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CRISIS LEADERSHIP AND COLLABORATIVE GOVERNANCE IN FOREST AND LAND FIRE MANAGEMENT: A SYSTEMATIC LITERATURE REVIEW USING THE TCCM-ADO FRAMEWORK

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Abstract: Abstract: Forest and land fires require leadership, interorganizational coordination, information management, resource mobilization, and community participation. Yet research on wildfire leadership, cross-jurisdictional collaboration, firefighter safety, and forest-and-land-fire governance differs in context, unit of analysis, and outcome measures, limiting comparability. This systematic literature review examines 51 studies published between 2015 and 2026 (43 core and 8 comparator articles), selected from 447 Scopus records (440 after deduplication), and follows PRISMA 2020 reporting. The literature is mapped using the Theory-Context-Characteristics-Methods (TCCM) framework and synthesized through the Antecedents-Decisions/Practices-Outcomes (ADO) framework. During emergency response, the most frequently coded themes are strategic communication and shared situational awareness (22 articles), followed by cross-actor coordination and resource negotiation (20 articles). Resource scarcity, time pressure, workload, and fatigue represent the most frequently coded constraints (23 articles), while open information flows and negotiated interdependence are each identified in 19 articles as enabling factors. These counts represent thematic coverage rather than effect sizes or causal evidence. The review identifies nine research gaps relating to leadership competencies, governance conditions, collaborative mechanisms, operational and safety outcomes, social-ecological impacts, power asymmetries, and the transferability of wildfire models to Indonesia. An integrative ADO model and nine propositions are proposed to guide future comparative, longitudinal, and mixed-methods research.

Keywords: crisis leadership; collaborative leadership; collaborative governance; forest and land fires; systematic literature review; TCCM-ADO

INTRODUCTION

Forest and land fires once again became a national crisis in 2026. According to the Ministry of Environment and Forestry's law-enforcement data, forest and land fire incidents in January-June 2026 increased by 366% compared with the corresponding period in 2025, while SiPongi recorded 202,010.96 hectares burned nationwide during January-August 2026. As of 14 September 2026, an estimated 85,765.57 hectares had burned in six priority provinces, including West Kalimantan (38,310.89 hectares), Riau (19,800.01 hectares), and Central Kalimantan (15,829.5 hectares) (BNPB, 2026). These figures reflect different geographic scopes and reporting dates. CELIOS estimated economic and health-related losses from fires in January-August 2026 at IDR 39.29-123.1 trillion. For historical comparison, the national area affected by fires reached 1,161,193 hectares in 2023 (SiPongi, 2026). The causes involve both natural and human factors: the Minister of Environment identified prolonged drought and declining peatland water levels, while media reports also cited El



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Niño and human activities, alongside criticism of coordination in several regions. These patterns suggest that effective fire management depends not only on technical capacity but also on how authority is exercised, information is shared, and decisions are coordinated across actors (ANTARA, 2026; Good News from Indonesia, 2026).

Forest and land fire management depends on more than the ability to detect hotspots, contain fire spread, or provide firefighting equipment. These activities take place within a governance system involving multiple organizations, divided authority, sometimes conflicting interests, changing social-ecological conditions, and communities living in fire-prone landscapes. Under these circumstances, leadership must be understood as a practice connecting decision-making, communication, coordination, and the legitimacy of cross-actor action, rather than merely an individual attribute.

Studies of wildfire management across complex jurisdictions indicate that coordination does not necessarily follow a single, uniform command structure. Joint management may range from cooperative assistance to negotiated coordination and more integrated strategies, depending on perceived interdependence, institutional arrangements, and incident requirements (Nowell et al., 2022). Research on cross-jurisdictional incidents also shows that differences in organizational missions and values do not affect every form of collaboration equally: communication and information management tend to be more resilient to pluralism than episodic cooperation or operational strategies requiring the negotiation of competing interests (Steelman & Nowell, 2025). At the organizational and team levels, scholarship emphasizes decision-making under uncertainty, strategic communication, socio-emotional competencies, and conditions that enable frontline personnel to communicate critical information (Barton et al., 2015; Boyatzis et al., 2017; Johansson & Bäck, 2017; Liu et al., 2020; Jahn & Black, 2017).

Evidence from formal wildfire management systems cannot simply be transferred to forest and land fire management in Indonesia. The Indonesian and wider Southeast Asian contexts involve interconnected issues of peatlands, local livelihoods, land use, community knowledge, policy politics, and the allocation of responsibilities across institutions. Studies of everyday adaptation in eastern coastal Sumatra, collaborative environmental governance in West Kalimantan, fire-policy dynamics in Riau, and bureaucratic inertia in responding to recurring fires show that local governance, power relations, and institutional capacity are integral to the problem (Ramdani & Mustalahti, 2023; Arai et al., 2021; Adni et al., 2025; Purnomo et al., 2021).

This literature draws on diverse analytical traditions. Some studies examine adaptive, transformational, ethical, or destructive leadership; others adopt collaborative governance, co-management, and network governance perspectives. Still others consider team competencies, safety, community resilience, and risk management. Units of analysis range from individual leaders and firefighting crews to organizations, cross-jurisdictional networks, communities, and public policies. Outcomes are reported through qualitative processes, statistical constructs, measured coordination outcomes, and conceptual frameworks. This diversity enriches understanding but complicates synthesis. The gap addressed here is the absence, within the analyzed corpus, of an integrated map distinguishing antecedent conditions, leadership practices, collaborative mechanisms, and outcomes, while separating direct wildfire evidence from comparator evidence. This gap is relative to the reviewed corpus and does not imply that these topics have never been studied.

Accordingly, this article uses two complementary frameworks. TCCM organizes the literature across Theory, Context, Characteristics, and Methods (Paul & Benito, 2018; Paul & Rosado-Serrano,



2019). ADO structures the synthesis around antecedents, decisions/practices, and outcomes (Paul et al., 2024). The ADO sequence is an analytical structure for developing a research agenda, rather than a claim that causal relationships have already been established.

This review addresses four research questions. RQ1 asks how the literature characterizes theoretical or conceptual frameworks, contexts, characteristics, and methods. RQ2 examines how leadership practices appear across prevention and preparedness, emergency response, and recovery and learning. RQ3 identifies factors that facilitate or constrain collaboration in fire management and related crises. RQ4 considers the gaps in linking leadership, collaborative processes, and forest and land fire management outcomes, and identifies priorities for further research.

The review makes three contributions. First, it maps the characteristics of the literature through TCCM without incorrectly treating conceptual terminology as formal theory. Second, it integrates phase-specific leadership practices with facilitators and barriers to collaboration. Third, it proposes an ADO model and nine propositions linking leadership competencies, institutional and relational conditions, collaborative mechanisms, and outcomes. Throughout the article, direct evidence concerning wildfires and forest and land fire governance is distinguished from evidence drawn from comparable contexts.

METHODS

Review Design and Reporting Framework

This study is a systematic literature review (SLR) following evidence-based review principles in management research (Tranfield et al., 2003). The identification and selection process is reported in accordance with PRISMA 2020 (Page et al., 2021). Descriptive and thematic synthesis uses TCCM to map the literature and ADO to integrate the findings. This review is not a meta-analysis: it neither calculates pooled effect sizes nor treats code frequencies as indicators of evidence strength. An individual article may contribute evidence to multiple themes (multilabel coding), so counts for individual themes cannot be summed to obtain a unique article total. Authors' conceptual claims and recommendations are distinguished from empirically observed or measured findings.

Literature Sources and Search Strategy

Searches were conducted in Scopus using title, abstract, and keyword fields (TITLE-ABS-KEY), restricted to English-language journal articles published between 2015 and 2026. Two search strings were employed. String 1 combined leadership terms (leadership, leader*, incident command*) with forest and land fire terms (wildfire*, forest fire*, wildland fire*, peatland fire*, bushfire*, firefighting). Conducted on 17 October 2026, this search yielded 122 records. String 2 combined crisis leadership and collaborative governance concepts (crisis leadership, collaborative leadership, collaborative governance, adaptive leadership, and related terms) with fires, haze, and disaster management; conducted on the same date, it yielded 325 records. In total, 447 records were identified, and seven duplicates were removed, leaving 440 records for screening. The full search strings are provided in Appendix 1. Because 'haze' in String 2 may refer to air pollution unrelated to fires, such studies were excluded during selection using criterion E1.

Eligibility Criteria and Corpus Classification

Articles were included if they explicitly examined leadership or leaders' roles (styles, competencies, practices, command, or collaborative leadership) in the context of fires, emergency management, disasters, or public crises, or if they examined forest and land fire governance and collaboration with clear relevance in the full text. Core articles formed the primary synthesis base.



Comparator articles informed the analysis of collaboration and research gaps, particularly in Indonesia and Southeast Asia, and were reported separately from direct wildfire evidence.

Table 1. Operational Selection Criteria

Category	Rule	Treatment in the Synthesis
Core	Leadership is a primary focus of analysis in the context of fires, emergency management, or public disasters/crises	Main evidence base for synthesis according to context and unit of analysis
Comparator	Forest and land fire governance/collaboration in Indonesia or Southeast Asia relevant to RQ3–RQ4	Reported separately; not equated with direct wildfire evidence
E1	Ineligible context, including haze referring to air pollution	Excluded
E2	Leadership or collaboration in crises is not addressed	Excluded
E3	Leadership/collaboration is not a direct analytical focus in the full text	Excluded following full-text assessment
E4	Full text could not be retrieved	Not used as substantive evidence

Source: Authors’ analysis (2026).

The Core designation does not mean that all articles concern forest and land fires in Indonesia. Some examine international wildfires, firefighting crews, incident command, or non-fire crises relevant to specific mechanisms. A flood risk governance study in Tangerang (Santosa et al., 2025) was retained as a Comparator for RQ3–RQ4 and was not treated as direct evidence on forest and land fires.

Selection Process and Final Corpus

At the identification stage, Scopus yielded 447 records from the principal search (n = 122) and supplementary search (n = 325). After seven duplicate records were removed, 440 remained for title-and-abstract screening. At that stage, 342 records were excluded and 98 were retained. Of these 98 records, 70 reports were prioritized for full-text retrieval. Thirteen full texts could not be obtained (E5), so 57 reports underwent full-text eligibility assessment. Six reports were excluded after examination, leaving a final corpus of 51 articles: 43 Core and eight Comparator articles (Figure 1).



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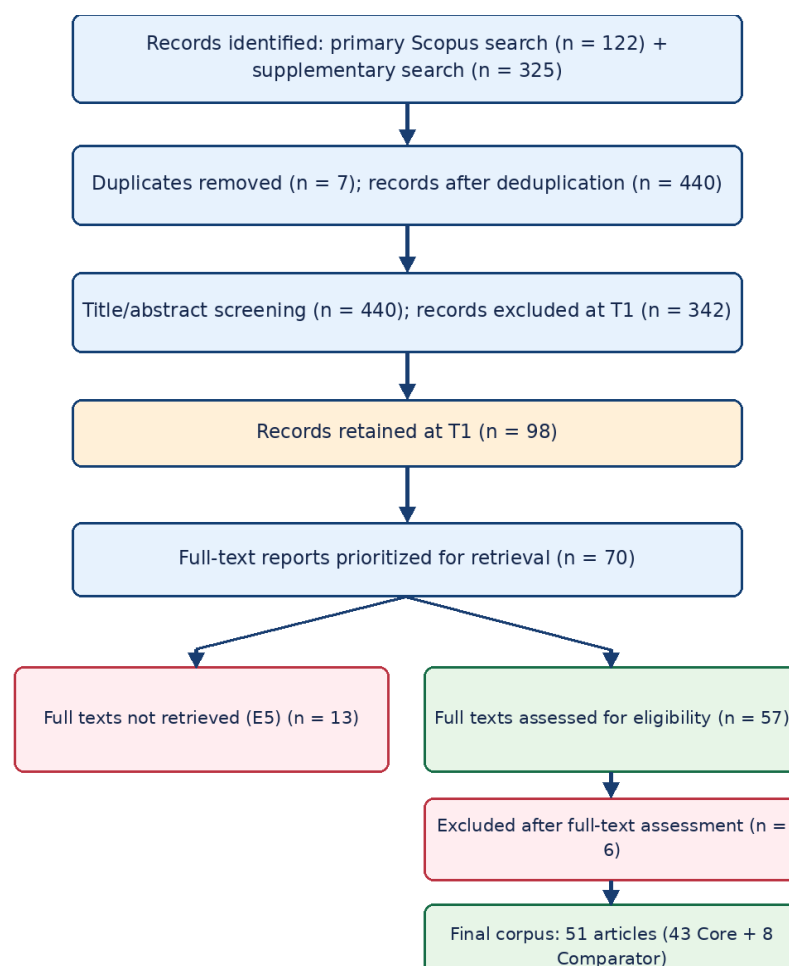


Figure 1. PRISMA Flow Diagram

Data Extraction and Thematic Coding

Data were extracted using bibliographic and substantive variables: year, authors, journal, corpus category, location, fire/crisis type, phase, research design, data/sample, leadership concept, competencies/practices, facilitators and barriers to collaboration, principal findings, limitations, and relevance to RQ1–RQ4. Coding for RQ2 produced 14 themes of leadership practice (five concerning prevention/preparedness, five emergency response, one cross-phase safety, and three recovery/learning). Coding for RQ3 yielded 15 themes (eight facilitators and seven barriers). The thematic categories were designed to answer the research questions and do not necessarily reproduce the original theoretical labels used by the reviewed authors.

TCCM Mapping, ADO Synthesis, and Gap Analysis

Within TCCM, Theory denotes the explanatory frameworks or concepts employed; Context refers to geographic location, fire/crisis type, and contextual boundaries; Characteristics covers leadership and collaboration constructs and practices; and Methods addresses research design, data, and analytical approaches. Not every extracted concept constitutes a formally tested theory. Within ADO, antecedents were grouped into four domains: governance and authority; relationships and information; capacity and resources; and power, participation, and interests. Decisions/practices



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follow the phases examined under RQ2. Outcomes are distinguished as process/governance, operational, safety, recovery/resilience, and socio-ecological outcomes. RQ4 gap analysis compared evidence coverage in the Core and Comparator sets across phases, methods, inclusion, outcomes, pre-disaster relationships, ecological/risk integration, and transferability, yielding nine gaps (G1–G9).

Heterogeneity, Transparency, and Limits of Inference

Findings were grouped by evidence type: narrative accounts of processes/governance, empirically measured constructs or associations, operational/collaboration outcomes, mixed forms, and syntheses or frameworks without outcome testing. Individual or crew-level leadership perceptions and competencies were not treated as direct measures of interorganizational collaboration effectiveness, and normative recommendations were not classified as evaluated outcomes.

Several methodological limitations warrant disclosure. First, searching was limited to Scopus and English-language journal articles, excluding studies indexed elsewhere or published in Indonesian and materials such as proceedings and book chapters. Second, title/abstract screening was assisted by language-model-based recommendations; these recommendations were not regarded as final decisions, and researchers made final judgments at each stage. Third, screening was not performed by two independent reviewers, and intercoder reliability was not calculated. Fourth, no standardized risk-of-bias or methodological-quality appraisal was conducted; methodological classification was intended to map comparability rather than rank quality. Fifth, 13 full texts were unavailable and therefore excluded from the substantive synthesis.

RESULTS AND DISCUSSION

Findings are presented in the following sequence: corpus profile and context (RQ1), theoretical perspectives and methods (TCCM), phase-specific leadership practices (RQ2), facilitators and barriers to collaboration (RQ3), and outcome mapping. Counts for each theme indicate how many articles were coded to that theme, not effect sizes or evidence of causal associations.

Corpus Profile and Contextual Proximity (RQ1)

The final corpus comprises 51 articles published between 2015 and 2026: 43 Core and eight Comparator articles. The Core corpus covers international wildfire and wildland firefighting studies from North America, Europe, and Australia; studies of command and competencies in fire services; and leadership research on other disasters that provides comparable concepts. The Comparator set includes studies more closely related to peatland fires, Indonesian forest and land fire governance, regional haze in Southeast Asia, and one Indonesian flood governance study.

The eight Comparator articles cover a Penta Helix study in Central Kalimantan (Devian et al., 2024), flood risk governance in Tangerang (Santosa et al., 2025), community adaptation to peatland fires in Sumatra (Ramdani & Mustalahti, 2023), facilitation of environmental governance in West Kalimantan (Arai et al., 2021), haze management in northern Thailand (Harnkiattiwong et al., 2026), fire-policy political dynamics in Riau (Adni et al., 2025), bureaucratic inertia in responses to annual fires (Purnomo et al., 2021), and integrated wildfire, smoke, and haze management in Upper Indochina (Wanthongchai et al., 2021).

The researchers' classification of the contexts reported in each article shows that international wildfire studies form the largest group (26 articles), while seven studies examine forest and land fires, peatlands, or haze in Indonesia and Southeast Asia (Table 2). Thus, the strongest knowledge



base concerns international wildfire operations and general crisis leadership, whereas fewer studies directly address forest and land fire governance in Indonesia.

Table 2. Corpus Contexts and Limits of Interpretation

Primary Context	Number	Interpretation for the Synthesis
Wildfire/wildland/bushfire/forest fire	26	Primary evidence for operational leadership, command, communication, and cross-jurisdictional collaboration; transferability to Indonesian forest and land fires requires testing
Forest/peatland fires and haze in Indonesia-Southeast Asia	7	Contextually relevant comparators concerning institutions, policy politics, local knowledge, and socio-ecological conditions
Non-fire disasters/crises or cross-context studies	9	Comparative perspectives on crisis command, adaptation, ethics, and coordination
Firefighting operations, crews, and safety (not specifically wildfires)	5	Internal team mechanisms and firefighter safety; not a direct measure of forest and land fire governance
Fires and other disasters	3	Cross-hazard process comparisons with explicit contextual limitations
Flood risk governance in Indonesia	1	Cross-disaster comparator; not direct evidence on forest and land fires

Source: Authors’ analysis (2026).

By method, 15 articles are qualitative studies, case studies, interviews, or documentary analyses; 12 are quantitative surveys or statistical analyses; eight use mixed or multiple methods; seven are reviews, syntheses, or conceptual studies; six combine qualitative research with document analysis or review; and one each provides limited methods reporting, an experiment/simulation, and a descriptive/applied-practice approach. These categories map the reported designs and do not constitute quality ratings.

TCCM – Theory: Diversity of Explanatory Perspectives

No single theory dominates the corpus. The literature combines several families of concepts that explain different levels and mechanisms; this classification is the authors' analysis and does not mean that every article formally tested a theory.

The first family encompasses collaborative governance, co-management, and network governance, emphasizing interdependence, role allocation, cross-jurisdictional relationships, and strategic negotiation. Research on co-management in complex wildfires indicates that actors may adopt different management orientations while balancing unity with respect for differences (Nowell et al., 2022). Research on organizational pluralism indicates that the type of collaborative outcome determines whether jurisdictional differences become significant obstacles or can be managed (Steelman & Nowell, 2025).

The second family of studies focuses on leadership styles and behaviors, including adaptive, transformational, ethical, facilitative, and destructive leadership. Transformational leadership in extreme contexts addresses performance under pressure (Geier, 2016), while adaptive and ethical approaches emphasize flexibility, fairness, transparency, and trust (Alibašić, 2025). Local adaptive leadership has also been examined in pandemic governance (Garavaglia et al., 2021). Studies of



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destructive leadership warn that formal authority does not guarantee healthy crisis coordination (Fors Brandebo, 2020, 2021). At crew level, wildfire leadership has been measured through members' perceptions and associated with leaders' mindfulness and self-compassion (Waldron et al., 2015; Waldron & Ebbeck, 2015). These findings arise from different settings and should not be treated as direct tests of forest and land fire management in Indonesia.

The third family concerns communication, sensemaking, and decision-making. Research on Naturalistic Decision Making and nontechnical skills identifies pattern recognition, decision-making, communication, and adjustment of actions as key frontline leadership competencies (Groenendaal & Helsloot, 2016; Hayes et al., 2020). In wildfire settings, crisis-network communication and high-reliability organizing demonstrate interactions among information exchange, hierarchy, and team coordination (Johansson & Bäck, 2017; Jahn & Black, 2017). Research on humor in frontline leadership communication adds an interpersonal dimension (Rosing et al., 2021). Communication may refer to public messaging, internal crew communication, or interorganizational information exchange; these differ in actors, purposes, and indicators.

The fourth family emphasizes communities, local knowledge, resilience, and socio-ecological dimensions. Community forests in British Columbia are associated with local governance capacity and proactive management (Dickson-Hoyle et al., 2024), while partnerships involving First Nations highlight Indigenous authority and leadership (Copes-Gerbitz et al., 2024). Community-solidarity disaster leadership provides an ethical lens grounded in local values (Pancasilawan et al., 2026), and research on gender and wildfire workplace culture points to the importance of access, identity, and organizational culture (Reimer & Eriksen, 2018). A study in northern Thailand connects leadership perceptions and participation with surface fuel conditions (Procuna Ramos et al., 2026), illustrating the potential for analyzing social and ecological indicators together. These studies emphasize the contextual nature of leadership mechanisms.

TCCM – Context and Methods: Implications for Comparability

Context determines the meaning of each mechanism. Wildfire studies in formal incident-command systems operate through relatively institutionalized mandates, procedures, and cross-jurisdictional networks. Research on Indonesian forest and peatland fires addresses different conditions involving land tenure, peat ecology, local livelihoods, political dynamics, and uneven institutional capacity. Thus, findings about coordination and leadership cannot be transferred across settings without assessing institutional and socio-ecological differences.

Methodological diversity also requires caution. Qualitative studies can explain how actors negotiate roles or interpret situations, but do not always measure outcomes quantitatively. Surveys and statistical models can examine associations between constructs, although their measurements may capture perceptions rather than actual interorganizational performance. Simulations and conceptual syntheses provide other kinds of evidence, each with distinct inferential limits. Comparisons must therefore account for study design, units of analysis, and outcome definitions.

Studies of individual leadership perceptions, network collaboration quality, the effectiveness of command procedures, and socio-ecological outcomes cannot be combined into a single measure of success. Each comparison needs to identify the analytical level, construct, measurement approach, and evidentiary limits involved.

RQ2 – Leadership Practices by Phase

Coding produced 14 leadership-practice themes across three phases (Table 3). Individual articles could receive more than one code (186 code assignments), so thematic counts overlap. The



distribution indicates coverage within the corpus rather than causal effects or the relative effectiveness of particular practices.

Table 3. Leadership Practice Themes by Fire Management Phase (RQ2)

Phase	Code	Leadership Practice	Articles
Prevention/Preparedness	P1	Risk anticipation and risk-knowledge infrastructure	12
	P2	Community-based prevention, local/Indigenous knowledge, and empowerment	10
	P3	Joint training, competency development, and pre-disaster networks	15
	P4	Governance architecture, mandates, roles, and preparedness plans	15
	P5	Anticipatory leadership and adaptive/consistent policy	13
Emergency Response	R1	Clarity of command, task allocation, and accountability	11
	R2	Sensemaking, adaptive decisions, and action under uncertainty	17
	R3	Strategic communication and shared situational awareness	22
	R4	Cross-actor coordination and negotiation of resources/strategies	20
	R5	Relational competencies, ethics, empathy, and psychosocial safety	14
Across Phases	R6	Safety-oriented leadership and crew protection	2
Recovery/Learning	L1	Post-incident evaluation, collective learning, and practice revision	16
	L2	Recovery governance, accountability, and restoration of trust	7
	L3	Community resilience and institutionalization of long-term capacity	12

Source: Authors’ analysis (2026).

Prevention and Preparedness

Risk anticipation includes risk mapping, warning information, hazard assessment, and integration of technical evidence with local conditions. Research on peatland fires and community wildfire risk shows that technical measures must be interpreted alongside social relationships, land-use practices, and institutional capacity. Leadership in preparedness therefore entails translating risk knowledge into shared plans and practical preventive action.

Community-based prevention moves residents from being recipients of instructions to participants in risk reduction. Research on community forests and First Nations partnerships emphasizes local governance capacity, recognition of Indigenous or local knowledge, and meaningful participation (Dickson-Hoyle et al., 2024; Copes-Gerbitz et al., 2024). In the Indonesian



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context, community adaptation and environmental governance likewise underscore the importance of negotiating responsibilities and addressing power imbalances (Ramdani & Mustalahti, 2023; Arai et al., 2021). Participation should be evaluated through its influence on decisions, rather than attendance alone.

Training, experience, and pre-disaster networks form a foundation for preparedness. Research on incident-management team competencies and the professionalization of emergency leaders highlights standards, training, accumulated experience, and repeated learning (Owen et al., 2018; Dippy, 2020, 2022). However, individual competence cannot automatically be equated with effective collaboration between agencies. The links between training, institutional arrangements, and operational outcomes require explicit examination.

Emergency Response

The most widely coded response themes were strategic communication and shared situational awareness (R3; 22 articles), followed by cross-actor coordination and resource negotiation (R4; 20 articles) and sensemaking and adaptive decisions (R2; 17 articles). These figures represent thematic coverage, not comparative effect sizes.

Communication operates at several levels. Within teams, leaders must allow frontline information to be heard, manage the relationship between communication and hierarchy, and enable corrections as circumstances change (Johansson & Bäck, 2017; Jahn & Black, 2017). Across organizations, strategic communication helps synchronize actions and public messages (Liu et al., 2020). Information exchange is useful when it creates shared situational understanding and supports timely decisions rather than merely increasing message volume.

Cross-actor coordination does not require erasing differences in mandates or centralizing all decisions under one leader. Co-management research identifies different forms of coordination when organizations must retain autonomy while responding to interdependent operational needs (Nowell et al., 2022). Research on organizational pluralism finds that differences in missions and values affect some collaboration outcomes more than others (Steelman & Nowell, 2025). Leadership therefore involves negotiating the type of coordination appropriate to each task and recognizing the limits of formal command.

Sensemaking and adaptive decision-making concern interpreting signals, testing assumptions, and acting under incomplete information (Groenendaal & Helsloot, 2016; Hayes et al., 2020). Crisis studies demonstrate that decisions depend on both available information and the ability to revise interpretations as the situation changes. These capabilities are especially relevant where uncertainty, time pressure, and rapidly changing hazards complicate standard procedures.

Command clarity and concern for personnel are addressed in studies of incident commanders, hospital command-and-control models, fire platoon leadership competencies, and forest-fire command characteristics (Nasiri et al., 2019; Wurmb et al., 2021; Fischer et al., 2025; Eliades et al., 2025). Operational leadership involves allocating roles, supporting personnel, and making decisions under pressure. However, evidence about crew-level safety and command effectiveness should not be treated as a direct measure of wider interorganizational governance.

Overall, communication and coordination receive extensive attention in the response literature, but their benefits depend on antecedent conditions: who holds authority, what resources are available, the quality of relationships, and whether information can be exchanged and acted upon.



Recovery, Learning, and Safety

Post-incident evaluation and collective learning (L1) were coded in 16 articles, community resilience and institutionalized capacity (L3) in 12, and recovery governance and restoration of trust (L2) in seven. These counts indicate the coverage of the reviewed literature and do not establish that one phase or practice is more effective than another.

Post-incident learning contributes to preparedness when recommendations lead to changes in procedures, training, resource allocation, networks, or operational plans. Studies of fire investigations, incident-management capability, and professionalization show that reviews can inform future practice, but their actual implementation must be assessed. Learning becomes an institutional mechanism when lessons persist beyond individual personnel and single incidents.

Recovery governance requires accountability and trust. Comparisons between the Victorian bushfires and the Christchurch earthquake link adaptive and ethical leadership with consultation, transparency, fairness, and the integration of knowledge. Community resilience also depends on local capacity and the continuity of relationships after the immediate response. These findings reinforce the need to evaluate recovery through social and institutional outcomes rather than incident closure alone.

Across phases, relationships and competencies developed before an incident may become relevant during response; response experience may generate learning; and learning may reshape structures and practices in subsequent seasons. These connections form plausible pathways for longitudinal investigation, not causal relationships already demonstrated by this review.

RQ3—Facilitators and Barriers to Collaboration

Facilitating Factors

Eight facilitating factors were identified (Table 4). Open information flow and shared situational understanding, together with common goals and coordination through negotiated interdependence, were the most frequently coded (19 articles each). Counts indicate the number of articles addressing each factor, and individual studies may appear under multiple categories.

Table 4. Facilitators of Collaboration in the Corpus

Facilitating Factor	Articles	Core Synthesis	Example Sources
Open information flow and shared situational understanding	19	Reliable, two-way, correctable information supports alignment of actions	Johansson & Bäck (2017); Liu et al. (2020); Steelman & Nowell (2025)
Shared goals and coordination through negotiated interdependence	19	Actors coordinate contributions without eliminating differences in missions or authority	Nowell et al. (2022); Steelman & Nowell (2025); Purnomo et al. (2021)
Adaptive, ethical, facilitative, and relational leadership	17	Facilitation and adaptation require legitimacy, contextual awareness, and opportunities for participation	Alibašić (2025); Arai et al. (2021); Johansson & Bäck (2017)
Clear mandates and context-appropriate coordination structures	16	Role clarity provides a foundation alongside operational flexibility	Nasiri et al. (2019); Nowell et al. (2022); Purnomo et al. (2021)



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Resources, technology, and authority to act	16	Personnel, equipment, data, funding, and discretion enable decisions to be implemented	Wurmb et al. (2021); Ramdani & Mustalahti (2023); Wanthongchai et al. (2021)
Training, experience, professionalization, and competence	14	Team preparedness requires continuous development; cross-organizational collaboration effects still require testing	Fischer et al. (2025); Dippy (2020, 2022); Owen et al. (2018)
Trust, social capital, and continuity of relationships	14	Relationships facilitate assistance and communication; network benefits are not necessarily linear	Nowell & Steelman (2025); Ramdani & Mustalahti (2023); Alibašić (2025)
Inclusive participation and recognition of local/Indigenous knowledge	12	Participation is meaningful when community voices and knowledge influence decisions	Arai et al. (2021); Copes-Gerbitz et al. (2024); Dickson-Hoyle et al. (2024)

Source: Authors' analysis (2026). Counts are multilabel.

These factors can be interpreted as the infrastructure of collaboration. Mandates and organizational structures clarify responsibility, but co-management and organizational-pluralism studies show that structures must respond to interdependence among actors (Nowell et al., 2022; Steelman & Nowell, 2025). Reliable information, trust, professional competencies, and adequate resources help actors move from nominal cooperation to coordinated action. Local and Indigenous knowledge matters when participation shapes practical decisions. Nevertheless, the presence of these conditions does not by itself prove improved operational outcomes; contextual differences and measurement limitations remain important.

Constraining Factors

Seven categories of constraints were mapped (Table 5). Resource scarcity, time pressure, workload, and fatigue had the widest coverage (23 articles), followed by conflicts over goals, values, and interests (19) and communication failures or fragmented situational awareness (17). These frequencies reflect the coding of the reviewed studies, not the relative severity of each constraint.

Table 5. Barriers to Collaboration in the Corpus

Constraining Factor	Articles	Analytical Implications	Example Sources
Resource scarcity, time pressure, workload, and fatigue	23	Constrain the scope of decision-making and implementation capacity	Wurmb et al. (2021); Hayes et al. (2020); Björctman et al. (2024)
Conflicting goals, values, interests, and policy framing	19	Require negotiation of mandates and goals; differences do not necessarily imply failed collaboration	Nowell et al. (2022); Steelman & Nowell (2025); Adni et al. (2025)
Communication failure, information silos, and weak situational awareness	17	Distinguish channels, message consistency, feedback, and shared situational understanding	Johansson & Bäck (2017); Liu et al. (2020); Jahn & Black (2017)



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Centralization, fragmented mandates, and bureaucratic/jurisdictional rigidity	15	Formal structures may constrain action when poorly matched to field conditions	Purnomo et al. (2021); Nowell et al. (2022); Adni et al. (2025)
Power imbalances, exclusion of voices, and political interests	13	Examine who makes decisions and how public voices influence resource allocation	Arai et al. (2021); Ramdani & Mustalahti (2023); Adni et al. (2025)
Destructive or ambiguous leadership and low accountability	5	Limited thematic coverage; source contexts and construct definitions need scrutiny before generalization	Fors Brandebo (2020, 2021); Nasiri et al. (2019)
Weak or inadequate pre-disaster relationships	1	Emerging theme requiring replication and network data	Nowell & Steelman (2025)

Source: Authors’ analysis (2026). Counts are multilabel.

Capacity constraints reveal limits on leaders' room for action. Even where communication and coordination structures exist, shortages of personnel, equipment, time, and energy restrict feasible decisions. Studies of command and emergency teams emphasize that operational pressure and fatigue influence practice. Leadership cannot compensate for structural shortages without appropriate resources and organizational support.

Communication barriers include unavailable or inconsistent information, fragmented channels, insufficient feedback, and difficulty constructing a shared situational picture. Crisis-communication research emphasizes coordination across organizational boundaries, while high-reliability studies examine how hierarchy affects the circulation of frontline knowledge (Johansson & Bäck, 2017; Liu et al., 2020; Jahn & Black, 2017). Institutional fragmentation, conflicting objectives, and uneven power further complicate information use. Effective collaboration therefore requires more than technological connectivity: it also depends on trust, interpretive alignment, and decision-making authority.

Destructive leadership and weak pre-disaster ties had the narrowest thematic coverage. Crisis research highlights the importance of context and sources of evaluation when assessing destructive leadership (Fors Brandebo, 2020, 2021). Findings on pre-disaster relational investment likewise require replication across settings before broad conclusions can be drawn (Nowell & Steelman, 2025).

Reported Outcomes: Processes, Constructs, and Operational Results

Outcome mapping shows considerable heterogeneity (Table 6): 24 studies report narrative or descriptive findings about processes and governance, 12 measure empirical constructs or relationships, six present syntheses or frameworks without direct outcome testing, five report operational or collaboration outcomes, and four combine narrative processes with some empirical measures. These classifications describe reporting types rather than evidence quality.

Table 6. Types of Outcome Reporting in the Corpus

Outcome Reporting Category	Articles	Limits of Interpretation
Narrative or descriptive process/governance findings	24	Describe how leadership and coordination work; do not automatically measure effects



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Measured relationships/outcomes or empirical constructs	12	May comprise associations, scales, perceptions, or performance; specific definitions must be reviewed for each study
Synthesis/framework/recommendations without direct outcome testing	6	Provide models or research agendas rather than empirical outcome verification
Empirical operational/collaboration outcomes	5	Process or operational outcomes are assessed; inference strength depends on design and indicators
Mixed narrative processes and selected empirical measures	4	Provide triangulation; indicator comparability still needs examination

Source: Authors' analysis (2026).

Narrative outcomes illustrate how coordination develops and how actors negotiate differences. Measured constructs may capture statistical associations, scale validity, leadership perceptions, or individual/team performance. Operational outcomes provide other forms of evidence, but often at different analytical levels. These categories should not be interpreted as interchangeable indicators of successful forest and land fire management.

The main problem is limited comparability of constructs and outcomes across research designs, not simply a shortage of studies. To test whether leadership practices relate to results, studies must specify the unit of analysis, timing, indicators, and plausible mechanisms. Such an approach can connect leadership and collaboration to measurable operational, safety, governance, and socio-ecological outcomes without conflating association with causality.

Research Gaps in the Corpus (RQ4)

The gap analysis identified nine gaps (G1–G9) by comparing the corpus's research foci and methods (Table 7). These gaps are relative to the 51 analyzed articles, not claims that the subjects have never been studied. The proposed agenda prioritizes connections among leader competencies, institutional conditions, collaboration mechanisms, and outcomes; power imbalances; longitudinal designs; methodological compatibility; and contextual transferability to Indonesia.

Table 7. RQ4 Gaps and Proposed Research Agenda

Code	Research Gap (Relative to the Corpus)	Potential Research Design	Priority
G1	Leadership–collaboration–outcome integration: leader competencies, discretion, coordination quality, and outcomes are rarely measured in the same study	Multi-site studies in fire-prone areas of Sumatra and Kalimantan; interviews, operational observations, documents, and outcome data	Very High
G2	Power imbalances and governance politics: insufficient cross-governmental testing of how formal power becomes collaborative authority in fire operations	Process tracing of decisions; interviews with government agencies, villages, firms, academics, volunteers, and affected communities	Very High
G3	Collaborative mechanisms versus measurable outcomes: relationships between processes (trust, communication, allocation of authority) and comparable findings lack standardization	Shared indicators, communication and decision logs, and comparative analyses of similar incidents	High



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G4	Phase imbalance: models following actors and mechanisms from prevention to recovery remain inconsistent	Multi-season longitudinal design with repeated measures of competencies, networks, decisions, learning, and recovery	High
G5	Local knowledge, inclusion, and representation: limited testing of whether participation changes decisions and resource allocation	Participatory research, stratified interviews, and decision-tracing	High
G6	Methodological compatibility and inference strength: constructs and outcome measures remain misaligned across research designs	Mixed methods combining quantitative data, interviews, observations, and document triangulation	High
G7	Pre-disaster relationships and network resilience: the most effective combination of formal and informal ties remains unclear	Longitudinal social-network analysis before, during, and after fire seasons	Medium-High
G8	Ecology-risk-leadership links: landscape indicators are rarely connected to leadership practices	GIS/remote sensing, weather, peatland conditions, water access, cross-actor interviews, and operational data for the same geographic units	Medium-High
G9	Transferability to Indonesian forest and land fires: models from formal firefighting systems lack testing in governance involving government, firms, communities, and cross-jurisdictional actors	Multi-site conceptual replication, construct adaptation, and boundary-condition tests	Very High

Source: Authors' analysis (2026).

Summary of Findings by Research Question

RQ1. The corpus is dominated by international wildfire studies and cross-context crisis leadership, with heterogeneous theories, units of analysis, and methods; consequently, direct comparability is limited. RQ2. Leadership practices vary by phase. In emergency response, strategic communication and shared situational awareness (22 articles) and cross-actor coordination and resource negotiation (20 articles) receive the greatest coverage. RQ3. The most frequently coded constraints involve resource scarcity, time pressure, workload, and fatigue (23 articles); open information flows and negotiated interdependence each appear as facilitating factors in 19 articles. RQ4. Nine gaps highlight the need to link leadership competencies and institutional conditions with collaborative mechanisms and observable operational, safety, and socio-ecological outcomes. Theme frequencies indicate coverage, not effect magnitudes or causal evidence.

DISCUSSION

This discussion interprets the TCCM, RQ2, RQ3, and RQ4 findings on the premise that leadership, collaboration, and outcomes operate at different analytical levels. Individual leadership qualities, interorganizational processes, and operational results should therefore not be conflated. The reviewed evidence is used to develop conceptual relationships and empirically testable propositions, rather than to assert causal pathways that have not been demonstrated.



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Leadership as a Cross-Level Mechanism

Leadership in forest and land fire management cannot be adequately understood solely as an individual's style or personal characteristics. Across the corpus, leader practices interact with command procedures, organizational mandates, relationships among actors, resource support, and socio-ecological contexts. Leadership is therefore treated here as a cross-level mechanism linking decisions and actions within teams, organizations, interorganizational networks, and communities. This interpretation does not imply that all levels were measured jointly in the reviewed studies.

The theoretical implication is a shift from asking which leadership style is effective to asking under which governance conditions, through which mechanisms, particular practices are associated with particular outcomes. A competent leader may still face restrictive mandates, limited resources, and power asymmetries. Conversely, coordination structures may fail without meaningful information exchange and trust. The proposed framework therefore links leadership to institutional and relational antecedents instead of isolating individual behavior.

Communication, Sensemaking, and Negotiation as Proximal Mechanisms

Communication and coordination are related but not identical. Communication involves exchanging, correcting, organizing, and conveying information; coordination requires using that information to align tasks, resources, schedules, and responsibilities. A large volume of messages does not necessarily produce coordinated action. Collaborative governance requires mechanisms for negotiation and adjustment when mandates and organizational priorities differ.

Sensemaking shifts attention from the flow of messages to how actors interpret changing conditions (Barton et al., 2015; Groenendaal & Helsloot, 2016). Frequent communication does not automatically create shared situational awareness if participants interpret the same information differently or cannot correct assumptions. Leaders must support the identification of relevant cues, feedback, and revision of operational judgments. This mechanism connects communication practices with the quality of decisions.

A conceptual pathway warranting empirical testing is: information and mandate conditions → communication and sensemaking practices → coordination clarity and decision quality → operational outcomes. This is a hypothesized mechanism rather than an established causal chain. Comparative studies could examine the pathway using communication records, observations, decision logs, and matched operational indicators.

Trust and Pre-Disaster Networks

Nowell and Steelman (2025) report a nonlinear relationship between pre-disaster relational investment and actual relational outcomes: very infrequent interaction does not differ from no connection for some outcomes, and more ties do not necessarily produce proportional benefits. Thus, network density alone is an insufficient measure of collaboration quality. Research should examine the content, strength, continuity, and operational functions of relationships before, during, and after crises. The findings also caution against assuming that additional coordination meetings necessarily improve response outcomes.

Power, Substantive Inclusion, and the Indonesian Institutional Context

Collaboration quality cannot be judged solely by the number of organizations represented or the existence of a forum. It also depends on who sets agendas, whose knowledge is recognized, how discretion is shared, and whether community input changes decisions. Research on collaborative environmental governance demonstrates that facilitation may mitigate power imbalances but does



not automatically eliminate them (Arai et al., 2021). The distinction between formal attendance and substantive influence is central to evaluating inclusion.

Indonesia's institutional context must also be considered. Purnomo et al. (2021) report that decision-making in Riau's fire management was concentrated at higher levels of government, constraining lower-level actors. Studies of political dynamics and everyday adaptation further demonstrate the role of policy interests, land-use practices, and local community capacities (Adni et al., 2025; Ramdani & Mustalahti, 2023). These circumstances make the direct transfer of formal wildfire-management models to Indonesia problematic. Institutional arrangements and local ecological conditions must be analyzed together.

The important gap is not merely insufficient participation, but limited evidence about when facilitation changes the distribution of power, when local knowledge influences operational decisions, and when collaboration improves outcomes. Future studies should trace decisions, authority, and resource allocation rather than relying only on participants' reported experiences.

Capacity, Operational Pressure, and Destructive Leadership

Resource scarcity, time pressure, workload, and fatigue (B4; 23 articles) were the most widely coded constraints, followed by goal conflicts (19), communication failures (17), and centralization or fragmented mandates (15). These conditions interact: shortages may intensify conflict, while fragmented authority can delay the mobilization of scarce resources. Leadership practices should therefore be evaluated against operational capacity and stress, not in isolation. Counts are thematic frequencies rather than estimates of causal strength.

Research on destructive leadership (Fors Brandebo, 2020, 2021) directs attention to role ambiguity, excessive control, limited empathy, and weak accountability. This evidence must not be merged uncritically with studies directly measuring Indonesian forest and land fire outcomes; different research contexts and constructs require careful distinction.

Uneven Evidence across Phases and the Need for Longitudinal Studies

The corpus concentrates on response-phase themes, while recovery and institutionalized capacity receive less attention. This reflects the composition of the assembled literature, not evidence that recovery practices are less important. Many studies examine a single incident, phase, or level of governance, making it difficult to trace changes in networks, competencies, decisions, and socio-ecological conditions over time. Longitudinal, multi-season studies are needed to connect preparedness, response, recovery, and organizational learning.

Integrative ADO Model

The proposed model (Table 8 and Figure 2) groups antecedents into four domains that enable or constrain leaders' actions: governance and authority; relationships and information; capacity and resources; and power and interests. Decisions and practices are organized by phase, while proximal mechanisms link these practices to various potential outcomes. Boundary conditions include jurisdictional complexity, time pressure, political dynamics, and landscape characteristics. The model is intended to guide future tests, not to assert causal effects established by this review.

Table 8. Components of the Integrative ADO Model

Component	Conceptual Content	Key Empirical Question
A – Antecedents	Mandates and discretion; relationships and trust; information channels; capacity and resources;	Which conditions enable or constrain leaders, and how do



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	power and interests; socio-ecological risks	they vary across territories and government levels?
D – Decisions/Practices	Risk anticipation, community participation, training, planning; command, sensemaking, communication, negotiation, safety; evaluation and learning	Which practices are actually undertaken, by which actors, and during which phases?
Proximal Mechanisms	Task clarity; shared situational awareness; negotiated interdependence; substantive inclusion; resource mobilization; safety culture; learning	Through which processes are antecedents and practices associated with outcomes?
O – Outcomes	Decision and coordination quality; mobilization and response timeliness; safety; prevention and response outcomes; legitimacy and trust; recovery and resilience	Which outcomes are measured, at which analytical units, and over what time horizon?
Boundary Conditions	Jurisdictional complexity; time pressure; budgets and fatigue; community discretion; policy politics; ecological and landscape characteristics	Under what conditions do the proposed relationships change, weaken, or cease to hold?

Source: Authors' analysis (2026).

Boundary conditions: jurisdictions, time pressure, policy politics, landscapes

A – Antecedents



D – Decisions/practices by phase



Proximal mechanisms



Additional mechanisms: resource mobilization, safety culture, learning

O – Outcomes



Figure 2. Integrative ADO Model for Leadership and Collaboration in Forest and Land Fire Management

The model does not assume a universal linear pathway across all incidents. Antecedents shape available leadership and collaboration practices, while outcomes may generate feedback that changes institutional capacities, trust, and future preparedness. Accordingly, the relationships proposed in the ADO framework should be tested in contexts that vary in governance arrangements, ecological risks, and degrees of interorganizational interdependence.

Propositions for Empirical Testing

To translate the identified gaps into a testable research agenda, this article develops nine propositions. Each proposition identifies relationships among antecedent conditions, leadership practices, collaborative mechanisms, and outcomes, together with potential empirical designs. These are research propositions rather than conclusions already established by the reviewed corpus.

Table 9. Working Propositions and Testing Designs

Proposition	Proposition to Be Tested	Suggested Test Design
P1 – Mandates and discretion	Clear mandates and roles are associated with better coordination when operational discretion meets field needs; excessive centralization or overlapping mandates may weaken this relationship	Measure role clarity, scope for discretion, duplicated or delayed decisions, and jurisdictional conditions
P2 – Relationships and information	Trust and two-way communication support shared situational understanding and the mobilization of assistance; network benefits depend on the quality and function of ties, not merely network density	Longitudinal social-network analysis before, during, and after fire seasons
P3 – Substantive inclusion	Community participation and local knowledge are more relevant for prevention when input shapes decisions, priorities, or resource allocation	Compare villages; trace decisions and conduct interviews across stakeholder groups
P4 – Sensemaking and response	Adaptive leadership is associated with response quality through situational interpretation, strategic communication, and information correction	Triangulate meeting observations, communication logs, decision records, interviews, and operational indicators
P5 – Capacity and pressure	Resource shortages, time pressure, and fatigue constrain the relationship between leadership practices and outcomes; resource sharing can reduce, but not always remove, these constraints	Combine personnel, equipment, crew rotation, safety, weather, and landscape data
P6 – Pluralism and negotiation	Recognition of interdependence and negotiated coordination enable joint action without complete consensus; outcomes depend on the type of decision and conflicts of mandate	Compare tasks and incidents; trace assistance patterns, mediators, and decision legitimacy
P7 – Learning	Post-incident learning strengthens subsequent preparedness when recommendations are	Multi-season studies; measure implementation of



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	institutionalized in procedures, training, budgets, and networks	recommendations and changes in practice
P8 – Safety	Leadership practices that protect crew members' voices and foster a safety culture are associated with safety behavior; wildfire- and Indonesian forest-and-land-fire-specific evidence needs to be expanded	Replicate among forest-fire units and field teams; measure safety climate, near misses, compliance, and fatigue
P9 – Transferability	Relationships among leadership practices, collaboration processes, and outcomes depend on institutional and political conditions, community participation, and socio-ecological landscape characteristics	Multi-site conceptual replication with shared measures and documentation of boundary conditions

Source: Authors' analysis (2026).

Evidence on safety remains limited because only two articles link leadership with firefighter safety behavior or attitudes (Mullins-Jaime et al., 2025; Moon & Lim, 2025). Both provide useful conceptual starting points, but replication among forest-fire units such as Manggala Agni and field teams is necessary before drawing conclusions specific to Indonesian forest and land fires.

Theoretical, Methodological, and Practical Implications

Theoretical implications. These findings redirect research from leaders as isolated units toward cross-level relationships involving individuals and crews, organizations, interagency networks, communities, and socio-ecological landscapes. Communication, negotiated interdependence, substantive inclusion, and learning can be specified as mechanisms potentially linking antecedent conditions to outcomes. However, claims about these relationships should be tested with compatible measures across levels and contexts.

Methodological implications. Future research should maintain construct equivalence across studies of individual leadership, firefighting teams, interagency networks, communities, and ecological risk. Comparative mixed-methods designs could combine interviews, observations, network analysis, communication records, institutional documents, operational data, and socio-ecological indicators. Longitudinal and multi-site designs would help clarify transferability and identify the limits of inference.

Practical and policy implications. Leadership development must go beyond soft-skills training. Competencies should be linked to clear mandates, adequate resources, joint interorganizational exercises, open information flows, meaningful community participation, and procedures for translating reviews into institutional learning. For Indonesian forest and land fire governance, policy design should take account of peatland and landscape conditions, uneven institutional capacity, power imbalances, and differences among government, private, and community actors. The proposed priorities constitute an agenda for improvement and evaluation, not evidence that the recommended interventions have already achieved specific outcomes.



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Study Limitations

Several limitations must be considered when interpreting the findings.

Database coverage. The search was restricted to Scopus and English-language journal articles; therefore, studies in other databases, Indonesian-language publications, conference papers, and book chapters were not systematically included.

Selection process. Screening was assisted by language-model recommendations, but was not conducted by two independent reviewers; intercoder reliability was not calculated.

Quality appraisal. No standardized risk-of-bias assessment was undertaken; the categorization of methods was used only to describe research designs.

Heterogeneity. The corpus encompasses diverse contexts, units of analysis, and study designs, limiting direct comparison and causal inference.

Meaning of frequency. The number of articles coded to each theme reflects thematic coverage, not the direction, magnitude, or strength of evidence.

Transferability. Most Core studies concern international wildfires, other crises, or formal firefighting organizations; their applicability to Indonesian forest and land fire governance requires further testing.

Outcome measurement. Some outcomes are reported narratively or conceptually and therefore cannot be treated as directly measured changes in operational effectiveness.

CONCLUSION

This systematic literature review synthesizes 51 articles published between 2015 and 2026 (43 Core and eight Comparator studies) through the complementary TCCM and ADO frameworks. The review maps how leadership practices and collaborative governance are examined in forest and land fire management and comparable crisis contexts, and distinguishes directly observed evidence from conceptual arguments and cross-context comparisons.

For RQ1, the corpus is dominated by international wildfire research and cross-context crisis leadership studies, with diverse theoretical approaches, analytical units, and research designs. For RQ2, communication, shared situational awareness, cross-actor coordination, and resource negotiation are prominent during emergency response, while prevention, recovery, and institutional learning receive comparatively less consistent attention. For RQ3, resource scarcity, time pressure, workload, and fatigue constitute the most frequently identified constraints, whereas open information exchange and the negotiation of interdependence are prominent facilitating conditions. These frequency counts describe coverage of the reviewed literature, not effect sizes or demonstrated causal relationships.

For RQ4, the review identifies nine research gaps. Especially important priorities include linking leadership competencies and governance conditions to measurable operational, safety, and socio-ecological outcomes; addressing institutional power asymmetries and meaningful community participation; and testing whether international wildfire leadership models are transferable to Indonesia's specific social-ecological and



administrative context. Comparative, longitudinal, and mixed-methods designs are proposed to address these gaps.

The principal contribution is a TCCM map that distinguishes research contexts and types of evidence, together with an integrative ADO model and nine propositions for further empirical investigation. The framework offers a way to analyze antecedent conditions, leadership decisions and practices, collaboration mechanisms, and outcomes without prematurely asserting causality. For practice, the review supports attention to cross-agency communication, negotiated coordination, preparedness networks, inclusive participation, and institutional learning. Future studies should test these relationships with comparable indicators, robust designs, and evidence grounded in Indonesian forest and land fire governance.

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