International Journal of Environmental Sciences
ISSN: 2229-7359
Vol. 11 No. 6, 2025
https://theaspd.com/index.php

Disaster Logistics Governance for Strengthening Local Resilience: Evidence from Indonesia

Prasinta Dewi[1,2], Bambang Supriyono[2], Endah Setyowati[2], Sujarwoto Sujawoto[2]
[1]National Agency for Disaster Countermeasure, Jakarta, Indonesia
[2]Department of Public Administration, University of Brawijaya, Malang, Indonesia
Corresponding author: Prasinta Dewi (email: prasintadewi426@gmail.com)

Abstract
This research aims to analyse the application of collaborative governance to disaster logistics governance in Lumajang District, Indonesia, using Howden's disaster phase approach as an analytical framework. The main focus is on the extent to which cross-sector actors are involved in planning, implementing, and evaluating disaster logistics management in a deliberative manner to promote sustainable local resilience. This study adopts a mixed approach, combining post-positivist and constructivist paradigms, with data collection techniques including in-depth interviews, participatory observation, and policy document analysis. The theoretical framework is based on Ansell and Gash's collaborative governance model, combined with a thematic analysis of logistics governance practices across each disaster phase preparedness, response, transition, recovery, and mitigation. The findings show that collaboration among actors in disaster logistics governance in Lumajang District remains sectoral, fragmented, and predominantly controlled by state actors. Most disaster logistics tend to be managed only during the response phase; they are reactive and not institutionalised across other phases. This research makes a conceptual contribution by proposing the integration of a collaborative governance framework into disaster logistics governance across all phases. The findings allow for a more in-depth evaluation of power relations, collaborative capacities, and forms of participatory exclusion that are often hidden within local disaster management practices. The implication is to promote the reform of disaster logistics governance through collaboration, with an emphasis on community-based logistics systems and a regulatory framework that affirms the role of the community as the primary actor in all phases of disaster management.
Keywords: *Logistics Governance, Local Resilience, Disasters.*

1. INTRODUCTION

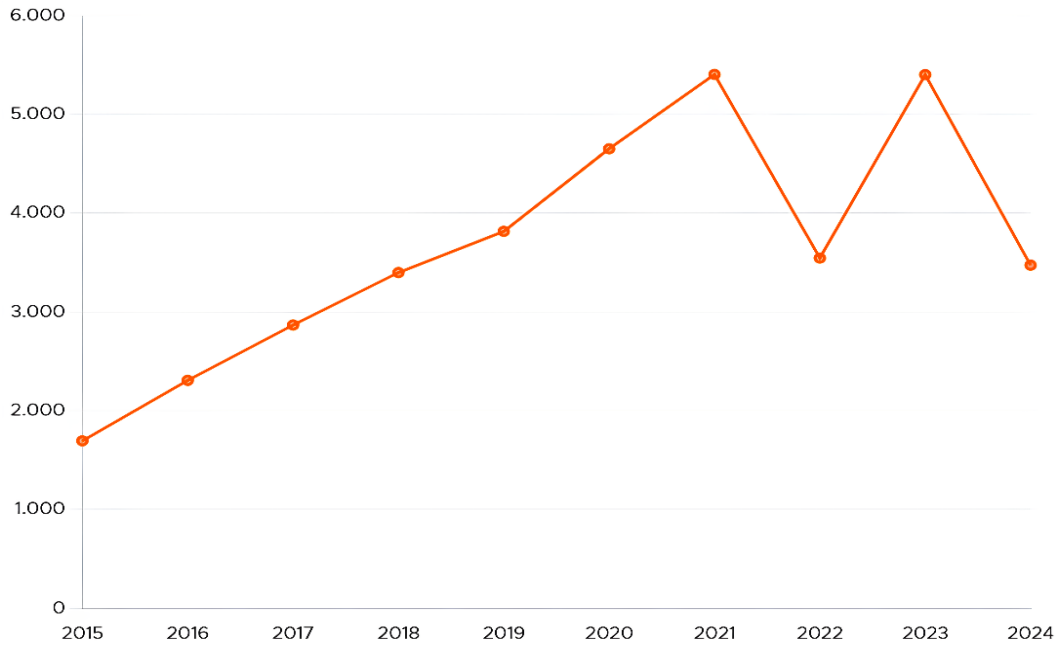
As a country located in the Pacific Ring of Fire, which contains 452 active volcanoes and accounts for 75% of all global volcanic activity, Indonesia is ranked as the second highest natural disaster risk country in the world after the Philippines, with a disaster risk index of 43.5 [1], [2]. This is evident from the increasing number of natural disasters recorded in the country from year to year. In 2023, there were 31 earthquakes and 4 volcanic eruptions out of a total of 4,940 disaster events [3]. However, from 2015 until now, the highest number of disaster events occurred in 2021, reaching 5,402 events, dominated by hydrometeorological disasters such as floods and landslides, in addition to earthquakes and volcanic eruptions [4]. As of 2025, Indonesia's geographical and geological vulnerability to disasters has resulted in well over 800,000 deaths and more than three million injuries since 1900 [5]. This situation highlights the urgent need to develop a disaster management system that is not only responsive, but also supported by strong, integrated, and adaptive logistics governance in response to the increasing frequency of disaster events.

The high frequency of disasters and their significant impact on the sustainability of various sectors make disaster management and mitigation strategies in Indonesia an increasingly urgent priority [6]. In several cases, disaster risk reduction policies in Indonesia face persistent challenges. One such challenge is the presence of disaster capitalism in central government interventions, which tend to prioritise post-disaster recovery through economic extraction rather than genuine risk reduction, such as the issuance of sand mining permits following the 2010 eruption of Mount Merapi [7]. Therefore, the government must be prepared for all possible scenarios to effectively minimise the impact of disasters. Given Indonesia's location at the intersection of the Indo-Australian, Eurasian, and Pacific tectonic plates, which are three of the world's major tectonic plates [8], disasters appear to have become an annual routine. This situation suggests that disaster threats in Indonesia are not merely sporadic incidents but rather stem from complex structural and ecological vulnerabilities that recur consistently. Therefore, a deeper understanding of annual disaster trends and a comprehensive analysis of their causal factors are necessary, as illustrated in the trend shown in Figure 1 below.

Source: Indonesia's National Disaster Management Agency

Based on Figure 1, it can be seen that the number of disasters has increased sharply since 2015, reaching its peak in 2021, which recorded the highest number of disasters in nearly a decade. The intensity of earthquakes that year was driven by the activation of the previously unmapped Central and West Balantak Faults, identified through seismic analysis following a series of major earthquakes in Sulawesi [9]. Furthermore, global warming and climate change, as illustrated by Tropical Cyclone Seroja, have shifted the geographical boundaries of extreme weather events, resulting in irregular weather patterns that have become a dominant factor in hydrometeorological disasters [10]. Although there was a decline in the following year, disaster events rose again significantly in 2023, almost reaching the previous peak, before declining again in 2024. Given this trend, experts emphasise that Indonesia requires a more integrated and adaptive approach to disaster risk management, including disaster logistics management [11], [12], [13]. Most disaster risk management frameworks in Indonesia often overlook the importance of community involvement and the availability of adequate resources for implementation. This represents a social dimension challenge that is rarely acknowledged by decision-makers [14].

One element that cannot be separated from risk management and disaster response efforts is logistics management. Khalili [15] emphasises the importance of disaster logistics management as a systematic effort to ensure that the movement of human resources or the distribution of equipment, transportation, medicines, and other relief supplies can reach disaster-affected locations quickly and accurately, and provide quality assistance to victims. In this context, Aretoulaki [16] highlights the importance of integrating the four phases of a disaster into disaster logistics management: mitigation, preparedness, response, and recovery. This integration aims to maximise the achievement of the primary objectives of saving lives, alleviating suffering, and restoring the conditions of communities affected by disasters. This also implies that in striving to achieve these objectives, disaster logistics management is not merely about delivering goods to disaster sites. It also includes data collection, evidence-based decision-making, condition monitoring, and coordination among multiple stakeholders [16]. Therefore, research on disaster logistics management is a scientific and systematic effort to design and evaluate disaster



management systems that support all stages of disaster response effectively.

The development of insights into disaster logistics management can be observed through research conducted in countries that frequently experience disasters. In the Netherlands, Wieke Pot [17] explored how the experience of severe flooding in the summer of 2021 served as an important lesson for strengthening multilayer resilience-based water management and improving inter-agency coordination in aid distribution. In Asia, Jonas Schwarz [18] stated in his research that Japan remains the most prepared country for earthquakes and tsunamis, particularly through the provision of satellite communication facilities and high-tech monitoring stations, which were enhanced following the 2011 Tohoku earthquake. Immediately after the disaster, relief efforts were carried out swiftly, including the

establishment of approximately 2,500 evacuation centres, the deployment of thousands of personnel from the Japanese Self-Defence Forces, police, firefighters, and medical staff, and the allocation of $250 billion for cleanup and long-term reconstruction over the first five years. These efforts were coordinated under the authority of the Ministry of Land, Infrastructure, Transport and Tourism (MLIT) [18]. In contrast to India, where Nakum and Divi [19] found that the dominant top-down approach resulted in total dependence and weak coordination between government agencies, the military, and non-governmental organisations, which led to uneven distribution of aid, logistical delays, and overlapping aid deliveries after the Gujarat earthquake, a similar situation is observed in the Philippines. The institutional framework in the Philippines is prone to fragmentation, and the limitations of its information and communication systems hinder effective disaster logistics response [20].

Indonesia, as a country that also faces a high disaster risk, has not escaped the attention of researchers in the field of disaster logistics management. To date, several studies on disaster logistics management in Indonesia have been conducted. Syukri [6] conducted research comparing disaster management practices in Garut and Majene, finding that both regions share similarities in their top-down distribution of aid and in the lack of consideration for local context adaptation, which results in suboptimal local development. A similar point was made by Triyanti [21], who noted that the mismatch between national policies and local realities in various disaster events affects the accuracy of post-disaster aid. In Frennesson's [22] research, it is explained that this problem occurs because the dominant operational model is adopted and controlled by large institutions or the central government. Pontoh [23] explains in his research that local power and community well-being have a significant impact on the number of extreme casualties, meaning that disaster logistics management must be designed based on local capacity profiles. Slightly differently, Sentia [24] found that, in addition to failing to reach local communities, logistics management has also not integrated technology and information systems, either for determining the location of facilities and warehouses or for resolving delivery and routing issues.

Several studies on disaster logistics management in Indonesia have described a tendency toward a top-down approach and a lack of utilisation of community capacity in logistics design. However, there have been few studies that discuss models for managing disaster logistics based on local resilience through collaborative governance practices. This study aims to analyse disaster logistics management by focusing on how collaborative governance approaches in logistics management in Indonesia can be effectively developed to enhance local community resilience. Focusing on resilience involves placing greater emphasis on what communities can do for themselves and how to strengthen their capacities, rather than concentrating on their vulnerabilities to disasters, environmental shocks, and pressures, or their needs during emergencies. Therefore, this study not only discusses disaster logistics management but also examines how collaboration in effective logistics management can strengthen local resilience in Indonesia.

2. MATERIALS & METHODS

2.1. Research Design

This study uses a mixed method [25] to discover, understand, explain, analyse, and obtain an overview of the phenomena studied in depth related to disaster logistics management based on local resilience in Indonesia, particularly in Lumajang Regency, East Java. First, a post positivist approach was adopted to enable researchers to examine the objective reality of the logistics system while considering the social context, local values, and perceptual limitations in understanding its effectiveness holistically. Second, a constructivist approach was adopted to emphasise understanding the meaning constructed by local actors through experience, social interaction, and cultural context in facing or responding to disasters. Data collection was conducted using a naturalistic approach through observation, in depth interviews, and document analysis to capture the meanings formed by participants. This process was flexible, reflective, and inductive, with validation through triangulation and confirmation from informants.

2.2. Types and sources of data

The data used in the analysis consists of primary and secondary data. Primary data consists of information from key actors from both government and non-government institutions [26], [27]. Government actors include the National Disaster Management Agency, the East Java Provincial Disaster Management Agency, the Lumajang Regency Disaster Management Agency, the Regent, and the Regional Work Unit. Non-government actors or informants include the Disaster Risk Reduction Forum, the Disaster Management Operations Control Centre, non-governmental organisations, philanthropic institutions,

the private sector, universities, and the media. In addition, primary data also consists of recordings of strategic events that reflect the dynamics of institutional interactions and local community participation in disaster logistics management in Lumajang Regency through disaster risk reduction programmes, disaster management logistics systems and equipment, and the formation of provincial clusters. Secondary data consists of documents obtained from intermediary media [28]. These documents include mapping of disaster prone areas at both the national and regional levels, strategic documents on disaster response logistics owned by the central government, provinces, and districts, documents from the Disaster Risk Reduction Forum, as well as distribution and logistics mapping data from various parties involved in collaborative activities.

2.3. Data Analysis

Data analysis techniques were performed inductively using phenomenological procedures [29]. First, the data were prepared for analysis. After analysis, coding and data adjustment were performed. The coding process was carried out to produce descriptions and categories or themes. Next, a descriptive narrative was compiled. Finally, the research findings were interpreted.

3. RESULTS & DISCUSSION

Disaster logistics management in Indonesia is carried out based on National Disaster Management Agency Regulation No. 4 of 2018 concerning logistics management systems and equipment. The regulation stipulates that disaster logistics management does not follow the cycle or phases of a disaster but rather follows a series of disaster logistics management processes in accordance with existing policy directions. Ensuring such a supply chain is similar to the approach described in the research findings of Syukri [6], Triyanti [21], and Frennesson [22], which tend to depend on decisions made by the central government in a hierarchical manner. Especially when a disaster is about to occur, local governments only have the authority to carry out the steps outlined in this policy framework. The following explanation clarifies the disaster logistics management process as outlined in the regulation:

3.1. Disaster logistics planning

In the planning process, the Lumajang Regency Disaster Management Agency identifies needs, inventories availability, collects data, and conducts analysis to produce minimum standards for disaster management. This process aims to enable the government to predict and calculate the quantity and type of disaster logistics needs, estimate the number of disaster victims, and determine the distribution methods to be implemented. The agency also formulates disaster logistics needs, whether they are short term, medium term, or long term. Although the entire planning process is conducted before a disaster occurs, data updates on needs are also conducted by the rapid response team during the disaster. However, most of the identified needs are often still categorised as short term or reactive. This is because planning only focuses on ensuring that the process does not deviate from the provisions of National Disaster Management Agency Regulation No. 4 of 2018, which serves as a reference, without fully separating each phase of the disaster cycle. Thus, it can be understood that in planning, the government only ensures disaster logistics up to the pre disaster or preparedness stage and has not yet reached the mitigation and post disaster stages, such as the planning of the public kitchen sector as outlined in Table 1 below.

Table 1. Planning for the Public Kitchen Sector

Description	**Standard**	**Unit**	**Kebutuhan**		
A. Personnel			Malang	Lumajang	Total Kebutuhan
1. Public Kitchen Cooking Staff	10 people per unit in 3 shifts	People	120	810	930
2. Distribution Personnel	6 people at each evacuation site in 3 shifts	People	360	3.060	3.420
Total			480	3.870	4.350

B. Equipment and Supplies					
1. Squad Tent	1 tent per public kitchen unit	Unit	4	27	31
2. Mattress	40 pcs for one tent	Pcs	160	1.080	1.240
3. Tarpaulin	2 pcs per public kitchen unit	Pcs	8	54	62
4. Generator Set	1 unit per public kitchen unit	Unit	4	27	31
5. Lighting Lamp	7 units per public kitchen unit	Unit	28	189	217
6. Data Board (Whiteboard)	4 units per public kitchen unit	Unit	16	108	124
7. Public Kitchen Vehicle	1 unit for 1,000 people	Unit	1	7	8
8. Wrapping Paper	3 sheets per person per day	Sheets	552.531	4.693.245	5.245.776
9. Plastic Spoon	3 pcs per person per day	Pcs	552.531	4.693.245	5.245.776
10.Rubber Band	1 kg for one public kitchen unit every 2 days	Kg	60	390	450
11.Large Plastic Bag	1 pc for 25 rice packages	Pcs	22.101	187.730	209.831
12.LPG 12 Kg (1 unit/240 hours of use)	4 units per public kitchen unit	Unit	480	3.240	3.720
13.Dishwashing Soap	2 litres for one public kitchen unit per day	Litres	240	1.620	1.860
14.Dishwashing Equipment Set (large bucket and sponge)	2 sets for one public kitchen unit	Sets	8	54	62
15.Generator Fuel	80 litres for one unit per day	Litres	9.600	64.800	74.400
16.Public Kitchen Vehicle Fuel	20 litres for one unit per day	Litres	4.200	31.800	36.000
C. Food and Beverages					
1. Rice	400 g per person per day	g	73.670.813	625.765.978	699.436.790
2. Cooking Oil	20 litres for one public kitchen unit per day	Litres	2.400	16.200	18.600
3. Canned Fish	1 can per person per day	Cans	184.177	1.564.415	1.748.592

4. Eggs	3 eggs per person per day	Eggs	552.531	4.693.245	5.245.776
5. Vegetables	400 g per person per day	g	73.670.813	625.765.978	699.436.790
6. Baby Biscuits	1 pack per person per day	Packs	2.006	35.070	37.076
7. Infant Formula	1,000 g per person every 7 days	g	334.374	5.845.034	6.179.407
8. Toddler Formula	1,000 g per person every 7 days	g	1.191.956	9.780.258	10.972.214
9. Pregnancy Milk	1,000 g per person every 7 days	g	40.520	505.478	545.998
10.Sugar	20 kg per day per public kitchen unit	Kg	2.400	16.200	18.600
11.Coffee	10 kg per day per public kitchen unit	Kg	1.200	8.100	9.300
12.Tea	20 boxes per day per public kitchen unit	Boxes	2.400	16.200	18.600
D. Transportation					
1. Pick-up Truck	2 units for each evacuation site on standby at the public kitchen unit	Unit	40	108	148
2. Fuel	40 litres for one pick-up truck	Litres	48.000	32.400	80.400

Source: 2022 Mount Semeru Eruption Disaster Contingency Plan

Based on the disaster logistics planning data for public kitchens shown in Table 1, it can be seen that logistics management only covers basic logistics. Therefore, a contingency plan is needed that not only explains the analysis of logistics needs when a disaster occurs but also formulates a plan to meet those logistics needs until the post disaster recovery period ends sustainably. The village government and the local community affected by the disaster must be the main actors in this contingency plan, where local resilience is created from the ability to predict the potential needs of the disaster affected community and the logistics requirements that will be needed by the community. Additionally, the community must be provided with training in storing and managing disaster logistics as part of the contingency plan. The fundamental reason for the need for contingency plans with local communities as key actors is that they are the ones who best understand the area at the smallest level, namely the neighbourhood association, community association, and village. In addition, scenarios or mechanisms for fulfilling emergency supplies can be carried out through local resource allocation schemes such as village funds, procurement agreements and commitments, or cooperation with multiple parties. Thus, the community is not only able to identify logistical needs but also to ensure how they are procured.

3.2. Disaster logistics procurement

The planned procurement of disaster logistics must ensure that all needs are adequately met. In this context, procurement is carried out by local governments through the Regional Revenue and Expenditure Budget and other official sources. The procurement process carried out by the government is still based on the same regulations. In the face of disaster emergencies, this often results in the available disaster

logistics being inadequate to meet needs. In other cases, the quantity may exceed the required standard. This condition is caused by the fact that during procurement, which takes place simultaneously with the disaster, many parties also provide logistical assistance. However, the majority of disaster relief logistical assistance is not based on data on the needs of disaster victims but on the humanitarian wishes of donors. This is morally commendable but less relevant to the objective situation. During the eruption of Mount Semeru, the Lumajang District Disaster Management Agency (BPBD) focused on two main things: distributing logistics already in the warehouse and receiving assistance from third parties. Such response practices are only effective immediately after a disaster occurs and require optimisation in emergency situations.

From a regulatory perspective, there is a weakness in that government regulations do not provide standard rules regarding procurement at each stage of a disaster. Textually, the regulations only outline the stages of the logistics management system in general terms, without detailing the implementation mechanisms. In particular, the timing of implementation at each stage remains unclear. This indicates that the disaster logistics management process lacks a clear conceptual framework, even though each stage involves distinct logistics components and segments. Consequently, there is a risk that disaster logistics management will fail to meet the urgency of each phase and cycle of a disaster. Moreover, the limited capacity of local communities and volunteers to manage logistics often hampers this process. Aid may arrive in large quantities, accompanied by command posts established by the private sector and community groups, without coordination with the BPBD. This lack of coordination results in overlapping procurement and distribution efforts, leading to aid that is not always distributed evenly or appropriately targeted.

3.3. Disaster logistics warehousing

Disaster logistics warehousing is a series of processes that include the receipt, storage, and maintenance of disaster logistics, as well as their distribution. The location of the warehouse must take into account ease of access, type of warehouse, storage capacity and facilities, and security systems. In Lumajang Regency, which is frequently affected by volcanic eruptions, the Regional Disaster Management Agency (BPBD) must ensure that logistics are always available for rapid distribution. However, implementing the warehouse system poses challenges, particularly during emergencies. Warehouse locations are often determined solely based on capacity, distance from the disaster site, and temporary protected status. Furthermore, not all disaster-affected areas have logistics storage warehouses. The lack of detailed technical guidelines also makes it difficult for the BPBD to conduct logistics clustering. According to the Head of the Emergency and Logistics Division, clustering has so far been carried out based only on experience, without standardised operational procedures. He further emphasised that existing disaster logistics management regulations should be complemented by SOPs that clearly differentiate the handling of fast-moving logistics, rescue equipment, and other types of items within the warehouse system.

3.4. Distribution of disaster relief logistics

There are several important considerations to ensure that the logistics distribution process runs smoothly and helps ease the burden on disaster victims. The first is the accurate selection of the mode of transportation for distributing logistics, whether by land, sea, river, or air. In addition to choosing the right method and ensuring delivery speed, the safety, security, and integrity of disaster logistics must be maintained until they reach the affected victims. Consequently, the quality and competence of the personnel involved in this stage are critical. These personnel must be able to identify victims, determine their locations and numbers, calculate the quantity of goods, and master distribution routes. However, a shortage of skilled personnel remains a challenge, particularly since disaster logistics in Lumajang require special handling. The lack of sufficient experience and knowledge in response operations increases the risk of social tensions arising from unfair or uneven distribution.

The ability of distribution actors extends beyond physically navigating the disaster area to managing complex situations in the aftermath of a disaster. Strengthening the information system for processing data on needs, recipients, and distribution is therefore a priority in distribution management during the response phase. The proliferation of unauthorised shelters following the eruption has also disrupted the regulatory stability of disaster logistics management. During the 2021 Semeru eruption, there were 406 official BPBD command posts accommodating 10,400 evacuees [30]. However, field evidence indicates the presence of more than 160 unofficial command posts established by political parties, community organisations, religious groups, and others. This situation directly affected logistics distribution.

Consequently, the information system should be designed to monitor the type, purpose, and target of logistics through a centralised one-stop platform under the authority of the Lumajang BPBD. Such a mechanism also serves to reduce distribution imbalances through rigorous data validation. Field observations reveal that logistics tend to reach only accessible locations, leaving disaster-affected areas with limited access and isolation struggling to receive aid.

3.5. Disaster logistics removal

Disposal is the final stage in the logistics and equipment management system, as regulated by the National Disaster Management Agency. Logistics procured with state funds through the official procurement process become state property, and their disposal must comply with the procedures stipulated in the relevant regulations. Disposal of disaster logistics may be conducted once the relief goods have been handed over to users, ownership has been formally transferred, or destruction has been carried out. In the case of destruction, the Lumajang District Disaster Management Agency (BPBD) typically conducts this process once the disaster has subsided, except for food items found to be expired during the procurement process, which are destroyed immediately during the emergency response phase. This process includes assessing items no longer fit for use, returning unused items, and redistributing supplies to locations in need. Effective disposal enables the BPBD to avoid unnecessary stockpiling and ensures that the remaining logistics remain relevant and ready for future disasters. This stage is crucial and integral to the entire management process, as logistics disposal is not merely about discarding unused items but also about managing resources to maintain effectiveness and efficiency.

From the description of disaster logistics management in Indonesia, it can be understood that the management approach is a reference that begins with planning and ends with disposal. In fact, the management approach model has positive aspects, one of which is that it strengthens the internal capacity

Phase	***Preparedness***	***Response***	***Transition***	***Recovery***	***Mitigation***
Period	Long Term - Continuous	Days – Months		Months – Years	Long Term - Continuous
Logistics Volume	Low	High		Medium	Low
Supplies Required	Specific standard supplies pre-positioned for disaster response	Specific standard supplies: Food, medical supplies, water and sanitation equipment, shelter, household kits, etc.		Varied supplies depending on the context of the disaster: reconstruction material, livelihoods equipment	Varied supplies
Urgency	Low	High: Lead times for supplies can make the difference between life and death.		Medium: There may be government and donor pressure to complete recovery activities	Low
Procurement of Supplies	Local	International		Local-International	Local

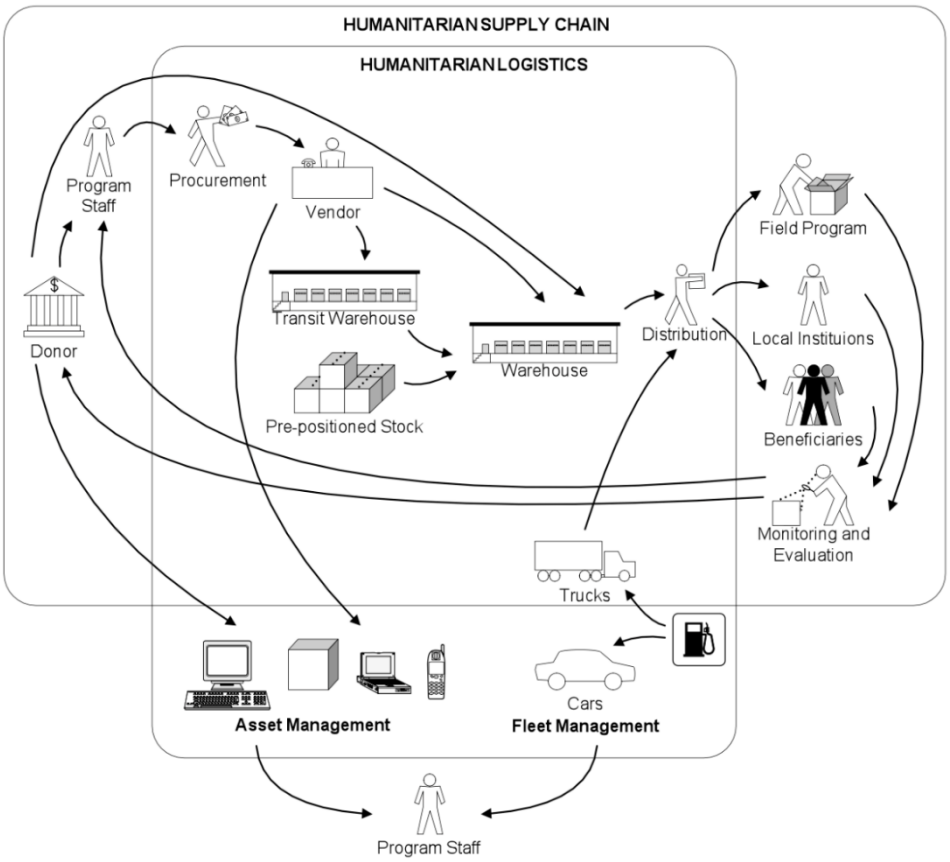
of organisations to survive when external assistance is not yet available [31]. However, such approaches and policies have consequences that are quite resistant to a deeper understanding of disaster logistics management. Disaster logistics support should not be viewed as an action that focuses solely on the responsibility of using state funds through management practices. In this context, the author wishes to compare it with Michael Howden's understanding of disaster logistics management. Howden [32] emphasises that in humanitarian operations, disaster logistics management must be implemented in every phase of a disaster, namely preparedness, response, transition, recovery, and mitigation. From the unified phases that occur in the disaster cycle, management approaches tend to focus the majority of logistics management efforts on the preparedness and transition phases, thereby failing to maximise logistics management during the response phase when the disaster occurs. Furthermore, such management cannot be said to fully address the elements of logistics management in the recovery and mitigation phases. The understanding of humanitarian operations and logistics management presented by Howden is more holistic and distributive across each phase of a disaster, as shown in Figure 1 below.

Figure 2. Four phases of disaster management

Source**:** From Howden [32]

Disaster logistics management in each phase has different objectives, as shown in Figure 1. Therefore, the series of disaster logistics management processes that have been implemented in Indonesia must also be further developed in accordance with the usefulness or urgency of each disaster phase. The preparedness phase is carried out before a disaster occurs with a focus on increasing capacity and readiness to confront disasters, especially in terms of logistics readiness. In the context of the Mount Semeru eruption in Lumajang Regency, all decisions in the logistics management process in each phase were centralised at the central government level and disseminated in the form of directives to local governments, including in the stages of contingency plan development and procurement of basic logistics goods. There should be a strengthening of the local supply chain, which, according to Howden, is an effort to build logistical sovereignty through independent decision-making. As for the response phase, it should ideally be designed before the crisis and not formed ad hoc when it has already occurred, which causes delays, uneven distribution of aid, and dependence on procurement.

While Lumajang has implemented the transition phase by eliminating logistics, its disaster logistics management has not progressed further. There are no indications of a genuine recovery phase. This is particularly concerning in relation to efforts that go beyond mere physical reconstruction and must also address aspects of livelihood recovery, mental health, education, and community capacity to regain self-reliance. Howden stresses that recovery must be logistics designed to foster self-reliance, not create new



dependencies. In Lumajang, however, recovery has been carried out using a project-based approach, such as resettlement or limited to road and bridge repairs, rather than long-term social processes such as post-disaster skills training or rebuilding community cohesion damaged by the disaster. This phase has a strong influence on the next phase, mitigation, where recovery is not the end of the crisis but the beginning of the process of preventing the next crisis. This means that recovery not designed to strengthen mitigation is equivalent to lost opportunities for sustainable strengthening. For example, if economic recovery does not include livelihood diversification, communities remain vulnerable to similar disasters. Implicitly, Howden explains how the humanitarian supply chain and humanitarian logistics operate, as illustrated in Figure 3 below.

Figure 3 Humanitarian Logistics Throughout the Disaster Management Cycle

Source: From Howden [32]

Figure 3 provides a comprehensive representation of the humanitarian supply chain and humanitarian logistics systems. It explains the flow of procurement, storage, distribution, and monitoring of humanitarian aid from international donors to beneficiaries. However, this diagram also illustrates the centralised and vertical structure of disaster logistics management, which poses a major challenge to achieving local resilience. The diagram signifies a global humanitarian supply chain structure that is technically complex and efficient but weak in terms of local sovereignty principles. Its impact on local resilience is that if logistics strengthening is only carried out bureaucratically and hierarchically when a disaster is already imminent, it cannot build the capacity of local communities to anticipate and avoid disaster threats. Disasters occur infrequently. Maintaining this approach will adaptively create a community that lacks power and constantly depends on others for their safety. Building disaster management based on local resilience requires a transformation toward a more horizontal, collaborative, community-based system that supports post-disaster sustainability.

If the problem arises from positioning international donors as patrons who are the source and key actors in disaster logistics management, it is time to shift to a more effective solution. It would be better if the existing disaster logistics paradigm shifted towards a more collaborative approach by providing more space for parties outside the government, including the community, to achieve local resilience. Several important elements create a collaborative approach. First is principled engagement, which is the process of establishing a platform for all parties to formulate solutions, share information, and achieve collective goals. Next is shared motivation, which is the provision of incentives to create individual willingness, legitimacy, and commitment among stakeholders. Shared motivation is inseparable from mutual understanding, which encompasses the individual's ability to understand the interests, values, needs, and constraints of parties that transcend organisational boundaries, jurisdictions, and personal perspectives. Finally, the capacity for joint action is essential for fostering collaboration among the government, private sector, community, and NGOs by integrating resources, expertise, and technical capabilities from various parties, which leads to a more effective response.

Anseel and Gash [33] suggest that we can understand collaborative space as a cycle, as its stages occur repeatedly and nonlinearly. Therefore, a collaborative approach is relevant to the understanding of governance, which also has a regular sequence of stages. Collaborative governance is needed in efforts to improve disaster logistics governance in Indonesia, especially in Lumajang Regency, to create resilience to disasters based on local resilience. Additionally, the implementation of collaborative governance in disaster logistics management must not overlook the disaster phases outlined by Howden, as previously explained, to ensure that resilience and preparedness for disasters continue to progress sustainably. In the preparedness phase, the implementation of collaborative governance begins with mapping relevant actors, including analysing their capacities, strategic roles, and networks, to then form a disaster logistics coordination forum as a formal platform with minimal legal validity in the form of a regent's decree. The response phase is established with a fast, adaptive, and coordinated system across actors based on the principle of equality of roles and responsibilities, rather than merely distributing tasks based on bureaucratic structures or state dominance, while the private sector tends to act only as an executor of aid and not as part of the decision-making mechanism. After a disaster, the momentum to build shared motivation and trust among actors through strengthening the medium term logistics system must be carried out during the transition phase and not merely narrowed down to a period of waiting for recovery funds. Once the recovery phase is underway, physical infrastructure reconstruction alone is insufficient; rather, the community's capacity must be encouraged to transition from being mere beneficiaries to co-producers of recovery, meaning a shift from a “supply based” to a “demand responsive” approach through capital assistance and partnership based economic diversification. When communities are able and independent in managing disaster logistics, local social resilience will grow through trust, recognition of citizens' roles, and the sustainability of the system in the mitigation phase.

This study also divides the roles of each actor specifically in the practice of collaborative disaster logistics governance for each phase. The government acts as the policymaker to underpin activities such as needs identification, logistics management mechanisms, and evacuation posts, with the community acting as the implementer. To support the formulation and implementation of these activities, academics act as intellectual actors through evidence based findings and theoretical studies in research on the impact of damage, logistics needs, instruments, disaster potential, and inclusive early warning system innovations.

Regarding material assistance, the private sector can contribute as donations through corporate social responsibility programs. Combined with efforts to foster a positive perception of the importance of community capacity in disaster logistics management through the role of the media, pessimism about disasters can be converted into strength to survive in vulnerable situations. By continuously adapting actions taken and the capabilities of each actor to each phase, the above proposition will be able to create a disaster logistics management model through collaborative governance, ultimately enhancing the resilience of local communities in facing disasters.

4. CONCLUSION

Disaster logistics management in Indonesia, particularly in Lumajang Regency, has not yet fully adopted the principles of collaborative governance as developed by Ansell and Gash. The pattern of relationships among stakeholders tends to be dominated by a vertical coordination approach with state actors dominating, while the involvement of civil society, the private sector, and local communities is often ad hoc, non deliberative, and lacking equality in the decision making process. This has led to weak cross phase disaster logistics institutions, as described by Howden, particularly in preparedness and mitigation, which are the foundation of long term local resilience. Even the collaboration that occurs during the emergency response phase has not yet evolved into a sustainable system but rather remains an incidental response based on situational pressure.

Going forward, the transformation of disaster logistics management in Indonesia, such as in Lumajang, requires the establishment of an institutionalised, participatory, and capacity building collaborative architecture for joint action. A collaborative approach is not only necessary to effectively respond to crises but also to build the social, economic, and institutional resilience of communities to disaster risks. Therefore, strengthening the structure of cross actor forums, legalising the role of communities in the regional logistics system, and creating participatory transition and recovery mechanisms are prerequisites for the functional institutionalisation of collaborative governance principles within the framework of regional disaster management. If not, logistics management will continue to rely solely on the state's capacity, which is prone to failure, slow in responding to the complexity of crises, and difficult to achieve sustainable local resilience.

REFERENCES

[1] F. W. Handoyo et al., "Enhancing Disaster Resilience: Insights from the Cianjur Earthquake to Improve Indonesia's Risk Financing Strategies," SAGE Open, vol. 14, no. 2, pp. 1–16, 2024, doi: 10.1177/21582440241256777.
[2] Bündnis Entwicklung Hilft/IFHV, WorldRiskReport 2023. 2023.
[3] A. Rosyida, M. Aziz, Y. Firmansyah, T. Setiawan, K. P. Pangesti, and F. Kakanur, "Buku Data Bencana Indonesia 2023," Buku Data Bencana Indones., vol. 3, pp. 3–11, 2023.
[4] BNPB, "Kejadian Bencana Tahun 2021," https://bnpb.go.id/. [Online]. Available: https://bnpb.go.id/infografis/kejadian-bencana-tahun-2021
[5] E. Setiawan and T. M. Mahendra, "Formulating Disaster Mitigation Strategies for Surakarta City, Indonesia by Using Risk Matrix and House of Risk Phase 2," E3S Web Conf., vol. 517, 2024, doi: 10.1051/e3sconf/202451703002.
[6] U. Syukri, N. A. Deliarnoor, and I. Widianingsih, "Comparison of Disaster Management Practices in Indonesia: A Study of Resilience in Garut and Majene Districts," 2025.
[7] M. B. Rahman and P. Van den Broeck, "Disaster capitalism in Merapi post-2010 eruption: Tracing the co-optation footprints of the disaster risk reduction agenda," Environ. Sci. Policy, vol. 170, p. 104103, 2025, doi: https://doi.org/10.1016/j.envsci.2025.104103.
[8] J. A. Reid and W. D. Mooney, "Tsunami Occurrence 1900–2020: A Global Review, with Examples from Indonesia," Pure Appl. Geophys., vol. 180, no. 5, pp. 1549–1571, 2023, doi: 10.1007/s00024-022-03057-1.
[9] A. V. H. Simanjuntak et al., "The western extension of the Balantak Fault revealed by the 2021 earthquake cascade in the central arm of Sulawesi, Indonesia," Geosci. Lett., vol. 11, no. 1, 2024, doi: 10.1186/s40562-024-00353-7.
[10]N. S. E. Putri, D. D. Wijaya, M. R. Abdillah, Z. A. J. Tanuwijaya, S. T. Wibowo, and W. Kuntjoro, "Characterizing the tropical cyclone Seroja using the Indonesian CORS network," Nat. Hazards, vol. 119, no. 3, pp. 1819–1838, 2023, doi: 10.1007/s11069-023-06181-w.
[11]F. Dwirahmadi, P. Barnes, A. Wibowo, A. Amri, and C. Chu, "Linking Disaster Risk Reduction and Climate Change Adaptation through Collaborative Governance: Experience from Urban Flooding in Jakarta," Geosci., vol. 13, no. 11, 2023, doi: 10.3390/geosciences13110353.
[12]S. Sufri and J. A. Lassa, "Integration of disaster risk reductionand climate change adaptation in Aceh: Progress and challenges after 20 Years of Indian Ocean Tsunamis," Int. J. Disaster Risk Reduct., vol. 113, no. June, p. 104894, 2024, doi: 10.1016/j.ijdrr.2024.104894.
[13]A. H. Purnomo et al., "Revisiting the climate change adaptation strategy of Jakarta's coastal communities," Ocean Coast. Manag., vol. 253, p. 107112, 2024, doi: https://doi.org/10.1016/j.ocecoaman.2024.107112.
[14]A. Abdillah, I. Widianingsih, R. A. Buchari, and H. Nurasa, "Resilience-based Governance: A Public Administration Perspective and Resilience Agenda," Public Organ. Rev., vol. 25, no. 2, pp. 695–715, 2025, doi: 10.1007/s11115-025-00834-z.

[15]S. M. Khalili, M. Mojtahedi, C. Steinmetz-Weiss, and D. Sanderson, "A Systematic Literature Review on Transit-Based Evacuation Planning in Emergency Logistics Management: Optimisation and Modelling Approaches," Buildings, vol. 14, no. 1, 2024, doi: 10.3390/buildings14010176.
[16]E. Aretoulaki, S. T. Ponis, G. Plakas, D. Tzanetou, and A. Kitsantas, "From Theory to Practice: Digital Innovations in Humanitarian Logistics for Real-World Disaster Management BT - Supply Chains," I. Kostavelis, D. Folinas, D. Aidonis, and C. Achillas, Eds., Cham: Springer Nature Switzerland, 2025, pp. 144–148.
[17]W. Pot, Y. de Ridder, and A. Dewulf, "Avoiding future surprises after acute shocks: long-term flood risk lessons catalysed by the 2021 summer flood in the Netherlands," Environ. Sci. Eur., vol. 36, no. 1, 2024, doi: 10.1186/s12302-024-00960-3.
[18]J. Schwarz, V. Kascel, M. Azmat, and S. Kummer, "Collation of best practices for preparedness: lessons from disasters in Pakistan and Japan," J. Humanit. Logist. Supply Chain Manag., vol. 13, no. 3, pp. 311–330, 2023, doi: 10.1108/JHLSCM-07-2022-0086.
[19]N. Vipul and D. Sriram, "Collaborative Governance in Building Community Resilience for Disaster Risk Reduction: Lessons from Kutch, Gujarat, India," Int. J. Environ. Sci., vol. 10, no. 1, pp. 56–67, 2024.
[20]J. E. Mendoza et al., "Multi-hazard probability assessment in Quinali A Watershed, Albay, Philippines," Prog. Disaster Sci., vol. 26, no. February, p. 100408, 2025, doi: 10.1016/j.pdisas.2025.100408.
[21]A. Triyanti et al., "Governing systemic and cascading disaster risk in Indonesia: where do we stand and future outlook," Disaster Prev. Manag. An Int. J., vol. 32, no. 1, pp. 27–48, 2023, doi: 10.1108/DPM-07-2022-0156.
[22]L. Frennesson, J. Kembro, H. de Vries, L. Van Wassenhove, and M. Jahre, "Localisation of logistics preparedness in international humanitarian organisations," J. Humanit. Logist. Supply Chain Manag., vol. 11, no. 1, pp. 81–106, 2021, doi: 10.1108/JHLSCM-06-2020-0048.
[23]R. S. Pontoh et al., "Assessing Sustainable Development in Community Welfare and Economic Resilience to Extreme Weather in Indonesia," Sustain., vol. 16, no. 15, 2024, doi: 10.3390/su16156693.
[24]P. D. Sentia, S. Abdul Shukor, A. Abdul Wahab, and M. Mukhtar, "Exploring trends and issues in information technology and information systems for humanitarian supply chain: the crossbreed literature review," J. Humanit. Logist. Supply Chain Manag., no. February, 2025, doi: 10.1108/JHLSCM-09-2023-0086.
[25] John W Creswell, "My 35 Years in Mixed Methods Research," J. Mix. Methods Res., vol. 18, no. 3, pp. 203–215, May 2024, doi: 10.1177/15586898241253892.
[26]S. M. Kilonzo and A. Ojebode, Research Methods for Public Policy. 2022. doi: 10.1007/978-3-030-99724-3_4.
[27]F. Eiró and G. Lotta, "On the Frontline of Global Inequalities: A Decolonial Approach to the Study of Street-Level Bureaucracies," J. Public Adm. Res. Theory, vol. 34, no. 1, pp. 67–79, 2024, doi: 10.1093/jopart/muad019.
[28]M. M. Kelly, T. Martin-Peters, and J. S. Farber, "Secondary Data Analysis: Using existing data to answer new questions," J. Pediatr. Heal. Care, vol. 38, no. 4, pp. 615–618, 2024, doi: https://doi.org/10.1016/j.pedhc.2024.03.005.
[29]M. Naeem, W. Ozuem, K. Howell, and S. Ranfagni, "A Step-by-Step Process of Thematic Analysis to Develop a Conceptual Model in Qualitative Research," Int. J. Qual. Methods, vol. 22, no. October, pp. 1–18, 2023, doi: 10.1177/16094069231205789.
[30]T. Yanuarto, "Hari ini Tercatat 10.400 Warga Tersebar di 406 Titik Pengungsian Paska Erupsi Semeru," BNPB, 2021. [Online]. Available: https://bnpb.go.id/
[31]A. Aghsami, S. Sharififar, N. Markazi Moghaddam, E. Hazrati, F. Jolai, and R. Yazdani, "Strategies for Humanitarian Logistics and Supply Chain in Organizational Contexts: Pre- and Post-Disaster Management Perspectives," Systems, vol. 12, no. 6, 2024, doi: 10.3390/systems12060215.
[32]M. Howden, How Humanitarian Logistics Information Systems Can Improve Humanitarian Supply Chains: A View from the Field. J. Landgren and S. Jul, Proceeding. Gothenburg, Sweden, 2009.
[33]I. Christensen, "Understanding Tradeoffs in the Institutional Design and Leadership of Collaborative Governance," Public Perform. Manag. Rev., vol. 47, no. 2, pp. 263–290, 2024, doi: 10.1080/15309576.2023.2283583.