate the conditions supporting system performance. Rather than assessing individual organizational capability in isolation, system stewardship directs attention towards the stewardship of relationships, information, capability, and accountability across the wider system, providing a structured basis for identifying governance strengths, gaps, and priorities for improvement. The principal contribution of the framework lies in the interdependence of the three stewardship dimensions. Relational stewardship is undermined when informational barriers prevent the shared situational awareness on which coordinated action depends; informational stewardship is constrained when institutional under-resourcing prevents organizations from investing in the data systems and learning processes it requires; institutional stewardship loses legitimacy when relational exclusion means that governance arrangements are not trusted by the actors they are designed to coordinate. Conversely, when the three pillars are aligned, they are mutually reinforcing: trust facilitates information sharing; shared understanding strengthens institutional confidence; equitable resourcing enables sustained engagement through which relationships are built.

Maintaining these conditions is itself an ongoing governance challenge, particularly in environments characterized by resource inequality, competing institutional priorities, workforce instability, and contested information environments. Importantly, the conditions underpinning system

stewardship should not be assumed to persist indefinitely. Trust, shared learning, institutional legitimacy, and collaborative relationships require continual investment and renewal, and may be weakened by organizational change, resource constraints, competing priorities, declining institutional confidence, or the pursuit of organizational or individual interests that undermine collective learning and coordination.

Accordingly, this article argues that system stewardship provides a governance approach through which the relational, informational, and institutional conditions underpinning effective DEM can be deliberately cultivated and sustained, strengthening the system's capacity to coordinate, learn, and adapt over time.

5.2 Limitations

Several limitations should be acknowledged. The findings are derived from qualitative interviews with practitioners operating within a single national DEM environment—Aotearoa New Zealand—and therefore reflect perspectives shaped by its institutional arrangements, governance context, and hazard profile. The analysis draws on participant interpretations of system dynamics rather than direct observation of governance processes, meaning that coordination behaviors are perceived rather than independently measured or observed, although the integration of social network analysis within the CNGT methodology provides a partial structural check on these accounts.

Furthermore, the cross-sectional design captures participants' reflections at a single point in time and therefore cannot fully assess the longer-term processes of social learning, relationship development, and institutional adaptation through which system stewardship is cultivated, sustained, or eroded across the DEM system.

Finally, this article forms part of a broader program of research (Miller et al. 2025a, 2025b, 2026), and its limitations are partly addressed by the complementary findings of prior work in the series; the framework should therefore be understood as cumulative rather than standalone.

6 Conclusion

This study examined how system stewardship functions as a meta-governance capability within a complex adaptive DEM system, using Aotearoa New Zealand's DEM system as the empirical case. Findings demonstrate that system coherence and adaptive coordination depend on three interdependent conditions: relational connectivity and trust, effective information flow and learning, and institutional arrangements that sustain capability, accountability, and legitimacy. These findings provide the empirical basis

for considering system stewardship as a broader meta-governance capability within decentralized, multi-actor DEM systems. It responds to a persistent gap in governance and leadership scholarship: the absence of an integrated framework capable of explaining how coherence, adaptive coordination, and legitimacy are sustained across decentralized, multi-actor environments where formal authority alone is insufficient. Three interconnected contributions are advanced. The study demonstrates how interpreting DEM through a complexity-informed perspective provides a stronger explanation of how coherence, adaptive coordination, and legitimacy emerge across distributed systems through the interaction of relational, informational, and institutional conditions rather than hierarchical authority alone. It introduces system stewardship as a meta-governance function concerned not with directing operational activity but with cultivating the enabling conditions within which coordination and adaptation occur, extending stewardship theory from its organizational origins to the system level. It also offers a three-pillar framework comprising relational, informational, and institutional stewardship, operationalizing the interdependent governance conditions identified through the empirical findings.

The practical implications are significant. For national agencies, stewardship implies a reorientation of the governance function—from setting requirements to cultivating conditions, from assuring compliance to strengthening capability. For policymakers, the framework makes visible the structural interdependencies between funding, professional standards, and accountability mechanisms, demonstrating that reforms to any single dimension in isolation are unlikely to produce significant improvement. Future research should examine the framework's applicability across DEM systems operating under different governance models and hazard contexts. Ultimately, this study argues that strengthening DEM systems requires the deliberate stewardship of the relational, informational, and institutional conditions through which adaptive coordination, collective learning, and long-term system coherence are cultivated and sustained.

Acknowledgments The authors acknowledge the contributions of all participants who generously shared their time, knowledge, and experience. No funding was received for this research.

Funding Open Access funding enabled and organized by CAUL and its Member Institutions.

Open Access This article is licensed under a Creative Commons Attribution 4.0 International License, which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if changes were made. The images or other third party material in this article are included in the article's Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons licence and your intended use is not

permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this licence, visit <http://creativecommons.org/licenses/by/4.0/>.

References

- Abbas, R., and T. Miller. 2025. Exploring communication inefficiencies in disaster response: Perspectives of emergency managers and health professionals. *International Journal of Disaster Risk Reduction* 120: 1–15.
- Ahola, T. 2023. Classic perspectives on project governance: Transaction cost economics, agency theory, and stewardship theory. In *Research handbook on the governance of projects*, ed. R. Müller, S. Sankaran, and N. Drouin, 31–41. Cheltenham: Edward Elgar Publishing.
- Altay, N., and M. Labonte. 2014. Challenges in humanitarian information management and exchange: Evidence from Haiti. *Disasters* 38(1): 50–72.
- Avery, M. 2025. Boundary-spanning leadership. *Asia Pacific Journal of Health Management* 20(3). <https://doi.org/10.24083/apjhm.v20i3.5547>.
- Baltacı, A., and A. Balcı. 2017. Complexity leadership: A theoretical perspective. *International Journal of Educational Leadership and Management Communication Quarterly* 5(1): 30–59.
- Bebbington, J., and A. Rubin. 2022. Accounting in the Anthropocene: A roadmap for stewardship. *Accounting and Business Research* 52(5): 582–596.
- Boin, A., and P. Hart. 2003. Public leadership in times of crisis: Mission impossible?. *Public Administration Review* 63(5): 544–553.
- Boin, A., L.K. Comfort, and C.C. Demchak. 2010. The rise of resilience. In *Designing resilience: Preparing for extreme events*, ed. A. Boin, L.K. Comfort, and C.C. Demchak, 1–12. Pittsburgh: University of Pittsburgh Press.
- Bugaj, J., and A. Sulyma. 2022. Problems in defining leadership—A systematic literature review. *Krakow Review of Economics and Management* 2(996): 99–117.
- Cairney, P., and C. Toomey. 2025. Systems leadership: A qualitative systematic review of advice for policymakers. *Open Research Europe* 5: Article 6.
- Canyon, D.V., and P.D. Morrison. 2010. Do the emergency management and emergency medicine professions require a new leadership theory. *Journal of Rural and Tropical Public Health* 9(1): 51–52.
- Charmaz, K. 2014. *Constructing grounded theory*. Thousand Oaks: Sage.
- Charmaz, K. 2017. Constructivist grounded theory. *The Journal of Positive Psychology* 12(3): 299–300.
- Churchman, C.W. 1971. *The design of inquiring systems: Basic concepts of systems and organization*. New York: Basic Books.
- Comfort, L.K. 2006. Cities at risk: Hurricane Katrina and the drowning of New Orleans. *Urban Affairs Review* 41(4): 501–516.
- Comfort, L.K. 2007. Crisis management in hindsight: Cognition, communication, coordination, and control. *Public Administration Review* 67: 189–197.
- Comfort, L.K., and A. Okada. 2013. Emergent leadership in extreme events: A knowledge commons for sustainable communities. *International Review of Public Administration* 18(1): 61–77.
- Comfort, L.K., and S.L. Resodihardjo. 2013. Leadership in complex adaptive systems. *International Review of Public Administration* 18(1): 1–5.

- Comfort, L.K., N. Oh, G. Ertan, and S. Scheinert. 2010. Designing adaptive systems for disaster mitigation and response. In *Designing resilience: Preparing for extreme events*, ed. L.K. Comfort, A. Boin, and C.C. Demchak, 33–62. Pittsburgh: University of Pittsburgh Press.
- Contrafatto, M. 2014. *Stewardship theory: Approaches and perspectives*. In *Accountability and social accounting for social and non-profit organizations*. Bingley: Emerald Group Publishing Limited.
- Cousin, S. 2019. System leaders in England: Leaders of a profession, or instruments of government?. *Educational Management Administration & Leadership* 47(4): 520–537.
- Davis, J.H., F.D. Schoorman, and L. Donaldson. 1997. Toward a stewardship theory of management. *Academy of Management Review* 22(1): 20–47.
- Denny, K., and J. Veillard. 2015. Towards a model of stewardship and accountability in support of innovation and “good” failure. *Healthcare Papers* 15(2): 38–43.
- Devitt, K.R., and E.P. Borodzicz. 2008. Interwoven leadership: The missing link in multi-agency major incident response. *Journal of Contingencies and Crisis Management* 16(4): 208–216.
- Dynes, R.R. 1969. Organized behavior in disaster: Analysis and conceptualization. Disaster Research Center, Ohio State University, Columbus, OH, USA.
- Dynes, R.R., and B.E. Aguirre. 1979. Organizational adaptation to crises: Mechanisms of coordination and structural change. *Disasters* 3(1): 71–74.
- Hallsworth, M. 2011. System stewardship. <https://www.instituteforgovernment.org.uk/sites/default/files/publications/System%20Stewardship.pdf>. Accessed 8 May 2026.
- Hayashi, C., and A. Soo. 2012. Adaptive leadership in times of crisis. *Prism* 4(1): 78–86.
- Hodges, L.R., and M.D. Larra. 2021. Emergency management as a complex adaptive system. *Journal of Business Continuity & Emergency Planning* 14(4): 354–368.
- Jensen, J., and M. Ferreira. 2023. An exploration of local emergency management program accreditation pursuit. *Journal of Homeland Security and Emergency Management* 20(3): 351–384.
- Kaiser, L., and C. Kenney. 2025. Emergency managers’ perspectives on Māori response and recovery approaches: Managing catastrophic hazard events in Aotearoa New Zealand. *The Australian Journal of Emergency Management* 40(2): 30–38.
- Kapucu, N. 2005. Interorganizational coordination in dynamic context: Networks in emergency response management. *Connections* 26(2): 33–48.
- Kapucu, N., and V. Garayev. 2013. Designing, managing, and sustaining functionally collaborative emergency management networks. *The American Review of Public Administration* 43(3): 312–330.
- Koliba, C., and J. Koppenjan. 2023. Managing “wicked problems” through complex adaptive governance networks. In *Public management and governance*, ed. T. Bovaird, and E. Loeffler, 232–244. New York: Routledge.
- Lertzman, K. 2009. The paradigm of management, management systems, and resource stewardship. *Journal of Ethnobiology* 29(2): 339–358.
- Lockwood, M. 2010. Good governance for terrestrial protected areas: A framework, principles and performance outcomes. *Journal of Environmental Management* 91(3): 754–766.
- Marcus, L.J., I. Ashkenazi, B. Dorn, and J. Henderson. 2007. *The five dimensions of meta-leadership*. Cambridge: National Preparedness Leadership Initiative, Harvard School of Public Health.
- Marcus, L.J., B.C. Dorn, I. Ashkenazi, J. Henderson, and E.J. McNulty. 2009. *Meta-leadership: A primer*. Cambridge: National Preparedness Leadership Initiative, Harvard School of Public Health.
- Martin, J.A., and F.C. Butler. 2017. Agent and stewardship behavior: How do they differ?. *Journal of Management & Organization* 23(5): 633–646.
- McDaniel, R.R. 2008. Management strategies for complex adaptive systems: Sensemaking, learning, and improvisation. *Performance Improvement Quarterly* 20(2): 21–41.
- Miller, T., L. Le Dé, and K. Hore. 2025a. The adaptive shift: Embracing complexity in disaster and emergency management. *International Journal of Disaster Risk Reduction* 119: Article 105323.
- Miller, T., L. Le Dé, and K. Hore. 2025b. Constructivist networked grounded theory: A methodology for complex disaster and emergency management systems. *International Journal of Qualitative Methods* 24. <https://doi.org/10.1177/16094069251378368>.
- Miller, T., L. Le Dé, and K. Hore. 2026. The adaptive system: Networks, relationships, and boundaries in disaster and emergency management. *Journal of Contingencies and Crisis Management* 34(1): Article 15.
- Morin, E. 1992. From the concept of system to the paradigm of complexity. *Journal of Social and Evolutionary Systems* 15(4): 371–385.
- New Zealand Government. 2015. *National civil defence emergency management plan order 2015*. Wellington: New Zealand Government.
- New Zealand Government. 2018. *Delivering better responses to natural disasters and other emergencies: Government response to the Technical Advisory Group’s recommendations*. Wellington: New Zealand Government.
- Nolte, I.M., E.C. Martin, and S. Boenigk. 2012. Cross-sectoral coordination of disaster relief. *Public Management Review* 14(6): 707–730.
- Nowell, B., and T. Steelman. 2015. Communication under fire: The role of embeddedness in the emergence and efficacy of disaster response communication networks. *Journal of Public Administration Research and Theory* 25(3): 929–952.
- Perrow, C. 1984. *Normal accidents*. New York: Basic Books.
- Quarantelli, E.L. 1988. Disaster crisis management: A summary of research findings. *Journal of Management Studies* 25(4): 373–385.
- Rietsema, K., and D. Watkins. 2012. Beyond leadership. *International Journal of Business and Social Science* 3(4): 22–30.
- Select Bipartisan Committee to Investigate the Preparation for and Response to Hurricane Katrina. 2006. A failure of initiative: Final report of the Select Bipartisan Committee to Investigate the Preparation for and Response to Hurricane Katrina. <https://www.govinfo.gov/content/pkg/CRPT-109hrpt377/pdf/CRPT-109hrpt377.pdf>. Accessed 16 Aug 2026.
- Stephenson, M., Jr., and M.H. Schnitzer. 2006. Interorganizational trust, boundary spanning, and humanitarian relief coordination. *Nonprofit Management and Leadership* 17(2): 211–233.
- Stevenson, J.R. 2014. *Organisational resilience after the Canterbury earthquakes: A contextual approach*. Christchurch: University of Canterbury.
- Stokka, G.L., and T.R. Falkner. 2022. Systems thinking perspectives on stewardship and our future. *The Veterinary Clinics of North America: Food Animal Practice* 38(2): 201–207.
- Te Tiriti o Waitangi. 1840. Māori and English texts. <https://www.waitangetribunal.govt.nz/en/about/the-treaty/maori-and-english-versions>. Accessed 16 Aug 2026.
- Tidball, K.G., M.E. Krasny, E. Svendsen, L. Campbell, and K. Helphand. 2010. Stewardship, learning, and memory in disaster resilience. *Environmental Education Research* 16(5–6): 591–609.
- Uhl-Bien, M. 2006. Relational leadership theory: Exploring the social processes of leadership and organizing. *The Leadership Quarterly* 17(6): 654–676.
- Uhl-Bien, M., R. Marion, and B. McKelvey. 2007. Complexity leadership theory: Shifting leadership from the industrial age to the knowledge era. *The Leadership Quarterly* 18(4): 298–318.
- Walker, A. 2025. No man(ager) is an Island: For a process-oriented systems approach to leadership. *Leadership* 22(4): 231–250.
- Walsh, J.P., and G.R. Ungson. 1991. Organizational memory. *Academy of Management Review* 16(1): 57–91.
- Westover, J.H. 2025. Leadership redefined: Looking beyond traditional models to thrive in today’s complex world. *Human Capital*

Leadership Review 24(3). <https://doi.org/10.70175/hclreview.2020.24.3.3>.

Zafari, K., S. Biggemann, and T. Garry. 2020. Mindful management of relationships during periods of crises: A model of trust, doubt

and relational adjustments. *Industrial Marketing Management* 88: 278–286.