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Post-Disaster Management of Mount Sinabung: A Systematic Literature Review from a Multi-Level Governance Perspective

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Abstract

This literature review aims to investigate post-disaster management of the Sinabung volcano eruption. The analysis used Vos Viewer. The author limited the publication years of articles to 2014 to 2024. From the bibliometric review, the author used the keyword "Multi-Level Governance" and found 565 documents published in reputable journals (Scopus). However, when the author used the keyword "Multi-Level Governance and Disaster," the author only found 49 documents. The author then continued using the keywords "Multi-Level Governance and Mount/Eruption" and "Multi-Level Governance and Disaster Management," which yielded "0" documents (no documents specifically using these keywords in the article titles). The review revealed the importance of multi-level governance in post-disaster management, such as encouraging refugee involvement in the complex relocation process, meeting social, economic, and cultural needs to support social ties among refugees in their new location, and building relationships and communication with local cultures. The author sees that research using the Multi-Level Governance concept needs to enrich the Multi-Level Governance concept itself and analyze the governance problems that arise in disaster management so that it is necessary to increase the use of the multi-level governance concept in analyzing disaster management, starting from the pre-disaster, emergency response and post-disaster stages.

Keywords: Multi-level Governance, Relocation, Disaster, Eruption, Mount Sinabung, Refugees

1. Introduction

Indonesia is an archipelagic country located in the Pacific Ring of Fire (Firdaus et al., 2023; Widjanarko et al., 2024). This reflects Indonesia's geographical location, with 130 volcanoes (Widjanarko et al., 2024) and the potential for earthquakes. This has implications for the many active volcanoes that have the potential for volcanic eruptions. The Global Volcanism Program records that since 1960, Indonesia has had 55 active volcanic eruptions, making Indonesia the country with the most active volcanoes in the world (Global Volcanism Program & Venzke, 2025). The large number of active volcanoes impacts the potential risk of disasters they pose. According to Simonović (2010), disasters trigger vulnerability and serious disruption to affected communities, impacting human, material, economic, and environmental resources beyond their capacity. The eruptions of Mount Sinabung

in 2010 and 2013, to date, are examples of disaster impacts that significantly impact the lives of surrounding communities.

In disaster management, the government established Law No. 24 of 2007 concerning disaster management (*UU No. 24 Tahun 2007*, 2007). This became the initial capital for the paradigm shift in Indonesia's disaster management, moving from an emergency response paradigm to a disaster risk reduction paradigm. This law became the background for the establishment of a disaster management agency that has the duty and responsibility to coordinate disaster management in Indonesia at a national level (the National Disaster Management Agency/BNPB). Meanwhile, for disaster management at the regional level, BNPB and Law No. 24 of 2007 encouraged regional governments to establish their own special regional disaster management agency, namely the Regional Disaster Management Agency (BPBD), as an institution that coordinates disaster management at the provincial and district/city levels (*UU No. 24 Tahun 2007*, 2007).

However, in practice, local governments face difficulties in implementing disaster management. Putra et al. (2019) identified several challenges faced by local governments, including a lack of funding and capacity to establish local institutions, and a lack of expert participation. This is due to the complexity of disaster management, making it impossible for any single institution to handle it alone (Krogh & Røiseland, 2024). This inability drives local governments to seek assistance or collaborate with other institutions, both horizontally and vertically. Krogh & Røiseland (2024) emphasize that disaster management ideally requires collective capacity to rapidly increase response capacity. Therefore, the problems that emerged in post-disaster management following the eruption of Mount Sinabung are common to those encountered by experts in disaster management.

The relocation obstacle is believed to be due to the release process for production forest areas, which requires coordination between regional and central governments (the Ministry of Environment and Forestry). The release of forest areas must be based on the issuance of a decree from the Ministry of Environment and Forestry regarding the forest area. Decree No. 547/MENLHK/SETJEN/PLA.2/10/2017 October 2017 covering an area of 480.11 hectares to exchange forest areas (TMKH) for refugee housing and agricultural land. Judging by the date and year of the decree, it was issued in 2017, after the first phase of refugee relocation in 2015 was completed. According to information contained in Karo Regent Regulation No. 19 of 2018 (*PERBUP Kab. Karo No. 19 Tahun 2018*, n.d.), between September 2013 and May 2015, the Sinabung eruption caused damage and losses totaling Rp 1.80 trillion. This consisted of Rp 578.99 billion in damages and Rp 1.23 trillion in losses. Institutional issues such as the Karo Regional Disaster Management Agency (BPBD) which was only established in February 2014 (Karo Regional Regulation No. 1 of 2014) following the eruption of Mount Sinabung (2010 and 2013). This certainly has an impact on the limitations of the Karo BPBD in deploying skilled resources for disaster management (Manurung & Trimurni, 2020). The existence of BPBD will undoubtedly increase the effectiveness of disaster management work, this illustrates how local governments must face limitations in mobilizing communities in facing disasters (Prihatin, 2018).

Experts argue that other problems faced by local governments in disaster management are due to limited resources, limited institutional capacity, and coordination capabilities, which result in ineffective government responses in disaster management (Alcántara-Ayala et al., 2025; Cao et al., 2026; Ledoh et al., 2026). This can be seen from the initial structure of the Karo Regional Disaster Management Agency (BPBD), which was filled with human resources/staff from various Karo regional government organizations who did not have a disaster background.

According to Jung (2016), local governments as the main actors in disaster management, ideally local governments are able to build networks that can meet disaster management needs so that they do not have to sacrifice their ability to carry out their organization's core functions. Networks can be built by establishing Collaboration between government institutions at the district/city, provincial, and central levels. Tierney (2012) added that collaboration should not only be limited to intergovernmental levels but should also be expanded to include the private sector and the community. This can encourage community resilience. In this study, local governments need to exert maximum effort in increasing community resilience, especially in disaster management. This is in line with what Cutter et al. (2008) stated in *The Hyogo Framework for Action: "increasing local capacity (institutions and mechanisms) for building hazard resilience"*. Increasing local capacity needs to be done by involving all levels of

government. (*multi-level governance*). Adger et al. (2005) argues that *multi-level governance* able to increase the government's capacity to overcome uncertainty and the potential for unexpected events to occur.

This study aims to analyze the disaster management challenges faced by the Karo Regency government using a multi-level governance approach. The author argues that multi-level governance is suitable for addressing complex issues—such as insufficient organizational capacity (Homsy et al., 2019)—that hinder the ability to engage in joint actions involving coordination, cooperation, or collaboration (Chen et al., 2021; Conteh & Harding, 2023; Homsy et al., 2019). Ultimately, this leads to the relocation of displaced persons in a manner inconsistent with planned strategies (Homsy et al., 2019). Furthermore, multi-level governance was selected because it offers opportunities for local organizations to build capacity while carrying out disaster management activities.

2. Method

The author uses Vos Viewer for Keyword Analysis of Multi-Level Governance and Disaster Management. Here the author limits the year of publication of articles from 2014 to 2024. From the results of the bibliometric review, the author uses the keyword "Multi-Level Governance" and finds 565 documents included in reputable journals (Scopus), whereas when the author uses the keyword "Multi-Level Governance and Disaster", the author only finds 49 documents. Then the author continues using the keywords "Multi-Level Governance and mount/eruption" and "Multi-Level Governance and Disaster Management" which result in "0" documents (no documents specifically use these keywords in the article title). The keyword Multi-Level Governance System tends to be related to collaboration, coordination, provision, transition, innovation, climate change, law, crisis, trend and Multi-Level Governance Perspective (local level, central government, top level).

3. The Concept of Multi-Level Governance

The concept of Multi-Level Governance (MLG) was first introduced by Gary Marks in the early 1990s through an article published in 1993. Since then, the concept has gained significant popularity and has been widely used in academic studies. MLG emerged as a vertical arrangement and a mechanism to represent the tight interdependency between domestic and international authorities (Stephenson, 2013; Tortola, 2017).

According to Haas (1958) and Lindberg (1963), MLG has its intellectual roots in neofunctionalist theory, which was originally developed to analyze the process of European integration (Ansell & Torfing, 2022; Bulkeley & Betsill, 2005). It is typically described as the involvement of multiple levels of government—distinct from cooperative federalism, where states act as agents of federal policy, as seen in the United States (Fischman, 2005). However, within the MLG framework, local and municipal governments do not merely interact with regional and national authorities through hierarchical structures; they also coordinate with one another and with non-state actors to achieve sustainability (Bulkeley & Betsill, 2005). In the case of the disaster management of the Mount Sinabung eruption, these non-state actors include civil society organizations, the private sector, refugees, and local communities. Furthermore, Bache et al. state the national government experiences a loss of control over processes within an increasingly complex network of interdependence, where supranational and non-state actors become increasingly influential (Ansell & Torfing, 2022).

Multi -level governance involves a shift in power relations and authority across three dimensions: (1) the devolution of power from central to local governments; (2) the increasing power-sharing between the state and civil society; and (3) the reduction of state sovereignty through the integration of international coordination mechanisms (Piattoni, 2009). This shift in power is further addressed by Lee & Kim (2024), who note that cross-sector partnerships now deliver several public services. Consequently, "who" provides public services has transformed and become increasingly diverse.

Liesbet & Gary (2003) state that "the main benefit of multi-level governance lies in its scale flexibility." This flexibility in multi-level governance arises from the involvement of numerous stakeholders across various levels of government. The participation of non-governmental civil organizations and the communities who will benefit from proposed policy decisions makes the multi-level governance concept frequently utilized in discussing

environmental issues, as these involve a wide array of parties. Beyond central and local governments, the concept of multi-level governance emphasizes the need to involve local communities. One "level" that has long been overlooked but is becoming increasingly vital is the local community level. This is because these groups are the parties most directly impacted by the policies being developed or are the primary risk-bearers of the problems intended to be resolved.

Paul et al. (2022) found that in Bangladesh, active engagement from both institutions and local communities is essential to enhance planning and policy effectiveness. Research conducted by experts indicates that partnerships involving local governments, the private sector, non-governmental organizations, and community groups can lead to more effective disaster management than efforts undertaken by institutions acting independently. In this regard, Paul et al. (2022) note that local governments need to create space for local organizations to assist during disasters, train them to assume responsibility when disasters strike, and enable them to act as an extension of the government during such events. This approach not only distributes the government's workload but also minimizes disaster casualties.

In a study conducted by Conteh & Harding (2023), they found that the implementation of multi-level governance requires joint action that can be coordinative, cooperative, or collaborative in nature. These collective actions often manifest as both formal and informal relationships, characterized by relatively enduring resource transactions, flows, and inter-organizational linkages aimed at achieving mutually beneficial goals (Mazzei et al., 2020; Oliver, 1990; Singh & Prakash, 2010).

Piattoni (2009) argues that multi-level governance has rapidly become an umbrella term indicating phenomena occurring across three distinct levels of analysis: political mobilization (politics), policy-making arrangements (policy), and state structures (polity). As Political Mobilization, Multi-Level Governance challenges the assumption that non-state groups can only influence policy-making by operating through state representatives—that is, they cannot successfully challenge the "gatekeeping" capacity of the central state.

In this study, multi-level governance is understood as a disaster management framework involving multiple governmental tiers—such as the Karo Regency Government, the North Sumatra Provincial Government, and the Central Government—alongside numerous non-governmental stakeholders, including disaster-focused organizations, civil society, local communities, and refugees. The involvement of these diverse levels and parties aims to produce an effective governance blueprint for disaster management during the post-eruption phases of MSU and other volcanoes in Indonesia.

4. Discussion

In this literature review, the author analyzes 21 reputable journal articles (indexed in Scopus). The author utilizes VOSviewer software, manually searches the Scopus website, and consults the SCImago database to determine the quartiles of the analyzed journals. The author presents the articles in charts illustrating the distribution of research origins, the research methods employed, and the thematic distribution regarding the use of the multi-level governance concept, as follows:

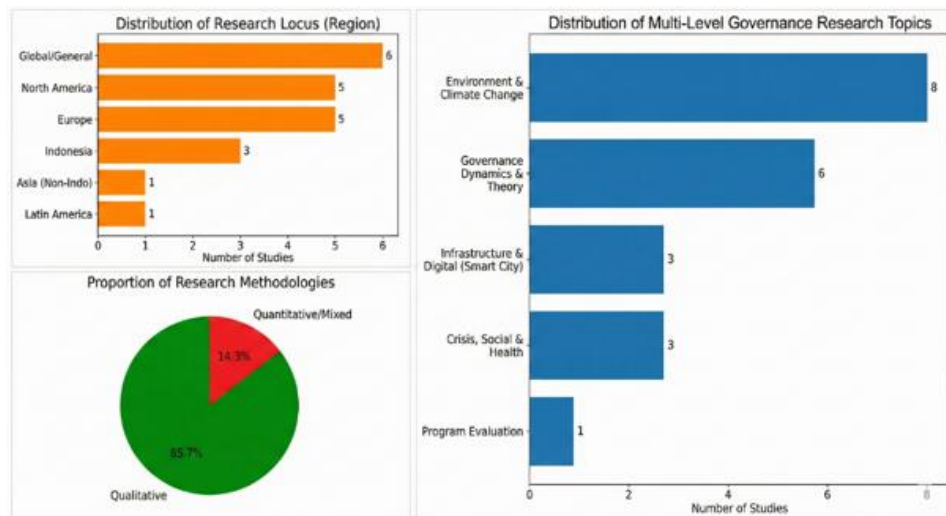


Figure 1: Distribution of research origins, the research methods employed, and the thematic distribution regarding the use of the multi-level governance concept

The studies presented here can be examined through the lens of Multi-level Governance to address issues related to energy and climate change. The author limited the scope to articles published between 2014 and 2024. A bibliometric review using the keyword "Multi-Level Governance" yielded 565 reputable journal documents (indexed in Scopus), whereas combining "Multi-Level Governance" with "Disaster" resulted in only 49 such documents. Subsequent searches using the keywords "Multi-Level Governance and mount/eruption" and "Multi-Level Governance and Disaster Management" returned zero results (i.e., no documents specifically included these keywords in their titles). The concept of a Multi-Level Governance System tends to be associated with terms such as collaboration, coordination, provision, transition, innovation, climate change, law, crisis, and trend, as well as the Multi-Level Governance Perspective (encompassing local, central, and top-level governance).



Figure 2: Analysis of Multi-Level Governance keywords using Vos Viewer (The author's processed results, 2025)

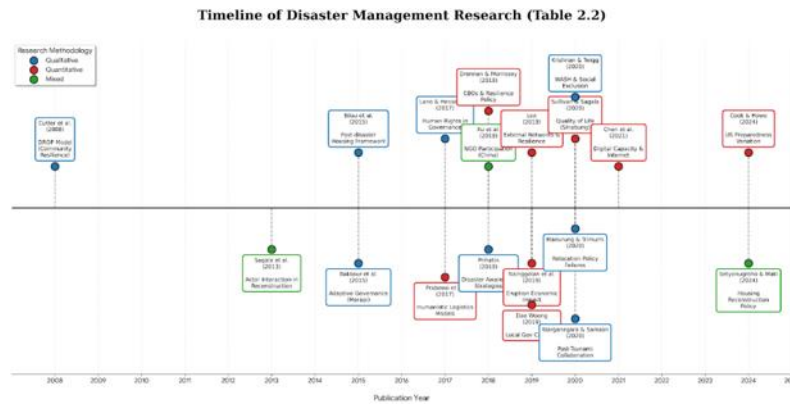


Figure 3: Timeline of Disaster Management Research (The author's processed results, 2025)

Based on the "Disaster Management Research" studies presented, research concerning volcanic eruptions—particularly continuous eruptions like that of Mount Sinabung—is relatively scarce. Furthermore, the concept of multi-level governance is rarely employed in such studies, even though disaster management typically involves multiple levels of government as well as numerous non-state actors. The author also analyzed studies on multi-level governance in the context of disaster management sourced from Scopus-indexed journals, as follows:

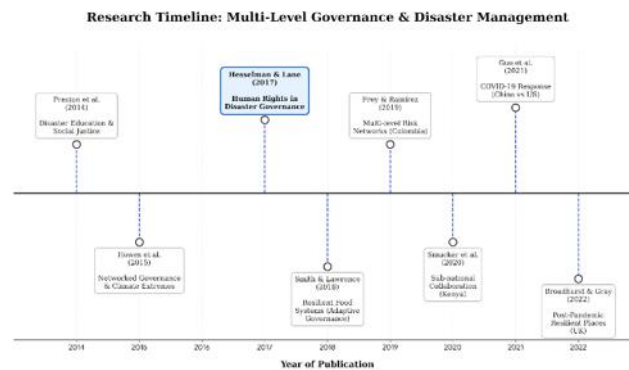


Figure 3: Timeline of Multi-Level Governance and Disaster Management Research (The author's processed results, 2025)

This aligns with the “multi-level governance and disaster management” figure above, which indicates an absence of research specifically employing the multi-level governance concept to unpack governance issues in disaster management—particularly regarding volcanic eruptions. Furthermore, this study examines the factors influencing the implementation of governance for Mount Sinabung eruption disaster management from a multi-level governance perspective.

Recent research findings relevant to this topic suggest that the Multi-Level Governance approach is ideally suited for local disaster management—specifically regarding the Sinabung eruption— as it addresses various challenges frequently faced by local governments. The Multi-Level Governance framework proposed by Homsy et al. (2019) integrates hierarchical and horizontal interactions, linking these components closely to "joint action" elements such as: (1) the coordinating and sanctioning role of a central authority, (2) engagement of civil society, (3) co-production of knowledge, (4) capacity provision, and (5) framing of co-benefits. The authors utilize these five components as a guide to explain and illustrate the governance of volcanic eruption disaster management. This framework was selected because its components align with the fundamental concepts of Multi-Level Governance, which require joint action—whether collaborative, coordinative, or cooperative (Conteh & Harding, 2023; Homsy et al., 2019; Lion et al., 2004)—and civil society engagement (Broadhurst & Gray, 2022; Dale et al., 2018; Do et al., 2024; Klinke, 2017). Furthermore, it reflects a dynamic Multi-Level Governance model that derives its sovereignty and authority from the community (Klinke, 2017) and relies on innovative funding mechanisms—requiring actors to mobilize resources and capacities often beyond the reach of many local governments (Alcántara-Ayala et al., 2025; Cao et al., 2026; Dale et al., 2018; Ledoh et al., 2026; N. N. Liu et al., 2015; Newig

& Koontz, 2014). Finally, leveraging provincial and local leadership to create aligned policies holds significant potential for fostering more inclusive and effective Multi-Level Governance (Dale et al., 2018; Gerli et al., 2023).

The components of the MLG framework employed in this study refer to the analytical framework proposed by Homsy et al. (2019). This specific framework has been previously used and published in several reputable journals, as follows:

Table 1: Research using Multi-Level Governance Framework

Gerli et al. (2023), <i>The Multilevel Governance of State Aid for Broadband Diffusion: Evidence from Three European Countries</i> (Q2)	The analytical results (utilizing the framework of Homsy, Liu, & Warner, 2019) indicate that distributed and shared governance has the potential to benefit the implementation of state aid programs; however, idiosyncrasies within public and private sector structures constrain its application. Centralized coordination can yield cost-savings in the delivery of public interventions and ensure homogenous distribution across Member States, while local stakeholders' involvement remains critical for designing and implementing place-based policies that are more responsive to local communities' needs.
Auslander (2022), <i>Multi-level Governance in Refugee Housing and Integration Policy: A model of Best Practice in Leverkusen</i> (Q2)	By integrating the multilevel governance framework proposed by Homsy (2019) into the Leverkusen model—characterized by collaborative ties government, the NGO Caritas, and the Refugee Council—this study finds that such between the city an arrangement has strengthened volunteer led and local initiatives regarding refugee integration. Furthermore, this approach expands the original scope of the Model by incorporating civil society as a fundamental pillar of its governance structure.

Sources: The author's processed results (2025)

The findings of Gerli et al. (2023) and Auslander (2022) demonstrate that this analytical framework effectively addresses the research questions and objectives proposed by their respective authors. Auslander (2022) found that NGOs, civil society, and volunteers play key roles in the integration of housing and refugee policies. This success was achieved through cooperation and collaboration among city governments, civil society organizations, and volunteers, all of whom facilitated the refugees' adjustment to urban life. Meanwhile, Gerli et al. (2023) discovered that distributed and shared governance potentially benefits program implementation, particularly when accompanied by centralized coordination that generates cost savings in public interventions. Furthermore, they emphasize that local stakeholders' involvement is essential for designing and implementing place-based policies that are more responsive to local community needs. Based on these publications, the author asserts that this analytical framework is both necessary and possesses significant potential for application within disaster management research.

4.1. Component of the Multilevel Governance Framework

In practice, policy coordination often becomes increasingly complex when addressing essential aspects of public life due to uncertainties regarding the scale, scope, and severity of the issues (C. Ansell et al., 2010; Hu et al., 2020; Z. Liu et al., 2021). Consequently, multilevel governance (MLG) has emerged as an approach proposed by numerous scholars. Since this concept facilitates the involvement of policy actors across various levels, regions, and sectors, cross-border coordination is essential for achieving effective policy outcomes (Adam et al., 2019; Bauer & Steurer, 2014; Liesbet & Gary, 2003; Z. Liu et al., 2021).

Conteh & Harding (2023) explain that the multi-level governance framework bridges policy challenges—whether social, economic, or environmental—that possess high levels of complexity. Such complexity tends to diminish any single agency or level of government's financial resources, technical expertise, constitutional standing, and jurisdictional authority. Therefore, these situations can be addressed more effectively through joint action. The joint action approach spans all boundaries in value creation and delivery. Within the context of multilevel governance, joint action may be coordinative, cooperative, or collaborative in nature, as elucidated by Conteh & Harding (2023). However, Chen et al. (2021) further emphasized the necessity of institutional capacity to adapt to dynamic conditions in the context of disaster risk reduction.

In relation to the coordinative, cooperative, or collaborative nature of joint action proposed by Conteh & Harding (2023), (Homsy et al., 2019) offer five components of the MLG framework that integrate both hierarchical and horizontal interactions. These components are closely linked to joint action and include the following: (1) the coordinating and sanctioning role of a central authority, (2) the engagement of civil society, (3) the co-production of knowledge, (4) capacity provision, and (5) the framing of co-benefits (Homsy et al., 2019). Touati et al. (2019) explained that the components of knowledge coproduction and capacity provision emphasize the exchange of information and resources among various levels of government to develop the necessary technical knowledge and managerial expertise (Gerli et al., 2023). The factors of civil society engagement and the framing of co-benefits serve to motivate public interventions and build consensus around them (Homsy et al., 2019). Finally, as noted by (Green & Orton, 2012), sanctioning and coordinating authority is required to establish a shared framework and ensure consistency among local interventions (Gerli et al., 2023). The following is a further explanation of the five components of multi-level governance.

4.1.1 The Coordinating and Sanctioning Role of a Central Authority

Multi-level governance requires an authority responsible for coordination and the imposition of sanctions to help frame issues, determine the distribution of externalities, provide organizational structures, and enforce solutions among decentralized actors (Hawkins et al., 2016; Homsy & Warner, 2013). This authority plays a coordinating role that fosters local innovation and engages multiple actors. This approach stands in clear contrast to top-down systems dominated by a central power that dictates policy goals and the solutions to be adopted at the local level. In a multi-level governance system, however, the reverse occurs: power is shared through networks (Auslender, 2022; Gerli et al., 2023). This power-sharing arrangement must be bounded by legal mandates and a central authority empowered to sanction parties or organizations that fail to fulfill their commitments to the framework's objectives; inaction must entail consequences (Keohane & Victor, 2011). The imposition of sanctions does not happen arbitrarily but results from a fair evaluation process. Conducting such evaluations helps implementers and policymakers remain committed to established plans. Lion et al. (2004) argue that evaluation systems should be grounded in partnership—specifically, the systematic involvement of all stakeholders across various stages of the evaluation process—and based on the integration of dual-level (central and local) evaluations covering diverse policies and sectors (encompassing implementation processes, outputs, outcomes, and achieved impacts).

Milward & Provan (2000) emphasize the importance of a strong central authority in encouraging subordinate parties to coordinate in order to achieve policy objectives. The involvement of all stakeholders necessarily includes the engagement of local stakeholders. Gerli et al. (2023) highlight the importance of local stakeholder engagement, noting that it ensures area-based policies meet the needs of the local community. Meanwhile, centralized coordination is required to achieve cost savings in the implementation of public interventions and to ensure uniform distribution. Coordinating central authorities with local stakeholders—through the active engagement of the latter—can lead to the efficient distribution of public interventions (Gerli et al., 2023).

4.1.2. Engagement of Civil Society & Increased Participation of Nonstate Actors

Ideally, the engagement of the public and non-governmental actors results in government policies that favor the public interest. Resource constraints have prompted the government to engage non-state actors; consequently, the involvement of the public and non-state actors is expected to help overcome these challenges. This aligns with

Alcantara's findings that resource limitations and low public engagement act as barriers to the implementation of disaster risk reduction (Alcántara-Ayala et al., 2025). To address this issue, the government needs to be flexible and adaptive, and to collaborate with non-state actors (Ledoh et al., 2026). A case in point is the United States, where public involvement—specifically through participation in government committees—drives local environmental action. Residents with established educational and economic backgrounds tend to participate actively in interest groups (Ramírez De La Cruz & Smith, 2016). Similarly, local activists in China have achieved notable success in opposing top-down and non-consultative decisions, such as those concerning the construction of dams, waste incinerators, and chemical plants (Johnson, 2013; Mertha, 2008).

The components proposed by Homsy et al. (2019) are consistent with the findings of Dale et al. (2018) in their study, "Multilevel Governance of Sustainability Transitions in Canada: Policy Alignment, Innovation, and Evaluation," which highlights the significance of active civil society engagement in accelerating climate innovation and multilevel governance. Furthermore, Gerli et al. (2023) and Auslender (2022), employing the framework proposed by Homsy et al. (2019), found that civil society involvement—when effectively enforced—enhances the efficiency and effectiveness of state aid programs. According to Dale et al. (2018) this involvement is represented by CSOs and supported by innovative funding mechanisms. They argue that leveraging provincial leadership to create aligned policies has great potential for fostering more inclusive and effective multi-level governance. Lion et al. (2004) asserted that the systematic engagement of all stakeholders throughout various stages of the multilevel governance evaluation process is essential, necessitating an integrated dual-level evaluation at both the central and regional levels.

Klinke (2017) contends that public thought, behavior, and actions are essential in the production of epistemic knowledge and the deduction of collective activities within dynamic multi-level governance configurations. Klinke (2017) further argues that dynamic multilevel governance provides equitable opportunities for cross-border communities to influence the transfiguration of the social and political order when they are affected by transformations and transitions. Public engagement can be facilitated through deliberative processes and procedures. These deliberative mechanisms provide the fundamental means for the democratic aggregation, collection, and channeling of public opinion and will, thereby generating democratic problem-solving capabilities. The fact that affected communities are both the subjects and objects of the vortex of transformation allows dynamic multi-level governance to derive sovereignty and power over these communities. Broadhurst & Gray (2022) found that the combination of voluntary organizations and local communities constitutes a valuable asset in facing crises. Voluntary organizations and communities act as primary drivers, particularly during the post-disaster recovery phase, as they assist in recovering from shocks and rebuilding lives. However, the embedded patterns of trust between society and "place" are frequently overlooked by central governments.

Participation constitutes a key argument for why and how MLG enhances policy delivery (Gollata & Newig, 2017). It improves the quality of (local) decision-making by integrating (local) knowledge and securing participants' acceptance and willingness to actively support and engage with proposed plans or new policies. The increased participation of non-state actors can be achieved by implementing the participatory governance framework proposed by (Newig & Koontz, 2014), which outlines several dimensions of participation.

Newig & Koontz (2014) propose the following dimension of participation: representation. Participatory processes vary depending on the participants involved, ranging from broad public engagement to small groups comprising selected individuals or representatives of interest groups (Cruz & Marques, 2013). Consultation with the general public within the policy's operational area and the active involvement of stakeholders—including private sector actors and civil society groups—should be encouraged, subject to the specific jurisdiction. Information flows can differ substantially across various participatory settings. Information exchange ranges from direct democratic procedures—such as public referendums—to access to information, consultation processes, and intensive face-to-face communication within collaborative management frameworks. Influence refers to the extent to which participants can genuinely shape decisions regarding the issues at stake, ranging from the provision of mere advice to co-determination. Furthermore, deliberation remains a mechanism of participation that is actively employed (Bensus, 2021; Fung & Wright, 2001).

Reflecting on the abovementioned studies, the engagement of civil society, non-governmental actors, and the private sector is a critical action that both central and local governments must undertake. This involvement is ideally accommodated through the participatory dimensions proposed by Newig & Koontz (2014), which include representation, information flows, and influence, as well as through deliberative mechanisms (Bensus, 2021; Fung & Wright, 2001). The active involvement of local governments and non-state actors, such as refugees, disaster victims, non-governmental organizations (NGOs), civil society organizations, religious institutions, and indigenous communities, can foster inclusive disaster management.

This involvement fosters a shared sense of responsibility among all parties participating in the decision-making process, encouraging a collective commitment to achieving shared goals. While such involvement tends to prolong the decision-making process due to the large number of actors involved, it cultivates a sense of shared purpose and solidarity among them, ultimately strengthening the resolve to achieve the objectives.

4.1.3. Co-Production of Knowledge

Ideally, knowledge production proceeds through both vertical and horizontal channels: horizontal collaboration among local groups in generating local knowledge, and the vertical role of the central government. This approach aims to foster a dialogue regarding local knowledge among the community, policymakers, and centralized technical analysts (Funtowicz & Ravetz, 1993; Homsy & Warner, 2013). Over time, as expectations and commitments are met, trust develops among officials—who begin to understand the perspectives and values of other actors—potentially leading to a focus on sustainability priorities and more effective policy implementation (Laurian et al., 2017).

Do et al. (2024) state that, in disaster management policy, the government must move away from colonial logic by incorporating the capacities and knowledge of indigenous governance systems, given that the policies adopted directly affect their lives. This approach aims to mitigate the disparities and ineffective responses often encountered by the government when formulating policies that directly concern indigenous communities. Do et al. (2024) found that the lack of indigenous engagement, including their rights, knowledge, and approaches, in the formulation and implementation of policies, climate change, and disaster plans is a primary cause of ineffective disaster management policies.

According to Klinkle (2017), deliberation is one of the primary characteristics of dynamic multi-level governance, which also includes being inclusive and adaptive. The features of dynamic multilevel governance generate a reflective authority with transformative and structured power to address complex transformation issues. Deliberation with local stakeholders receives specific attention within the institutional framework and active citizenship. This process fosters the effective participation of local stakeholders in the policy-making process (Gerli et al., 2023). Research by Gerli et al. (2023) further explains that centralized coordination can yield cost savings in the delivery of public interventions and ensure a homogenous distribution across the involved provinces. The involvement of local stakeholders is essential for designing and implementing place-based policies that are better equipped to meet local community needs. Gerli et al. (2023) add that central government coordination within the multilevel governance framework requires the participation of local governments and local communities as critical factors in fulfilling their requirements.

The discussion regarding the co-production of knowledge at the local level emerges as part of "managing local connectivity," as proposed by Agranoff (2014). Torenvlied et al. (2013) state that within administrative network activities, at least three dimensions—political support, bureaucratic coping, and coproduction—must be present as essential elements of network contact. Managing such connections is difficult to execute, as it involves a complex balancing act among several forces. Agranoff (2014) identifies six management domains: the development of local systems, engagement in inter jurisdictional politics, development of technical and operational collaborative knowledge, network management, shared governance based on common strategies, and supervision of relatively complex operations that demand interoperability. Agranoff (2014) further notes that local governments are equivalent to the "internal networkers" identified by Senge and Käufer (2000). Acting as focal points of government conductivity, these actors are often overlooked. Internal networkers can move freely within

the informal networks operating across all organizations, helping local leaders address various practical daily issues. However, their interests are frequently ignored, even by those who work closely with them because they typically do not hold significant positions within the managerial hierarchy.

Agranoff (2014) emphasizes that local governments remain local bureaucracies that must be increasingly engaged—in a constructive manner—with the central government and other civil society groups, while also participating in network structures. Local governments are undergoing transformation; the roles of local bureaucrats are evolving through externalization and network engagement as they interact and transact with "higher-level" governments, parallel government bodies, and NGOs.

Intergovernmental relations have evolved beyond their initial political and legalistic foundations to recognize mutual interdependence and incorporate local governments, collaboration, and networks as primary forms of governmental interaction management. Government institutions remain central and authorized partners in network arrangements, guiding interacting partners toward decision-making that respects legal, political, regulatory, and fiscal interests. Furthermore, they foster fair competition among participants (McGuire & Agranoff, 2011; Olsen, 2006). The government continues to serve as the agent that unifies various forces, distributes power and responsibility, and functions as the primary instrument of political legitimacy. Every public agency is a bounded jurisdiction that maintains day-to-day operational control over any potential actions involving its programs (Agranoff, 2007). Contemporary local governments can be understood within this context. Increasingly, local governments serve as essential and primary laboratories for building the core of governance theory.

4.1.4. Capacity Provision

Governments certainly require technical, professional, and financial resources to take action. As problems become increasingly complex, such as sustainability, a greater volume of resources is required (Honadle, 2001). Multilevel governance requires actors to can mobilize resources and capacities that many local governments lack (Liu et al., 2015; Newig & Koontz, 2014). The resources in question refer to innovative funding mechanisms, which are clearly necessary to produce effective and inclusive Multilevel governance (Cao et al., 2026; Dale et al., 2018; Ledoh et al., 2026).

Eaton & Schakel (2022) emphasized three substantive issues that can limit the application and utility of MLG in terms of capacity provision: capacity deficits, institutional instability, and the dominance of disputes over collaboration. This aligns with the perspective of Homsy et al. (2019), who identified capacity provision as a core component of the MLG framework. Multilevel governance is potentially less effective in the presence of capacity deficits and unstable institutions (Eaton & Schakel, 2022). Furthermore, the prevalence of disputes and conflict between government levels, as opposed to cooperation and collaboration, significantly influences the overall success of MLG.

Eaton & Schakel (2022) stated that capacity deficits often appear significant as a result of radical and sometimes abrupt decisions to devolve authority to local governments, which are rarely accompanied by clear capacity-building efforts. According to Oxhorn et al. (Eaton & Schakel, 2022), recipient local governments' capabilities tend to develop slowly, often resulting in responsibilities that exceed their actual capacity. Furthermore, these capacity deficits are likely to undermine regencies' or cities' de facto or de jure authority. In practice, when responsibilities exceed capacity, maintaining prerogatives is difficult, thereby hindering the non-hierarchical dynamics emphasized by the multi-level governance framework. The authority of provincial or local governments must be supported by higher levels of government. Frey & Ramírez (2019) state that the effectiveness of disaster risk governance networks, within a multi-level governance perspective, primarily depends on the core performance of local governments, their ability to engage local communities and citizens, and their capacity for continuous interaction with higher-level intermediaries. Governments at higher levels that possess greater resources must clearly support this capacity.

4.1.5. Framing of Co-Benefits

Local governments are highly expected to undertake environmental actions when co benefits are present, such as energy cost reductions (Homsy et al., 2019), public health improvements (Bloomberg & Aggarwala, 2008), or job creation (Homsy, 2018; Kostka & Mol, 2013). Reframing collective issues can counteract negative political attitudes and build consensus (Hawkins et al., 2016), while also stimulating local action as citizens perceive these concerns as personally significant (Metz & Below, 2009).

Dale et al. (2018) argued that these co-benefits—specifically, social equity, environmental integrity, and community cohesion—can strengthen the resilience of climate change policies. This ensures policy continuity despite the shifting political directions. These co benefits result from innovative funding mechanisms, leveraging provincial leadership to create policy alignment, and fostering deep partnerships with CSOs. Ultimately, embedding and institutionalizing climate change concerns within the daily operations of municipal governments has great potential to trigger and sustain significant reductions in greenhouse gases while promoting more inclusive and effective multi-level governance.

Homsy et al. (2019) proposed multilevel governance framework components that integrate hierarchical and horizontal interactions, where these components are closely linked to joint action. These include the following: (1) the coordinating and sanctioning role of a central authority, (2) the engagement of civil society, (3) the co-production of knowledge, (4) capacity provision, and (5) the framing of co-benefits (Homsy et al., 2019). The author uses these five components as a guideline to explain and illustrate disaster management governance during the Mount Sinabung eruptions. This framework was selected because its components align with the fundamental concepts of multilevel governance, which necessitates collaborative, coordinative, or cooperative joint action (Conteh & Harding, 2023; Homsy et al., 2019; Lion et al., 2004). Furthermore, it emphasizes the engagement of civil society (Broadhurst & Gray, 2022; Dale et al., 2018; Do et al., 2024; Klinke, 2017), as dynamic multi-level governance derives its sovereignty and legitimacy from community groups (Klinke, 2017). This approach also requires support through innovative funding models that encourage actors to mobilize resources and capacities often lacking among local governments (Dale et al., 2018; N. N. Liu et al., 2015; Newig & Koontz, 2014), as well as the leveraging of local leadership to generate aligned policies; this will foster more inclusive and effective multi-level governance (Dale et al., 2018; Gerli et al., 2023).

4.2. Disaster Management

Within the disaster management paradigm centered on disaster risk reduction, the government initiates disaster management measures prior to the occurrence of a disaster by assessing potential hazards. Lee (2019) argues that local governments are the primary actors in disaster management—a view that is undeniable given that disasters occur locally and fall under local government responsibility. However, local governments often lack the capacity to handle disasters independently due to limited resources. Under the disaster risk reduction paradigm, local governments manage disasters across all phases—pre-disaster, during the event, and post-disaster—reflecting a shift in the government's role where the central authority for disaster management moves from the "central" to the "local" level (Lee, 2019). The central government plays a supporting and coordinating role, bridging the gap between the national and local levels.

A paradigm shift in disaster management is prompting local governments to plan disaster management activities tailored to local conditions. It is essential to conduct assessments of local disaster risks and integrate the findings into regional development policies. This role positions local governments as key actors in disaster management—responsible for mobilizing resources, building collaborative networks, and developing other capacities. Jung (2016) and Tierney (2012) note that local governments can leverage their networks to secure resources by fostering collaboration among government agencies and organizations, the private sector, and civil society to achieve community resilience. Such collaboration represents the strategic use of local governments' networks. Furthermore, Do et al. (2024) stated that the involvement of indigenous communities is a critical consideration that can either enhance the effectiveness of disaster management or deepen existing social disparities.

Do et al. (2024) specifically addressed the involvement of "indigenous communities" alongside urban populations. Indigenous communities are the groups that live and grow within these disaster locations. Collaboration with

indigenous people in evacuation procedures can minimize the risk of interventions that exacerbate experiences of marginalization and strengthen indigenous sovereignty. Do et al. (2024) found that the exclusion of indigenous communities—specifically, their rights, knowledge, and approaches—in the formulation and implementation of policies and climate change plans is a primary cause of ineffective disaster management policies. Do et al. (2024) refer to this as a form of colonial logic. For instance, the Canadian federal government has rejected indigenous capacity and knowledge in shaping policy areas that underpin emergency management. This has resulted in persistent disparities and less effective responses.

Sajow et al. (2020) argue that one of the primary recommendations to improve responses to future disasters is to enhance multi-sectoral coordination. This study aims to ensure the adequate provision of maternal and child health services, aligned with DRM policies. This perspective reinforces the findings of Simonović (2010), who stated that local participation and initiatives must be achieved. Several major obstacles in accelerating recovery include the lack of local involvement (Dale et al., 2018; Do et al., 2024; Klinke, 2017); poorly coordinated and conflicting demands from various government assistance programs; staff who are ill-prepared to interact with aid recipients; top-down, inflexible, and standardized approaches; and assistance that fails to meet the actual needs of the affected population.

Furthermore, the permanent relocation of communities from disaster-prone areas to new sites is a significant and energy-consuming challenge. Relocation can help reduce human vulnerability to hazards; however, it cannot resolve the social and economic issues that may arise from or be exacerbated by displacement (Abu et al., 2024). Ideally, population relocation should take into account the social, economic, and cultural factors of the communities being moved. One strategy employed in relocating communities displaced by the Mount Sinabung eruption involved retaining the names of their original villages (Sukameraih, Bekerah, and Simacem) at the relocation site (Siosar Phase 1) and providing agricultural land for their livelihoods. Relocation efforts that fail to consider social, economic, and cultural factors ultimately give rise to new problems; while the relocated communities no longer face flooding issues, a new problem emerges: the loss of their livelihoods (Abu et al., 2024).

Based on the concepts and theories outlined, a disaster is defined as a condition in which the normal functioning of a community is disrupted. Consequently, it is the responsibility of the local government to ensure that these communities continue to function normally. To achieve this objective, the local government must undertake disaster management. Disaster management is an integrated decision-making process encompassing the pre-disaster phase (prevention, disaster risk reduction, and preparedness), the emergency response phase (emergency period), and the post-disaster phase (rehabilitation, reconstruction, and relocation).

5. Conclusion

This paper aims to illustrate how the concept of Multi-Level Governance can serve as an alternative approach to addressing challenges in disaster management. A review of existing research indicates that the Multi-Level Governance concept is frequently employed to analyze issues regarding the roles of various government levels in environmental and climate change matters. This has prompted the author to apply the Multi-Level Governance framework to analyze disaster management issues, specifically regarding the eruption of Mount Sinabung. By utilizing the Multi-Level Governance framework proposed by (Homsy et al., 2019), the author outlines the challenges governments face in post-disaster management. As (Homsy et al., 2019) suggest, to avoid relocation-related problems—such as conflicts between displaced persons and residents of relocation sites or dissatisfaction with relocation housing—governments must actively involve displaced persons, NGOs, civil society, and religious institutions. The author envisions an ideal relocation policy in which displaced persons are involved from the initial stages through to the final determination of relocation sites, as well as in addressing social, economic, and cultural needs to support the maintenance of social ties in the new location. Engaging non-governmental actors offers significant benefits to the government, including minimizing development that fails to meet actual needs, ensuring the efficient use of budgetary resources (avoiding unnecessary spending), boosting public trust in the government, distributing tasks to non-governmental entities, fostering community ownership and respect for jointly agreed-upon developments, and strengthening the relationship between the government and the community.

The analysis results indicate that research discussing the concept of multi-level governance in post-disaster management is a limitation of this paper. It is hoped that more research will utilize the concept of multi-level governance, thereby enriching the literature for future research.

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