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Article

A Comparative Analysis of Federal Emergency Management Systems: Evidence from the United States, Canada, Japan, Germany, and Australia

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ABSTRACT

This paper examines how federal emergency management systems in the United States, Canada, Japan, Germany, and Australia differ in terms of governance arrangements, coordination mechanisms, and resilience-oriented practices. Using a qualitative, structured comparative case study design, it analyses legal frameworks, institutional architectures, funding mechanisms, and public engagement strategies across the five countries based on documentary analysis of legislation, policy frameworks, and peer-reviewed research. The analysis shows that all systems combine federal steering with subnational implementation. However, they vary significantly along four dimensions—centralization–decentralization, networked coordination, technological integration, and the role of volunteers and civil protection—resulting in distinct strengths and vulnerabilities. The study highlights transferable lessons for strengthening federal emergency management, including investing in multi-level resilience governance, institutionalized intergovernmental coordination, technology-enabled early warning, and sustained support for community-based and volunteer capacities.

KEYWORDS

Emergency management; disaster risk governance; federalism; resilience; intergovernmental coordination; comparative analysis.

1. Introduction

The frequency, intensity, and systemic nature of disasters have increased over the past decades, driven by climate change, urbanization, technological interdependencies, and socio-economic inequalities. In this context, federal emergency management systems operate at the critical interface between national policy and local implementation, coordinating legal mandates, multilevel institutions, technologies, and diverse stakeholders to reduce risk and manage crises. For countries with federal or quasi-federal arrangements, aligning national authority with subnational autonomy presents both opportunities and persistent governance challenges.



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The United States, Canada, Japan, Germany, and Australia are widely cited as relatively advanced cases of institutionalized emergency management, though they differ in hazard exposure, constitutional design, and administrative traditions. The United States relies on a centralized federal agency, the Federal Emergency Management Agency (FEMA), nested within the Department of Homeland Security and supported by ten regional offices and the National Incident Management System (NIMS). Japan's system is anchored in the Basic Act on Disaster Management and is coordinated by the Cabinet Office's Disaster Management Bureau and the Central Disaster Management Council, with extensive use of early warning technologies and public education. Germany's federal architecture divides responsibilities between the Federation and the *Länder*, with support from the Federal Office of Civil Protection and Disaster Assistance and the volunteer-based Federal Agency for Technical Relief (THW). Canada's system is built around Public Safety Canada, the Emergency Management Act, the Federal Emergency Response Plan, and cost-sharing mechanisms such as the Disaster Financial Assistance Arrangements (DFAA). Australia has progressively institutionalized national arrangements through the Australian Government Crisis Management Framework, the Australian Disaster Preparedness Framework, and the Disaster Recovery Funding Arrangements (DRFA), coordinated by the National Emergency Management Agency (NEMA).

Existing studies have examined these systems individually and, to a lesser extent, comparatively. Much of this scholarship focuses on legal evolution, institutional reforms after major disasters, or performance problems exposed during catastrophic events. Classic work on disaster policy and politics highlights how critical events, such as Hurricane Katrina and major earthquakes, drive institutional redesign in the United States and Japan (Sylves, 2008). More recent contributions emphasize disaster risk governance, resilience, and community-level outcomes, including cross-national analyses of disaster risk management in Europe and Asia that foreground the strengths and weaknesses of different governance models (Beli et al., 2025; Goyal, 2019). However, these studies often remain either country-specific or treat federal structures in a relatively descriptive fashion, without systematically comparing governance dimensions across multiple federal contexts.

This paper addresses that gap by conducting a structured, theory-informed comparison of federal emergency management systems in five advanced democracies. It moves beyond narrative description by organizing the analysis around key concepts from multi-level governance, network governance, and resilience governance, and by applying a consistent set of comparative dimensions—legal frameworks, institutional arrangements, coordination mechanisms, operational capacities, and community engagement—to each case.

Drawing on this background, the study is guided by these research questions: (a) How are federal emergency management systems in the United States, Canada, Japan, Germany, and Australia structured in terms of legal frameworks, institutional arrangements, and vertical division of authority? (b) What comparative patterns emerge in coordination mechanisms, technological integration, and the role of volunteers and community-based actors across these systems? (c) Which institutional and operational factors appear to strengthen or weaken the effectiveness and resilience of these federal emergency management systems, and what lessons are transferable across contexts?

The study pursues three objectives: (a) to map and compare the core features of federal emergency management systems in five countries using a structured analytical framework; (b) to interpret similarities and differences through the lenses of multi-level governance, networked coordination, and resilience governance; and (c) to derive evidence-based policy recommendations for strengthening federal emergency management in federal and quasi-federal systems.

The paper's contribution is threefold. First, it synthesizes dispersed literature and official documentation into a coherent, theory-informed framework that explicitly links federal institutional design to disaster risk governance and resilience outcomes. Second, it offers a comparative matrix and structured case analyses that move beyond descriptive country profiles toward analytical cross-case interpretation. Third, it distils concrete, transferable lessons—such as the potential for FEMA to learn from Japan's integrated early warning and education system, or for Australia to adapt Canada's intergovernmental financing mechanisms—that speak directly to both scholars and practitioners.

The remainder of the paper is organized as follows. Section 2 presents a thematic literature review and theoretical framework. Section 3 describes the methodological approach and comparative dimensions. Section 4 presents structured findings from the five country cases, including a summary table. Section 5 offers a cross-case comparative analysis and discussion. Section 6 concludes with policy recommendations, implications, and directions for future research.

2. Literature Review and Theoretical Framework

2.1. Federalism, decentralization, and disaster risk governance

The allocation of powers between central and subnational governments shapes disaster risk governance in federal and quasi-federal systems. Multi-level governance literature emphasizes that federalism can both enable and complicate disaster risk management: constitutional autonomy allows subnational innovation and context-specific solutions, yet overlapping mandates and shared responsibilities can lead to coordination failures, gaps, or redundancies (Boin & Lodge, 2016; Tierney, 2014). In Canada and Germany, for example, disaster risk management is constitutionally anchored at the provincial or *Länder* level, with the federal tier providing policy frameworks, funding, and technical support. This produces a system of “shared but asymmetric responsibilities,” where the quality of governance depends on both vertical coordination and the capacity of subnational institutions. Recent work expands this discussion by focusing on disaster governance and community resilience. Goyal (2019) conceptualizes disaster governance in India as a multi-actor, multi-level arrangement where legal mandates, institutional structures, and social actors jointly shape community resilience, highlighting the role of state disaster management authorities as intermediaries between central policy and local implementation. Beli et al. (2025) analyse strengths and weaknesses of disaster risk management systems in Bulgaria, Romania, and Albania, showing how central ministries, local authorities, and regional collaboration mechanisms interact to produce variable governance performance. These studies demonstrate that the design of intergovernmental relationships is a crucial determinant of the quality of disaster governance.

2.2. Network governance and inter-organizational coordination

Disaster management increasingly relies on networked forms of governance, in which multiple agencies, organizations, and sectors interact in loosely coupled yet coordinated ways. Network governance theory underscores that horizontal relationships—among ministries, emergency services, NGOs, private operators, and community organizations—are as important as vertical hierarchies for effective crisis response (Kapucu, 2006; Provan & Kenis, 2008). Inter-organizational coordination mechanisms such as joint planning committees, emergency operations centres, liaison officers, and shared information platforms are key instruments in this context. Empirical studies show that failures in inter-organizational communication and trust are often at the heart of disaster management breakdowns. At the same time, well-designed networks can enable rapid resource mobilization, situational awareness, and adaptive problem-solving. Recent works highlight how stakeholder participation and collaboration influence risk governance and operational performance. Guo and Kapucu (2019), for example, use network analysis to examine stakeholder participation in social stability risk assessment for mega-projects, demonstrating how network structure affects the quality of risk assessments and the legitimacy of decisions. Cross-national research in similar points to the role of collaboration between governmental agencies, humanitarian organizations, and private actors in strengthening disaster governance (e.g., Jevtić et al., 2025).

2.3. Resilience and resilience governance

Resilience has emerged as a central concept in disaster studies, referring not only to the ability of physical systems to withstand shocks but also to the capacity of communities, institutions, and gov-

ernance arrangements to anticipate, absorb, adapt, and transform in the face of hazards. Resilience governance addresses how institutional arrangements, policy frameworks, and social networks enable—or constrain—these capacities (Cutter, 2016; Tierney, 2014). Several studies have contributed significantly to this literature through conceptual and empirical work on resilience. Milenković (2024) provides a systematic review of community resilience research, identifying key dimensions, including social capital, institutional trust, and adaptive capacity. Vidović et al. (2024) show how advanced risk management and financial analysis of critical infrastructure can enhance organizational and sectoral resilience. Jevtić et al. (2025) analyse factors of vulnerability and resilience of persons with disabilities during disasters, highlighting the importance of inclusive governance and tailored risk reduction measures. Collectively, these studies stress that resilience outcomes are tightly linked to institutional design, participation, and the integration of scientific and local knowledge.

2.4. Comparative studies on national emergency management systems

Comparative research on emergency management systems has typically focused on either a small set of countries or specific institutional features such as incident command systems, crisis communication, or disaster financing. Sylves (2008) provides a foundational overview of U.S. disaster policy and politics, while subsequent work has examined FEMA's evolution, including performance-based assessment tools such as FEMA P-58, which links structural performance to risk-informed decision-making. In Japan, government white papers and analyses by the Cabinet Office detail how the Basic Act on Disaster Management underpins a multi-tiered system integrating national, prefectural, and municipal responsibilities, alongside sophisticated early warning and education programmes.

In federal Europe and Australia, comparative work highlights the interplay between central steering and subnational autonomy, emphasizing the roles of civil protection agencies and volunteer organizations in Germany, and the integration of scientific risk assessment with national frameworks such as the Australian Disaster Preparedness Framework and the DRFA in Australia. More recent contributions, such as cross-national disaster governance studies and resilience measurement models, broaden the empirical base for comparison while underlining persistent gaps in multi-country, theory-informed analyses (Beli et al., 2025; Goyal, 2019; Vidović et al., 2024).

2.5. Knowledge gaps and contribution of this study

Despite a growing body of research on disaster risk governance, resilience, and inter-organizational coordination, three gaps remain salient.

First, systematic comparative analyses of federal emergency management systems across multiple high-income democracies are limited. Existing work tends either to be single-country or to juxtapose cases descriptively without a clearly articulated analytical framework.

Second, federalism and multi-level governance are often treated as background conditions rather than as central variables shaping institutional design, coordination mechanisms, and resilience outcomes. How legal mandates, vertical authority structures, and funding arrangements influence risk governance remain under-specified.

Third, resilience governance is frequently analysed at the community level, but less attention is paid to how national-level institutional architectures and federal–subnational relations enable or constrain resilience capacities, a topic highlighted as important by several scholars.

This study responds to these gaps by (a) adopting a structured-focused comparison across five advanced federal or quasi-federal systems; (b) grounding the analysis in concepts from multi-level governance, network governance, and resilience governance; and (c) organizing the empirical analysis around clearly specified comparative dimensions that link institutional design to coordination mechanisms, operational capacities, and community engagement. In doing so, the paper aims to

enhance understanding of how federal emergency management systems can be designed and reformed to support resilient disaster risk governance.

3. Methodology

3.1. Research design

The study employs a structured comparative case-study design. It follows a “structured-focused comparison” logic in which all cases are examined using the same set of guiding questions and analytical dimensions, derived from the literature on disaster risk governance, multi-level governance, and networked emergency management. This design allows systematic cross-case comparison while accommodating contextual differences.

3.2. Case selection and sampling logic

The five countries—United States, Canada, Japan, Germany, and Australia—were selected using a purposive, most-similar systems logic with targeted variation. They are broadly similar in that they are high-income democracies with institutionalized emergency management frameworks and significant exposure to natural and technological hazards. At the same time, they differ in constitutional design (federal vs. quasi-federal; parliamentary vs. presidential), administrative traditions, and hazard profiles (e.g., earthquakes and tsunamis in Japan, bushfires in Australia, cyclones and floods in North America, and multi-hazard risks in Germany). These similarities and differences make them suitable for examining how variations in federal structures and governance arrangements shape emergency management systems.

3.3. Comparative dimensions and analytical framework

Guided by the literature, the comparison focuses on four primary analytical dimensions:

1. Legal and policy frameworks – core legislation and national policy instruments that define mandates, responsibilities, and the all-hazards approach.
2. Institutional arrangements – lead federal agencies, governance levels, and organizational architectures (centralization/decentralization, use of specialized agencies, role of civil protection).
3. Coordination mechanisms and operational capacities – vertical and horizontal coordination instruments (e.g., emergency operations centres, incident command systems, joint committees), resource and funding mechanisms, and technological systems for early warning and situational awareness.
4. Community and volunteer engagement – the role of volunteers, civil protection organizations, and community-based resilience initiatives in the overall system.

These dimensions are operationalized into a comparative matrix that captures, for each country, its governance level, lead agencies, principal legal foundations, main coordination mechanisms, funding arrangements, and the role of technology and volunteers.

3.4. Data sources and analytical procedures

The analysis is based on documentary research and qualitative content analysis of (a) National legislation and policy documents (e.g., Basic Act on Disaster Management in Japan; Emergency Management Act in Canada; Stafford Act and post-Katrina reforms in the United States; crisis management legislation in Germany; Australian Disaster Preparedness Framework and DRFA

guidelines), (b) Official government reports and white papers on emergency management structures and reforms and (c) Peer-reviewed scholarship on federal emergency management, multi-level governance, and resilience, including contributions on disaster governance, stakeholder participation, and resilience measurement (Beli et al., 2025; Goyal, 2019; Guo & Kapucu, 2019; Milenković, 2024; Vidović et al., 2024).

Documents were coded deductively according to the four analytical dimensions and inductively to capture emergent themes (e.g., politicization of federal agencies, central–local tensions, or specific mechanisms for inclusive resilience). The coded data were then synthesized into a comparative table and structured case narratives. Cross-case patterns were identified through iterative comparison of similarities and differences across the five systems.

3.5. Limitations

The study relies primarily on secondary sources and official documentation; it does not include primary fieldwork or interviews. As a result, informal practices, intra-organizational dynamics, and emergent innovations at local levels may be under-represented. In addition, the fast-evolving nature of disaster governance—particularly in response to recent extreme events and climate-related hazards—means that institutional reforms may have occurred after the most recent documents consulted. Nevertheless, the structured comparative approach provides a robust basis for examining the core institutional and governance features of the five systems.

4. Findings: Federal Emergency Management Systems in Comparative Perspective

4.1. Summary comparison of key features

Table 1 summarizes key features of the five federal emergency management systems along the core comparative dimensions.

Table 1. Summary comparison of federal emergency management systems in five countries

Country	Governance type & hazard context	Lead federal institution(s)	Core legal / policy foundations	Vertical coordination mechanisms	Funding mechanisms	Technology & data systems	Role of volunteers / community
United States	Federal presidential system; multi-hazard (hurricanes, floods, wildfires, earthquakes, technological hazards)	Federal Emergency Management Agency (FEMA) within DHS; supported by other federal departments	Stafford Act; Post-Katrina Emergency Management Reform Act; National Response Framework; NIMS	Federal–state cost-sharing; 10 FEMA regions; joint field offices; incident command system; emergency operations centres	Federal Disaster Relief Fund; cost-sharing with states and localities	Extensive but uneven use of GIS, early warning, and risk modelling (e.g., FEMA P-58)	Volunteer organizations (e.g., American Red Cross, VOADs), community emergency response teams (CERT)

Canada	Federal parliamentary system; provinces lead on most hazards; multi-hazard including floods, wildfires, storms	Public Safety Canada; Government Operations Centre; sectoral departments	Emergency Management Act; Federal Emergency Response Plan; provincial/territorial legislation	Federal–provincial–territorial agreements; multi-lateral forums; joint planning; Government Operations Centre for national co-ordination	Disaster Financial Assistance Arrangements (DFAA) and other cost-sharing programmes	All-hazards risk assessment guidelines, GIS and monitoring systems; growing integration of science into EM	Municipal emergency organizations, volunteer fire services, NGOs, and indigenous governance structures
Japan	Unitary but highly tiered; strong central government with robust local governments; high seismic and meteorological risk	Cabinet Office (Disaster Management Bureau); Central Disaster Management Council; line ministries	Basic Act on Disaster Management; Basic Plan for Disaster Management; sectoral acts	Strong national steering with prefectural and municipal disaster management councils; hierarchical but integrated planning and response	National and prefectural budgets; post-disaster reconstruction funds	Sophisticated early warning (J-Alert, seismological and tsunami systems), nationwide drills, education programmes	Community-based disaster management organizations, neighbourhood associations, and school-based preparedness
Germany	Federal parliamentary system; Länder hold primary responsibility for disasters; multi-hazard including floods and storms	Federal Office of Civil Protection and Disaster Assistance (BBK); Federal Agency for Technical Relief (THW)	Civil protection legislation; Länder disaster laws; national risk analyses	Division of responsibilities between Federation and Länder; joint committees; integrated control centres	Cost-sharing between Federation and Länder; project-based EU and national funding	Modern warning apps, risk analyses, and critical infrastructure protection; integration of EU civil protection tools	Strong volunteer base in THW, fire brigades, and relief organizations; dense local civil protection networks
Australia	Federal parliamentary system; states and territories hold primary response responsibilities; high wildfire, flood, and cyclone risk	National Emergency Management Agency (NEMA); Australian Government Crisis Management Framework	Australian Government Crisis Management Framework; Australian Disaster Preparedness Framework; DRFA; state/territory EM acts	National–state/territory councils; joint operations centres; standing arrangements for liaison	Disaster Recovery Funding Arrangements (DRFA) and state funding; targeted recovery packages	Extensive use of meteorological and bush-fire early warning systems, national resilience data initiatives	Strong culture of volunteerism (e.g., rural fire services, SES), community resilience programmes, NGOs

Table 1 synthesizes key features along the analytical dimensions of governance, institutions, legal bases, coordination, funding, technology, and community engagement.

The sections below elaborate these features for each country, following a consistent structure: (a) context and institutional setup, (b) coordination mechanisms and operational capacities, (c) strengths, (d) challenges, and (e) comparative insight.

4.2. *United States*

4.2.1. Context and institutional setup

The United States faces diverse hazards, including hurricanes, tornadoes, floods, wildfires, earthquakes, and technological and terrorist threats. The federal emergency management system is centred on FEMA, established in 1979 and integrated into the Department of Homeland Security in 2003. FEMA operates under key legal frameworks such as the Robert T. Stafford Disaster Relief and Emergency Assistance Act and the Post-Katrina Emergency Management Reform Act, which together define its authorities, responsibilities, and relationship with states and localities.

FEMA's organizational structure combines headquarters functions (policy, planning, and national coordination) with ten regional offices that liaise with state and territorial emergency management agencies. This regionalization reflects an attempt to align federal support with diverse regional risk profiles while maintaining centralized policy direction.

4.2.2. Coordination mechanisms and operational capacities

Coordination is organized through the National Incident Management System (NIMS) and the Incident Command System (ICS), which provide standardized concepts and structures for on-scene command, multi-agency coordination, and information management. During major disasters, joint field offices and multi-agency coordination centres integrate federal, state, and local actors. FEMA's Disaster Relief Fund finances federal assistance, with cost-sharing arrangements requiring state and local contributions for certain categories of aid.

Technologically, the United States has invested in advanced risk modelling and performance-based tools (e.g., FEMA P-58) and uses geographic information systems (GIS), early warning systems, and national platforms for situational awareness. However, adoption and integration of these tools vary across jurisdictions.

4.2.3. Strengths

Strengths include a robust legal foundation for federal assistance, standardized coordination frameworks (NIMS, ICS), and significant federal resources for disaster relief and mitigation. FEMA's emphasis on continuous learning—through after-action reviews, training, and doctrine updates—supports incremental improvement.

4.2.4. Challenges and comparative insight

Persistent challenges involve politicization of disaster declarations, variation in state and local capacities, coordination difficulties in large, complex events (as seen in Hurricane Katrina), and occasional fragmentation between homeland security priorities and traditional disaster risk reduction. These issues contrast with more tightly integrated legal and planning frameworks in Japan and with Germany's strong volunteer-based civil protection networks, suggesting that the U.S. system combines substantial federal capacity with uneven local resilience and complex intergovernmental politics.

4.3. Canada

4.3.1. Context and institutional setup

Canada's hazard profile includes floods, wildfires, storms, and public health emergencies across a vast and diverse territory. Constitutionally, emergency management is primarily a provincial/territorial responsibility, with the federal government supporting coordination, national-level risk management, and extraordinary assistance. Public Safety Canada serves as the lead federal department, supported by the Government Operations Centre and sectoral departments. The Emergency Management Act articulates federal roles, while the Federal Emergency Response Plan (FERP) establishes an all-hazards framework for coordinating federal support when events exceed provincial or territorial capacities. Provinces and territories have their own emergency management legislation and organizations.

4.3.2. Coordination mechanisms and operational capacities

Vertical coordination is structured through federal-provincial-territorial (FPT) mechanisms, including regular meetings of ministers and officials, joint planning processes, and collaborative frameworks. The Government Operations Centre provides a hub for national situational awareness and coordination during major events. Financially, the Disaster Financial Assistance Arrangements (DFAA) provide cost-sharing for large-scale natural disasters, with the federal contribution increasing as per capita eligible costs rise. Canada has also adopted all-hazards risk assessment methodologies and increasingly integrates scientific expertise into emergency management planning and evaluation.

4.3.3. Strengths

Canada's strengths lie in its formalized intergovernmental arrangements, clear legal basis for shared responsibilities, and well-developed mechanisms for financial burden-sharing. The combination of federal guidance and provincial leadership allows for context-sensitive approaches while retaining national coherence. The emerging emphasis on science-based risk assessment and whole-of-society engagement further strengthens governance.

4.3.4. Challenges and comparative insight

Challenges include fragmentation across jurisdictions, variable capacities among provinces and territories, and calls for a more coherent national framework for complex or cascading events. These concerns echo findings in recent analyses of Canada's "fractured" emergency management arrangements. Compared with the United States, Canada exhibits stronger formalized intergovernmental mechanisms and fewer explicit politicized disputes over authority, but it faces challenges similar to those of Australia in balancing subnational lead roles with national coherence in an era of escalating risk.

4.4. Japan

4.4.1. Context and institutional setup

Japan is one of the most hazard-prone countries in the world, facing frequent earthquakes, tsunamis, typhoons, floods, and volcanic eruptions. Its disaster management system is anchored in the Basic Act on Disaster Management (1961, as amended) and the Basic Plan for Disaster Management, which establish an integrated framework covering prevention, preparedness, response, and recovery.

ery. The Cabinet Office's Disaster Management Bureau and the Central Disaster Management Council provide national-level leadership and coordination. Prefectural and municipal governments are mandated to prepare disaster management plans aligned with national policies and to establish local disaster management councils. This results in a three-tiered structure that integrates national steering with local implementation.

4.4.2. Coordination mechanisms and operational capacities

Japan's coordination mechanisms are tightly institutionalized and supported by advanced technology. The J-Alert system and sophisticated seismological and meteorological networks provide rapid, nationwide warnings via multiple channels, including mobile phones, television, radio, and public loudspeakers. Regular nationwide drills and school-based education embed disaster preparedness into everyday life. During major disasters, the Cabinet Office coordinates inter-ministerial response, while prefectures and municipalities manage local operations through emergency operations centres and mutual aid networks. Legal provisions allow for rapid mobilization of the Self-Defense Forces and other national assets.

4.4.3. Strengths

Key strengths are high levels of preparedness, institutionalized public education, and extensive investment in early warning and resilient infrastructure. The integration of community-based organizations and neighbourhood associations into disaster planning fosters strong social capital and local response capacity.

4.4.4. Challenges and comparative insight

Japan faces challenges related to an aging population, the cost of maintaining and upgrading protective infrastructure, and managing long-duration, multi-hazard crises. The system's high degree of central steering ensures coherence but may reduce flexibility for local experimentation. Compared with Germany's decentralized model and Canada's cooperative federalism, Japan illustrates a more centralized yet participatory approach, demonstrating how strong national leadership combined with intensive public education can produce high levels of societal preparedness—an area where the United States and Australia can draw specific lessons, particularly regarding integrated early warning and education programmes.

4.5. Germany

4.5.1. Context and institutional setup

Germany is a federal parliamentary republic where the Länder hold primary responsibility for disaster management, while the Federation focuses on civil protection and national-level risk management. The system evolved from local fire brigades and municipal relief efforts into a multi-level arrangement strengthened by post-war reforms and European integration. At the federal level, the Federal Office of Civil Protection and Disaster Assistance (BBK) coordinates civil protection policy, risk analyses, and national preparedness programmes. The Federal Agency for Technical Relief (THW), a federal organization with a predominantly volunteer workforce, provides technical assistance domestically and internationally. Länder and municipalities maintain their own emergency management structures and legislation.

4.5.2. Coordination mechanisms and operational capacities

Coordination is organized through joint committees and integrated control centres that bring together police, fire, THW, and medical services. During large-scale events, the Federation and Länder operate through cooperative arrangements, with BBK providing expertise, coordination, and resources, while Länder maintain operational command. Germany has invested in warning apps (e.g., NINA), national risk analyses, and critical infrastructure protection measures. Volunteerism is central: THW and volunteer fire brigades constitute a significant portion of operational capacity.

4.5.3. Strengths

Germany's system benefits from strong local autonomy, a dense network of volunteer organizations, and federal technical support, producing robust capabilities at the municipal level. The combination of professional and volunteer resources enhances surge capacity and local knowledge during crises.

4.5.4. Challenges and comparative insight

Challenges include variation in capacities across Länder, coordination complexities during trans-boundary or concurrent events, and the need to further integrate new technologies and climate-related risk into existing frameworks. Compared with Japan's centralized coordination and the United States' federal reach, Germany exemplifies a decentralized, volunteer-centric model, highlighting the importance—and the vulnerability—of relying on sustained volunteer engagement and strong local institutions for resilience.

4.6. Australia

4.6.1. Context and institutional setup

Australia's hazard landscape is dominated by bushfires, floods, cyclones, and drought, often exacerbated by climate change and extensive settlement in hazard-prone areas. In the Australian federation, states and territories hold primary responsibility for emergency management, while the Commonwealth provides strategic coordination, funding, and support for large-scale or cross-jurisdictional events. The National Emergency Management Agency (NEMA), established in the early 2020s, leads national coordination across the disaster management cycle. The Australian Government Crisis Management Framework and the Australian Disaster Preparedness Framework articulate principles, capabilities, and governance arrangements for severe to catastrophic disasters.

4.6.2. Coordination mechanisms and operational capacities

Vertical coordination operates through ministerial councils, senior officials' committees, and joint operations centres. During crises, national-level coordination is led through the Australian Government Crisis Management Framework structures, integrating federal departments, states and territories, and key non-government stakeholders. Financially, the Disaster Recovery Funding Arrangements (DRFA) provide cost-sharing assistance to states and territories for recovery initiatives, complementing state/territory funding and targeted Commonwealth programmes. Australia also uses sophisticated meteorological and bushfire monitoring systems, national resilience data initiatives, and scenario-based planning tools.

4.6.3. Strengths

Australia's strengths include an all-hazards, capability-based approach to preparedness, significant investment in meteorological and bushfire early warning, and a strong culture of volunteerism, particularly through rural fire services and State Emergency Services. The integration of scientific research into policy and planning is relatively advanced.

4.6.4. Challenges and comparative insight

Key challenges involve managing complex inter-jurisdictional coordination in a geographically vast country, ensuring consistency of capabilities across states, and financing large-scale recovery under conditions of escalating climate risks. Compared with Canada, Australia has developed explicit capability frameworks and sophisticated early warning for fire and weather hazards, yet it faces similar tensions in balancing state leadership with national coherence. The Australian experience suggests that codified capability frameworks, combined with robust funding arrangements and volunteer engagement, can compensate for a relatively lean federal operational footprint.

5. Comparative Analysis and Discussion

5.1. *Centralization, federalism, and multi-level governance*

The comparison reveals distinct configurations along the centralization–decentralization continuum. Japan represents the most centralized steering model, with strong national leadership and tightly integrated local implementation through mandated councils and plans. Germany and Canada emphasize federalism and subnational autonomy, with Länder and provinces/territories holding primary responsibilities and the central government providing frameworks and resources. The United States and Australia occupy intermediate positions, combining substantial federal roles with strong state authority, but with more pronounced political and fiscal bargaining.

From a multi-level governance perspective, these configurations affect the clarity of roles, speed of decision-making, and capacity to manage transboundary or systemic hazards. Highly centralized models can act decisively but must invest heavily in local legitimacy and participation; decentralized systems harness local knowledge but require robust intergovernmental mechanisms to avoid fragmentation. Research on disaster governance and community resilience underscores that the quality of vertical relationships—and not just the formal allocation of powers—is crucial in determining outcomes (Beli et al., 2025; Goyal, 2019).

5.2. *Networked coordination and inter-organizational collaboration*

All five systems have developed networked coordination mechanisms, but they differ in formality, density, and inclusiveness. The United States institutionalizes inter-organizational coordination through NIMS/ICS, multi-agency coordination centres, and voluntary organizations active in disaster (VOAD) networks. Canada and Australia rely heavily on intergovernmental councils and joint working groups, which integrate sectoral agencies and increasingly, scientific advisory bodies. Germany's model is distinguished by its integration of volunteer organizations (THW, fire brigades, relief societies) into formal command structures. Japan combines hierarchical command with community-based organizations and school-centred networks.

Network governance theory suggests that effective disaster management requires both formal coordinating structures and informal relationships that support trust, information sharing, and adaptive problem-solving (Kapucu, 2006). Studies of stakeholder networks and collaborative governance

empirically confirm that network structure and quality strongly influence outcomes in risk assessment and emergency coordination (Guo & Kapucu, 2019; Jevtić et al., 2025). Across the five cases, systems that combine standardized frameworks with institutionalized platforms for stakeholder engagement (e.g., Japan's councils, Canada's FPT structures, Germany's volunteer networks) appear better positioned to manage complex, multi-actor emergencies.

5.3. Technology, data, and early warning

Technology and data systems are central to contemporary emergency management. Japan stands out for its highly integrated early warning infrastructure (J-Alert, seismological and tsunami networks) and pervasive public education. The United States has substantial technical capacity (e.g., FEMA P-58, advanced modelling and GIS) but experiences uneven adoption and integration across states and sectors. Australia's strengths lie in sophisticated meteorological and bushfire early warning systems and the use of scenario-based planning tools. Germany and Canada have modernized warning apps and risk analyses but face challenges in integrating national and local platforms.

Studies that focus on resilience and emerging technologies indicates that technology is most effective when embedded in broader governance arrangements, including clear responsibilities, data-sharing protocols, and inclusive communication strategies (Hanspal & Behera, 2024; Vidović et al., 2024). The comparative analysis suggests that the United States could benefit from emulating Japan's integrated national-local early warning and education system. At the same time, Canada and Germany could further strengthen national platforms for real-time data integration across jurisdictions.

5.4. Volunteers, civil protection, and community resilience

All five systems rely heavily on volunteers and community-based actors, but in different ways. Germany's THW and volunteer fire brigades, Australia's rural fire and State Emergency Services, and Japan's community disaster management organizations illustrate formalized integration of volunteers into statutory arrangements. The United States and Canada also rely on volunteer organizations (e.g., the American Red Cross, NGOs, community emergency response teams), but the degree of formal integration into governance structures varies across jurisdictions.

Research on community resilience, including systematic reviews and empirical studies, emphasizes that volunteerism and community engagement enhance preparedness, response capacity, and social recovery, particularly for vulnerable groups (Jevtić et al., 2025; Milenković, 2024). However, over-reliance on voluntary labour raises concerns about sustainability, equity, and burnout, especially as disasters become more frequent. The comparison suggests that models combining strong volunteer engagement with robust support, training, and recognition frameworks (as in Germany and Australia) offer important lessons for other systems.

5.5. Resilience governance and institutional capacity

The five systems demonstrate varying degrees of resilience governance, understood as the ability of institutions and networks to anticipate, absorb, adapt, and transform in response to hazards. Japan's long experience with catastrophic events has led to deeply institutionalized practices of learning, public education, and infrastructure investment. Germany and Canada illustrate resilience governance grounded in long-standing institutional traditions, volunteerism, and cooperative federalism. The United States shows considerable innovation in standards, risk modelling, and doctrine, but struggles with politicization and uneven implementation. Australia's capability-based frameworks and integration of scientific research position it to adapt to escalating climate risks, although inter-jurisdictional coordination remains a challenge.

Studies on resilience measurement and governance stress that resilience is not merely a technical property but a product of institutional arrangements, finance, and social inclusion (Beli et al., 2025; Vidović et al., 2024). Across the five cases, systems that embed resilience concepts into legal frameworks, funding mechanisms, and multi-actor governance—rather than treating resilience as an add-on—appear better suited to address emerging, systemic risks.

6. Conclusions and Policy Recommendations

6.1. Key comparative lessons

Synthesizing the analysis yields several concrete lessons and recommendations, each grounded in cross-country evidence. First among them is Institutionalize multi-level resilience governance. Across all five countries, clear allocation of responsibilities and robust vertical coordination mechanisms are essential for effective federal emergency management. Canada's Emergency Management Act, FERP, and DFAA, as well as Germany's division of tasks between the Federation and Länder, demonstrate how legal clarity and standardized intergovernmental forums can reduce ambiguity and facilitate joint action. The recommendation is that federal systems should periodically review and update their legal frameworks to ensure that responsibilities, funding rules, and coordination mechanisms align with evolving hazard profiles and societal expectations.

Second is Combine standardized coordination frameworks with flexible network governance. FEMA's NIMS/ICS, Germany's integrated control centres, Canada's FPT councils, and Australia's crisis management committees show that standardized coordination structures provide a necessary backbone for managing complex emergencies. However, effective performance depends on their integration with networked collaboration among agencies, NGOs, private operators, and communities. Building on insights from the studies on stakeholder networks, countries should invest in sustained inter-organizational platforms, joint exercises, and shared information systems that support trust and adaptability, rather than relying solely on formal plans.

Third significant lesson deals with Integration of technology and public education into a coherent early warning and preparedness system. Japan's national early warning infrastructure and pervasive disaster education offer a model for other countries, particularly the United States and Australia, where technological capabilities are strong but public preparedness and message consistency can be uneven. The recommendation is that FEMA and its partners systematically benchmark Japan's integration of J-Alert, seismological monitoring, and school-based education, adapting components to U.S. legal and cultural contexts. Similarly, Canada and Germany can enhance their warning systems by improving interoperability and ensuring accessibility for diverse populations.

Fourth lesson focuses on to Sustain and professionalize volunteer and community-based capacities. Germany's THW and volunteer fire brigades, Australia's rural fire and State Emergency Services, and Japan's community disaster management organizations illustrate the value of institutionalized volunteerism. The United States and Canada also benefit from volunteer and NGO capacities, but could further formalize training, accreditation, and integration into formal command structures. Policy recommendations include establishing national frameworks for volunteer training and recognition, investing in leadership development, and ensuring that funding models explicitly support volunteer organizations as critical components of national resilience.

The fifth lesson identifies a significant area: Alignment of Funding Mechanisms with risk and resilience objectives. Cost-sharing arrangements—such as the U.S. Disaster Relief Fund, Canada's DFAA, and Australia's DRFA—have proven essential for financing response and recovery. However, there is a risk that generous post-disaster funding can overshadow investments in prevention and resilience. The comparative analysis suggests that federal systems should rebalance funding portfolios toward risk reduction and resilience building, for example by linking eligibility for certain recovery funds to pre-event mitigation measures, capacity development, and inclusive resilience planning.

6.2. Implications for policy and practice

For policymakers, the findings underline that institutional design matters: the configuration of legal mandates, federal–subnational relations, networked coordination, and funding mechanisms directly shapes disaster risk governance and resilience. Reforms should therefore be grounded in a holistic understanding of these interdependencies rather than focusing narrowly on a single agency or instrument.

For practitioners, the study emphasizes the importance of inter-organizational relationships and community engagement. Even in systems with advanced technology and formal plans, outcomes depend on trust, communication, and mutual understanding among agencies and communities. Regular joint exercises, inclusive planning processes, and transparent communication are practical levers to strengthen operational performance.

For scholars, the analysis illustrates the value of structured comparative research that integrates concepts from multi-level governance, network governance, and resilience studies. Future work could extend the framework to additional federal and quasi-federal systems, incorporate qualitative fieldwork to capture informal practices, and develop quantitative indicators for comparing resilience governance across countries.

6.3. Directions for future research

Future research could explore three promising directions. First, there is a comparative performance assessment. Developing standardized indicators to evaluate how different federal systems perform across preparedness, response, and recovery, including equity and inclusion dimensions. Second is Climate change and systemic risk. Analysing how federal emergency management systems adapt to compounding and cascading risks associated with climate change, cyber threats, and critical infrastructure interdependencies. Third is Inclusive resilience governance. Building on studies on vulnerable populations and community resilience to examine how federal systems incorporate the needs and capacities of marginalized groups, indigenous communities, and persons with disabilities into national frameworks (Jevtić et al., 2025; Milenković et al., 2024).

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