

Humanitarian logistics challenges in disaster relief operations: A humanitarian organisations' perspective

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Background: The number of disasters affecting the world has climbed dramatically over the previous decade, from around 220 per year in the mid-1990s to around 350–400 per year now. The rising frequency of natural calamities encouraged the author to conduct a study on humanitarian logistics (HL) and its role in mitigating the consequences of any disaster incidence. Thus, this study aims to outline the issues and challenges affecting HL in disaster relief.

Objectives: The purpose of this study is to emphasize the critical role of HL in disaster management and to identify the issues that humanitarian organizations (HO) face while managing their logistics and supply chains during disaster relief operations.

Method: The study employed a qualitative approach to investigate the problems affecting HL and supply chains by conducting a literature analysis on disaster management/disaster supply chain. The literature related to HL was reviewed, analyzed, and accordingly, the findings are presented.

Results: The results of a thorough evaluation of the basic and contemporary literature on HL identified various challenges, reinforcing the necessity for additional research in HL operations to better the present situation. Additionally, it will lay the groundwork for various stakeholders such as humanitarian/non-profit organizations, governments, and policymakers to plan and develop appropriate solutions.

Conclusion: As natural disasters occur often throughout the world; it is critical to handle logistical operations properly and efficiently during disaster relief operations. While none of the disaster situations can be prevented, their impact can be minimized by adequate preparation and response during humanitarian logistical operations.

Keywords: humanitarian logistics; humanitarian supply chain; disaster management; humanitarian organisation; disaster preparedness and response.

Introduction

Tsunamis, floods, hurricanes, landslides, mudslides, and earthquakes are all rising in frequency that are leading to various complexities for humanitarian organisations (HOs) (Asian Disaster Reduction Centre 2016; Behl & Dutta 2019a; Pathak & Ahmad 2016; Thapa, Pathak & Pathak 2021). According to Hannah and Max (2019), over the last decade, around 60 000 people have died each year because of natural disasters, accounting for 0.1% of the global deaths. In many years, the death toll can be extremely low – frequently less than 10 000 and accounting for as little as 0.01% of overall mortality. However, the devastation caused by shock catastrophes such as the 1983–1985 Ethiopian famine and drought; the 2004 Indian Ocean earthquake and tsunami; Cyclone Nargis, which slammed Myanmar in 2008; and the 2010 Haitian Port-au-Prince earthquake has increased global disaster mortality to over 200 000 – accounting for more than 0.4% of deaths throughout these years (Hannah & Max 2019). According to the renowned CRED (The Centre for Research on the Epidemiology of Disasters) International Disaster Database, at least 396 natural disasters claimed 11 755 lives, impacted 95 million people, and cost almost \$130 billion in 2019 (CRED 2020). In 2018, the same pattern was found, with 281 climate-related and geophysical incidents resulting in 10 733 deaths (Dubey, Gunasekaran & Papadopoulos 2019b). Figure 1 depicts the annual global death toll because of natural disasters in absolute terms (from 2000 to 2018).

Droughts, floods, excessive temperature, wildfires, volcanic activity, landslides, extreme weather, earthquakes, and dry mass movements are considered as 'all-natural disasters'.

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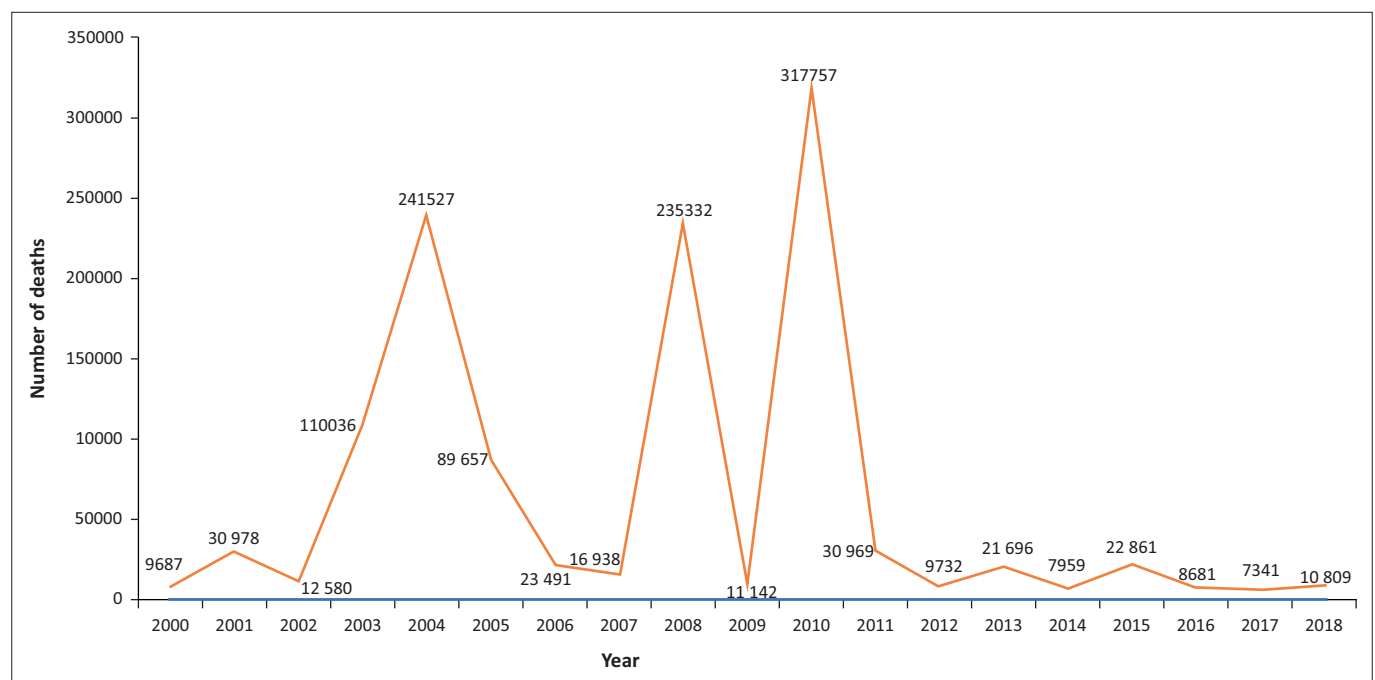
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According to CRED, the number of catastrophes affecting the globe has increased significantly over the previous decade, from around 220 per year in the mid-1990s to around 350–400 per year today. These affected more than 200 million people and are predicted to cost around \$200bn (Rodriguez et al. 2009). As John and Ramesh (2016) observed, over the last four decades, the world has witnessed over 6500 disasters (natural and man-made), affecting more than five billion people worldwide. According to CRED, the cumulative loss from all disasters has surpassed \$150 trillion, displacing more than 180 million people. Within these figures, several recent disaster incidents, including the 2005 Southeast Asian tsunami, the flooding in New Orleans following Hurricane Katrina, the Pakistan earthquake in 2005, Cyclone Nargis in Burma, the Sichuan earthquake in 2008, the Haiti earthquake and Pakistan flooding 2010, have all served to emphasise the critical need to understand the best methods for delivering humanitarian aid following such incidents. Additionally, the frequency, magnitude, and effect of natural disasters are all increasing (Scheuren et al. 2008). As a result of the rapid urbanisation, climate change and environmental degradation, disasters have had a greater impact in the past, particularly in less-developed nations (Fink & Redaelli 2011). The demand on HOs is projected to intensify, as predictions indicate that the impact of natural and man-made disasters would rise fivefold over the next 50 years (Thomas & Kopczak 2005).

Humanitarian organisations refer to the agencies that aid people who are suffering, particularly victims of armed conflict, famines, and natural disasters. Occasionally these organisations are also called relief societies. Since World War II, emergency relief for natural disasters and help to civilians affected by conflict have driven the

activity of a diverse spectrum of HOs (Marshall 2018). Humanitarian organisations work to eliminate human suffering through disaster relief and development assistance initiatives on a routine basis. This can be in the form of rescuing refugees and ensuring their safety, providing housing and food for the homeless, or assisting persons affected by natural disasters or civil unrest. The ability to quickly recognise the needs and engaging in fundraising, sourcing, transporting, distributing, and providing supplies and services to individuals in need is one of the HOs' essential competencies. Procurement of items (such as pharmaceuticals, food, and non-food items) and services (such as warehousing, transportation, and data collecting and analysis) is a crucial activity for HOs (Moshtaria et al. 2021).

The abundance of humanitarian challenges that society have experienced in recent years has justified the growing interest in this field including natural disasters and armed conflicts (Dubey & Gunasekaran 2015). Natural disasters strike frequently throughout the world, necessitating effective management of humanitarian logistics (HL) operations. Identifying and addressing numerous challenges and impediments in relief chains is one of the most important topics in humanitarian logistics and supply chain management (HLSCM) (Kabra & Ramesh 2015; Kabra, Ramesh & Arshinder 2015; Kovacs & Moshtari 2019; Petrudi, Tavana & Abdi 2020). As the number and severity of disasters increases around the world, HLSCM must be prepared to respond effectively. Nonetheless, HOs engaged on relief operations are facing numerous challenges that must be addressed (Ozdemir et al. 2021). With the same motivation, the author attempted to research on HL and its role in mitigating the consequences of any disaster incident. Because identifying issues and



Source: EMDAT, 2019, OFDA/CRED International Disaster Database, Université catholique de Louvain, Brussels.

FIGURE 1: Global deaths from natural disasters.

obstacles paves the way for planning and implementing effective mitigation strategies, this study aims to emphasise the critical role of HL in disaster management and to identify the obstacles that HL faces during disaster relief operations. The study will contribute to the vast knowledge of HL from the HO's perspective.

As none of the incidents related to disasters can be avoided, their aftermath however can be reduced through careful planning and effective HL operations (Vries & Wassenhove 2020). Additionally, historical data indicate that the world is seeing a substantial decrease in disaster-related deaths because of improved disaster prediction, response systems, emergency preparedness, and more resilient infrastructure (Hannah & Max 2019). The identified challenges would aid in the planning and management of any disaster event effectively, thereby saving millions of lives and nations' wealth.

Given the important role HL plays in disaster relief operations, it is vital to understand the challenges faced by HOs in managing the operations during an event of any disaster.

To inspire and enlighten new research, the current study provides an overview of HL and describes the real practices and associated challenges in managing HL in disaster relief operations. The aim of the present study is to answer the following research questions:

- What is the role of HL in managing disaster relief operations?
- What challenges are encountered by HOs in performing HL operations during any disaster relief operations?

To answer the questions above, the author examined the peer-reviewed research papers on HL and disaster relief operations and analysed the challenges related to HL in different disaster scenarios.

The remainder of this article is structured as follows. The methodology is discussed in the second section. The third section discusses HL and its role in disaster management. The fourth section outlines the pertinent literature on HLSCM in detail and then summarises the HL challenges. Finally, the conclusion is presented, and future research directions are outlined.

Methodology

This article focuses primarily on the role of HL and the challenges encountered during disaster relief operations. Using the available literature globally, this study used a qualitative approach to identify and highlight the challenges confronting HL. The author conducted a narrative review of the past literature and discovered a broad range of challenges to HL in disaster relief operations. The studies that are considered to complete

the present study ranges from 2000 to 2021. The researcher reviewed the available literature or body of knowledge using the steps as detailed next Jabbour et al. (2019).

The first step is to identify the primary articles on the subject that are available in academic databases (Scopus, Google Scholar, Research Gate, etc.) and to consider the primary keywords associated with the subject (disaster management, disaster supply chain, disaster relief operations); the second step is to screen the papers/articles identified in the previous step to reject those that are irrelevant to the field of study. Third, creating and implementing a classification system to detect the subject's or topic's central structures under consideration (role of HL, disaster relief operations, HLSCM challenges).

The author conducted an extensive literature review on various disaster incidents to examine the challenges and issues confronting HLSC. Secondary sources included research papers, conference proceedings, industry white papers, presentations, and case studies published in peer-reviewed journals. The author cited journals on HL published by reputable publishers such as Elsevier, Emerald, Wiley, Taylor and Francis, and Springer. The collected papers were then analysed to understand the role of HL and the logistical and related challenges that were faced by the participants/agencies/HOs in managing the past disaster events. The author identified the critical challenges to managing HL more effectively, thereby paving the way for various stakeholders such as state governments, policymakers, non-profit organisations (NPOs)/HOs to plan and develop strategies accordingly.

Humanitarian logistics' and its role in disaster relief operations

Disaster relief operations normally entails a series of phases involving establishing communication infrastructures, undertaking search and rescue operations, and providing any necessary first aid services (Narayanan & Ibe 2015). Disaster relief operations are focused on deciding the transportation of food, equipment, first aid supplies, rescue workers from supply points to many geographically dispersed destination nodes within the disaster region, as well as the evacuation and transference of disaster victims to healthcare facilities safely and expeditiously (Barbarosoglu, Ozdamar & Cevik 2002). The speed with which humanitarian aid is delivered following a disaster is contingent on 'logisticians' ability to procure, transport, and receive supplies at the site of a humanitarian relief effort' (Berkoune et al. 2011; Kovacs & Spens 2007; Thomas 2003).

Specifically, 'humanitarian logistics' refers to the activities of:

[P]lanning, implementing, and controlling the efficient, cost-effective flow and storage of goods and materials, as well as associated information, from point of origin to point of consumption to alleviate the suffering of vulnerable people. (Thomas & Kopczak 2005:2)

In a nutshell, for humanitarians, logistics refers to ‘the processes and systems involved in mobilizing people, resources, skills, and knowledge to assist vulnerable people affected by the disaster’ (VanWassenhove 2006).

In any emergency, logistics management is responsible for sourcing and managing medicines, food, clothing, and in-kind donations (both solicited and uninvited) from several donors. It also requires monitoring the commodities (Whybark 2007), finance, and information connected to the flow of disaster assistance (Lee & Zbinden 2003). The logistics component of any humanitarian aid programme accounts for the largest share (approximately 80%) of the overall activity and has always been a critical component of humanitarian assistance operations (Kovacs & Spens 2007; Trunick 2005). Following the 2004 Indian Ocean tsunami, both researchers and practitioners have developed an increased interest in logistics applied to disasters (Gunasekaran et al. 2018; Kovacs & Spens 2007). The tsunami demonstrated that emergency aid response efficacy is reliant on the speed and efficiency of logistics operations (Pettit et al. 2011), highlighting the importance of logistics in humanitarian relief efforts (Christopher & Tatham 2011).

As Daud et al. (2016) described, during HL, the following processes are required: (1) ensure that the appropriate supplies of goods are delivered in good condition; (2) bulk commodities storage, staging, and movement; (3) coordination and optimisation of the usage of limited and shared transportation; (4) people’s movement; and (5) specific delivery from outside the affected area. Logistical coordination in humanitarian aid management, according to Dolinskaya et al. (2011), brings together individuals with experience, expertise, and capabilities in a variety of disciplines to the disaster-affected area, where their collaborative endeavours support alleviating the suffering of the affected people.

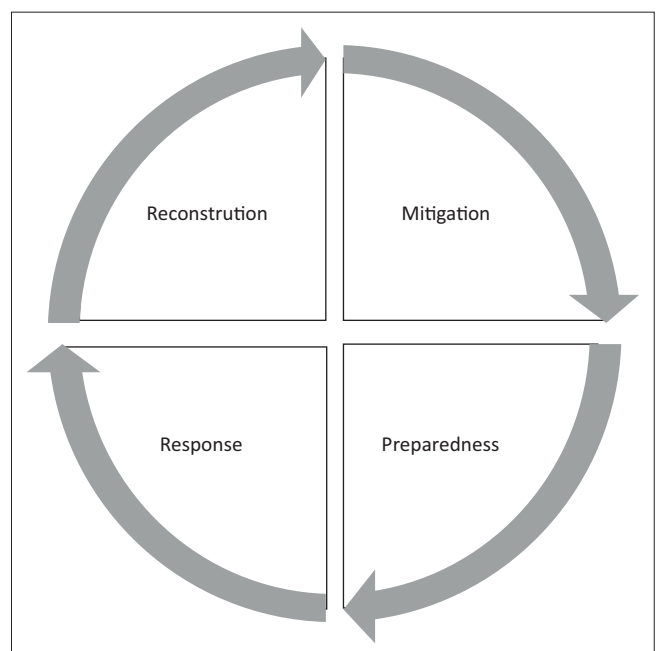
Humanitarian logistics differs from traditional logistics in that its goal is to give humanitarian aid in the form of food, water, medical assistance, and shelter (Kovacs & Spens 2009; Tatham, Spens & Kovacs 2017). Humanitarian logistics also focuses on search and rescue operations, sustaining or saving a life, and re-establishing self-sufficiency. However, these operations are perpetually hampered by logistical complexities, disaster management policies, HL management issues, and an overabundance of financial sources (Thevenaz & Resodihardjo 2010). According to Balcik and Beamon (2008), HL possesses several critical characteristics that distinguish it from business logistics. The following characteristics apply:

- The instability of demand in terms of product type, location, timing, and size.
- Unexpected demand in massive quantities with shorter response times for a diverse range of supplies.
- Shortage of resources (manpower, supply, transportation capacity, funds, and technology).
- High risks linked with delivery timeliness.

Humanitarian logistics supply chain stages

The literature agrees on the following four stages of HLSCM: (1) mitigation, (2) preparation, (3) response, and (4) reconstruction. The disaster management cycle comprises of the four components as mentioned above (Warfield 2008). With a strong emphasis on logistics and supply chain management, the preparation, response, and reconstruction processes are mostly logistical, forming HL streams (see Figure 2):

- This process of mitigation entails the activities necessary to avert a natural disaster, mitigate its impact, and mitigate the resulting losses and damages (Warfield 2008). It does not require the logistician’s direct engagement and refers to the rules and systems that mitigate the social vulnerability (Holguin-Veras et al. 2012). These are issues about the government’s responsibility (Pathak & Ahmad 2018).
- The preparation stage encompasses a variety of activities that occur before the onset of a disaster (Warfield 2008). This stage covers the strategies implemented to ensure the success of the operational response (Haddow, Bullock & Coppola 2013; Kumar & Havey 2013). This stage is critical since the collaboration base, information and communications technology (ICT) systems, and physical network design systems are developed in this stage. This includes: identifying threats, determining an organisation’s capacities in the event of a disaster, developing scenarios for training purposes, identifying key partners such as suppliers, and identifying important assets (Kunz, Reiner & Gold 2014).
- The response stage refers to the different functions that are immediately applied following the occurrence of a disaster. This comprises acts conducted immediately in response to any emergency or disaster events (Warfield



Source: VanWassenhove, L., 2006, 'Humanitarian aid logistics: Supply chain management in high gear', *Journal of the Operational Research Society* 57(5), 475–489. <https://doi.org/10.1057/palgrave.jors.2602125>

FIGURE 2: Stages in humanitarian logistics supply chain.

2008). The goal of response actions should be to mobilise resources, services, and emergency responders to the impacted region (Altay et al. 2018). Coordination between relief actors is critical at this stage (Ozen & Krishnamurthy 2018; Quarshie & Leuschner 2020).

- The reconstruction stage encompasses a variety of tasks carried out in the aftermath of a disaster (Warfield 2008). It entails rehabilitation, and this stage focuses on long-term solutions to the problem.

Humanitarian logistics- key players

The term 'HL players' refers to the individuals or organisations that contribute to the HL process. Kovacs and Karen (2007) categorised the actors in HL as governments, relief agencies, the military, NGOs (non-governmental organisations), private sector enterprises, and donors. Some of the main actors are discussed as follows:

- **Government:** Governments are key financial and material contributors to humanitarian operations (Baldini et al. 2012; Trestrail, Paul & Maloni 2009). In essence, every government participates in humanitarian aid as a donor, a beneficiary, or both (Kovacs & Spens 2009; Schiffing 2013).
- **Donor:** Even though HOs are non-profit, they must keep a constant eye on their finances because donor funding is limited and can be discontinued at any moment (Chandes & Pache 2010). Aside from giving relief, HOs must also maintain a steady funding stream from donors (Schiffing 2013).
- **NGOs:** Whilst NGOs lack the authority to affect another's supply chain and usually lack considerable autonomy, they are important players, whether in a positive way by demanding reform through cooperation or in a bad way by engaging in intense competition (Schiffing 2013).
- **Military:** The military's capacity to respond quickly in an emergency leads to more engagement during the immediate reaction. However, as the emergency settles, their role diminishes (Banomyong & Sopadang 2010). The military, particularly in HL, can be both a benchmark and a significant cooperating partner (Carroll & Neu 2009).

Each player has critical obligations and tasks to guarantee that the HL plan is successful and as cost-effective as possible. Because of the intensity and complexity of the crisis, as well as the scarcity of resources, participants in humanitarian supply chains (HSC) must work together and trust one another to achieve mutual goals (Dubey, Altay & Blome 2019a). A lack of coordination amongst players in the HSC could result in major losses and an ineffective response in affected areas (Dubey et al. 2018; Noori & Weber 2016). The function of each participant in HL is presented in Table 1.

Discussion on the humanitarian logistics/disaster supply chain challenges

This section examines research that has been conducted on the challenges associated with disaster management. On the

TABLE 1: The summary of players in humanitarian logistics and their role.

Player	Role/responsibility
NGO	Aid a humanitarian mission according to its function as a donor, a collector, or a supplier. Donors-provide financial assistance in the form of cash; Collectors-collect financial support from suppliers, employees, and customers; Provider— a business that provides its goods and services for free.
Government	The HL activators oversee authorising operations and deploying resources.
Donors	Those who contribute solely financial resources to enhance activities.
The military	A critical player, as soldiers are often tasked with providing primary aid, such as hospital and camp setup, route repairs, and telecommunications.

NGO, non-governmental organisation; HL, humanitarian logistics.

worldwide scale, researchers have conducted numerous studies on the HSC. The challenges inherent in HL have been described in detail in this section.

The subject of disaster management has grown in prominence, and within it, the area of knowledge on HLSCM has garnered interest from a diverse range of stakeholders, including academics, practitioners, and policymakers (Dashtpeyma & Ghodsi 2021; Kovacs & Spens 2010). Numerous authors have addressed various issues and challenges in HLSCM (Petrudi et al. 2020). Some of the authors who have discussed the challenges related to HLSCM include: Maghsoudi and Moshtari (2021); Behl and Dutta (2020); L'Hermitte and Nair (2020); Negi and Negi (2021); Altay et al. (2018); Behl and Dutta (2019a, 2019b); Dubey et al. (2019a, 2019b); Kim, Ramkumar and Subramanian (2019); Sabri, Zarei and Harland (2019); Tayal and Singh (2019); Dubey et al. (2018); Gunasekaran et al. (2018); John and Ramesh (2016); Baldini et al. (2012); Pathirage et al. (2012); Bagchi, Paul and Michael (2011); Overstreet et al. (2011); Balcik et al. (2010); Oloruntoba and Gray (2006, 2009); Pettit and Beresford (2006, 2009); Stephenson and Schnitzer (2006); Oloruntoba (2005); Stephenson (2005); Moore, Eng and Daniel (2003).

John and Ramesh (2016) conducted research in the Indian context and analysed the HSC's constraints and how they affect its operation through interpretive structural modelling (ISM). The study emphasised the critical role of skilled and experienced logisticians in the proper administration of most operations associated with HSCM. Additionally, the critical nature of generating credible bases of information to forecast the occurrence of a disaster has been emphasised. Pathirage et al. (2012) also researched identifying HSC issues, finding that operational/managerial, legal, social, economic, technological, and environmental factors all appear to have a direct effect on the disaster management cycle, whilst political and institutional factors appear to have an indirect effect. Lack of funding for economic planning measures, ineffective institutional measures, inadequate planning, the need for regular updating of disaster-related regulations, the need for effective education, poor communication, lack of detection and warning systems, and ineffective leadership were amongst the significant challenges identified. Ibrahim et al. (2017) found political related issues such as political pressure, weak enforcement mechanisms, weak institutions,

corruption, and a lack of political as major challenges affecting the procurement activities in HSC. John and Ramesh (2012) examined the current state of preparedness for disasters, identified gaps, and proposed a few strategies to address them. Numerous issues require attention, including the importance of a central authority, resource scarcity and abundance, identifying supply sources, coordinating amongst actors, the role of skilled supply chain management professionals, understanding of HLSCM, and the need for a financial supply chain.

As challenges experienced by World Vision, India, regarding HL, Joshi (2010) discussed the insufficiency of supply chain management software and communication equipment, the requirement of proper storage facilities, the difficulty of communicating, and the problem of receiving government clearance. Tatham and Houghton (2011) also found access to warehouses as a major challenge for international HOs in the aftermath of the 2008 Nargis storm in Myanmar. Maghsoudi and Moshtari (2021) identified the challenges during a recent disaster relief operation in the 2017 Kermanshah earthquake in Iran, where the humanitarian response is dominated by national actors. The author discusses the HL challenges of assessing needs, procuring supplies, storage, transporting and distributing them to the last mile. When an emergency strikes in India, Medicines Sans Frontiers observed that enormous distance, population density, lack of coordination, and a lack of accurate information/communication flow are important problems (Gandini 2010). Rajeshwar (2010) analyzed three significant disasters that affected India in the last 5 years (the Indian tsunami, the Supaul floods of Bihar, and the Kashmir earthquake) to highlight the issues faced. Parida (2010) analyzed the organisation of India's government response mechanism and the difficulties associated with HL management. Parida (2010) attempts to investigate the Government of India's reaction to numerous disasters during the last decade, discussing the government's disaster preparedness programme in detail, whilst also exploring the possibility of an alternate way to resolve the issues.

Quarshie and Leuschner (2020) looked into the New Jersey state government's reasonably successful Sandy response effort in collaboration with other humanitarian participants, highlighting the methods adopted by the government during the response phase. Pathak and Ahmad (2018) investigated the role, duties, and tactics used by the government during the '2011 floods in Thailand's Pathumthani region'. The study found inter-departmental miscommunication, dearth of transportation amenities in the affected area, a lack of interest in providing long-term sustainability on the ground, lack of transparency in the government's action plans, and mismanagement of existing resources as issues during the relief operations. In a similar manner, Kunz and Reiner (2016) identified transportation regulation and government constraints as two of the most significant HL challenges confronting humanitarian actors. Salem et al. (2019) highlighted the role of leadership and decision-making in enhancing performance of humanitarian operations. The

study discovered that the ability of HOs to deal with a variety of events in a number of situations has a substantial impact on the quality of their operations.

Singh (2010) examined the key issues of humanitarian logisticians through a Kosi flood case study, which includes the lack of logistician restructuring, poor and insufficient support. Kovacs and Spens (2009) also recognised the key issues faced by humanitarian logisticians concerning the various sorts of disasters, stages of disaster assistance, and types of HOs, and developed a conceptual model to help identify these issues. The most significant difficulty is in coordinating logistical efforts. The authors demonstrated that by assigning difficulties to distinct stakeholder settings, they can be managed more effectively.

Oloruntoba (2005) underlined the Tsunami's early warning system's failure and the difficulties inherent in efficiently reacting to and handling a transnational disaster of this magnitude. Suggestions for effective disaster management and response were made. Several of the difficulties include managing media and information, logistics and coordination, assessing requirements and damage, and ensuring the safety and security of donations. L'Hermite et al. (2016) and Constable (2008) also addressed security concerns, emphasising how a looter could exploit the chaotic situation to steal things. The same challenge was also found in the disaster relief operation in 2017 Kermanshah earthquake as per Maghsoudi and Moshtari (2021).

Gustavsson (2002) outlined the difficulties associated with reconstruction, delivery speed, the transfer of individuals from conflict zones, and the migration of humanitarian personnel. Sandwell (2011) examined humanitarian disaster relief logistics to gain a better knowledge of the issues confronting HOs. He noticed that the operational obstacles that HOs encounter are reflective of greater problems that HOs face. Fritz Institute (2005) demonstrated the critical role of HL relief efforts and identified some common issues through a survey of field logisticians from the main international organisations involved in the tsunami recovery efforts. The issues included a shortage of logistics experts, largely manual supply chain processes, insufficient assessments and planning, limited coordination and collaboration, transportation execution, procurement, track and trace, mobilisation of financial and human resources, preparedness, assessment, and appeal, organisational setup, monitoring/evaluating/reporting, stock asset management, and communication. Additionally, it is imperative to remember that in managing HL, the absence of coordination amongst many players, both in the public and private sectors, remains a critical component. Lack of coordination was also identified as a critical issue in HSC by Kabra and Ramesh (2015), who claimed that this challenge could result in a variety of consequences, including ineffective aid distribution, competition amongst participants for limited resources, and traffic congestion on transportation networks. Maghsoudi and Moshtari (2021), Baporikar and Shangheta (2018), Makepeace, Tatham and Wu (2017), Tatham et al. (2017),

Balcik et al. (2010), Kovacs and Spens (2009), Fritz Institute (2004) have all reported that logistics coordination at both the organisational and inter-organisational levels can disrupt the procurement of items, warehousing, and last-mile distribution of aid.

Baldini et al. (2012) discussed the fundamental characteristics and issues of HL, as well as the possible contribution of secured radio frequency identification in enhancing the security and overall management of HSC. Not only does an HL information system improve logistical activities within each stage, but it also has the potential to improve humanitarian operations' continuity by transmitting information during the transition between different crisis management cycle stages (Tyagi & Kaushal 2010; Whybark 2007). Tripathi (2010) developed a model for effective relief supplies that emphasised logistical operations. This model contains aspects about resource mobilisation, assessment, information management and control, warehousing, transportation, and procurement. Procurement of goods and services is an important and difficult process for HO, accounting for around 65% of relief costs (Moshtaria et al. 2021). Tripathi (2010) also created a comprehensive strategy that looks at many areas of logistical operations during a disaster in tough terrain like Leh.

Vaillancourt (2016) established a theoretical framework to help HL professionals adequately the incentives and barriers to material consolidation. The author identified particular causes of delays and hurdles to cooperation that occurs during catastrophe response and development operations. Tatham and Pettit (2010) discussed supply network management in the context of HL, arguing that the important philosophies that have been the subject of extensive academic study are correspondingly appropriate to the HL field and must result in a substantial enhancement in the effectiveness and efficiencies of HL preparation and response. According to Chandes and Pache (2010), collaborative action has a beneficial effect on the functioning of HSC when a 'hub' is employed to ensure reliability and accountability. If a technical approach is necessary to improve HL management such as the location of regional warehouses, and optimisation of transportation, it must also serve a collaborative strategy, most particularly in the pre-positioning of supplies and coordination of relief activities.

Challenges faced by humanitarian organisations in disaster relief logistics – A glance

The wide range of challenges presented in this section are identified based on the analysis of the literature review and are summarised in Table 2.

The author conducted literature research to identify the critical issues in HLSCM, which are explored and presented in detail in this section. The areas that are challenging, weak and require additional development in the HL context to successfully respond to future crises are identified. Several significant issues that confront HL and

the emergency supply chain include a lack of information flow, insufficient preparation for HL, and the non-accessibility of relief items in sufficient quantities. Additionally, it was discovered that the government response system in most of the incidents had flaws such as inadequate information management systems, inadequate planning, and inadequate preparedness for maintaining the supply chain of relief documentarians, lack of training for officials, lack of concentrated efforts on maintaining relief logistics supply, and duplication of efforts between the government and non-government sectors. Moreover, there is a dearth of clear-cut criteria or plans for assessing the estimations of relief supplies and logistics, and as a result, many nations across the globe lack a system for maintaining minimal reserves in warehouses or relief centres. The HOs must deliver the proper assistance to the suitable location at the appropriate time and at the relevant cost. However, the obstacles to attaining this are numerous and complex.

As HOs mobilised to offer help in this devastation and chaos, it became clear that sophisticated supply chains would be critical to providing food, housing, and medical supplies from across the country. Additionally, because most natural disasters are unanticipated, the demand for necessary items is similarly uncertain during these crises (Eftekhar & Webster 2020; Moshtaria et al. 2021). Thus, HL is difficult, as it must be progressively adaptable and able to operate under severe constraints. Thus, proper planning, preparation, and response stages are critical for emergency supply chain management and crisis logistics (Ben-Tal et al. 2011). The success of any disaster management effort is highly dependent on factors such as resource mobilisation, effective command and control, the capability to organise the effort logically and timely (Murray 2005), sound strategic planning (Altay et al., 2009; Ben-Tal et al. 2011; Vries & Wassenhove 2020), dealing with psychological factors during crises, and the logistics' capability to match up with relief operations (Meite 2010).

Furthermore, there is a need to improve understanding in this field. On the ground, logisticians are frequently untrained individuals who have gained their expertise on the job. Competency-based capacity-building programmes and processes must therefore be established and supported to elevate the skills and knowledge of humanitarian logisticians to a more professional level, backed up by appropriate training courses and accreditation (Gustavsson 2002). The importance of skilled and knowledgeable logisticians is critical for properly managing most HSCM of the activities (John & Ramesh 2016; Patil, Shardeo & Madaan 2021).

None of the agencies can address and overcome the issues listed above on its own. A greater level of collaboration across agencies is required in terms of common specialist pools and workshops. Agencies should provide possibilities for their workers to collaborate with NGOs. The business

TABLE 2: Humanitarian logistics challenges.

Factors	The challenges
Lack of preparedness	Without correct initial planning, an organisation is unable to adhere to established protocols and progress quickly to the subsequent stages of assessment, appeal, and resource mobilisation.
Procurement	- Procurement processes that have been developed in advance. - Delays in procurement. - Identifying the donations, prioritising the things, and determining whether the commodities should be transported or stored.
Transportation execution	- Infrastructure destruction, such as roads and airports, and customs delays are cited as the primary impediments to transportation implementation. - Congestion and strain on the few functioning highways and airports because of the limited local transit capacity.
Timely delivery	- Time restrictions are rigid. Food and medications that are perishable must be distributed quickly or they will be ineffective and may raise the danger of casualties and epidemics. - Emergency supplies, materials, and necessary commodities must be airlifted immediately.
Mostly manual supply chain processes	- Access to software that enables tracking and tracing is limited. - Inadequate supply chain management.
Shortage of logistics experts	Humanitarian agencies are affected by a shortage of qualified and skilled logisticians on the ground.
Demand forecasting	Relief chains depict the connections between demand and supply. Demand is difficult to forecast, as it fluctuates constantly in response to field reports.
Size of the relief chain	The volume of commodities that must be carried and transported might be considerable, as the crisis could affect a big geographical region and a huge population.
Inadequate assessments and planning	Certain logistical constraints are not expected or prepared for.
Security issues	- Criminals such as thieves and looters may exploit the messy situation to steal commodities or damage the supply chain. - In all emergency scenarios, theft at all supply chain levels poses a risk of loss. - Faulty medications or rotten food usage can risk the survivors' lives even further.
Assessment and appeal	- Inaccurate estimation of beneficiary numbers, locations, and other programmes because of a lack of precise ground data. - Lack of knowledge because of dearth of skilled local workers and their presence, and infrastructure destruction restricting access to impacted areas.
Stock asset management	- Utilisation of existing regional logistical infrastructure. - Positioning the stock in advance.
Human resources mobilisation	- Staffing levels, quality, and training at the worldwide, regional, national, and area levels. - The transfer of workers is a frequently underestimated variable and a severe logistical challenge in huge crises. The most pertinent question is: how can a huge number of relief workers be mobilised? Additionally, maintaining their safety and housing without causing economic distortions is a problem.
Mobilising affected people from conflict zones	When conflict breaks out, huge numbers of people must frequently be relocated to safe zones – temporary transit centres, tracking centres, and army camps.
Degradation of critical infrastructure	Significant infrastructures such as energy, transportation, and communications may deteriorate or be destroyed, impairing the delivery of necessary products. 'The final mile' is frequently the source of the trouble. The destruction of communications infrastructure has a severe effect on the level of collaboration and coordination amongst the crisis resolution participants.
Information and communication	- The issues associated with public information management are daunting; for example, insufficient, excessive, or wrong information may be released. - Cellular networks have been unable to cope with the rising number of demands.
Limited collaboration and coordination	Collaboration is generally ad hoc — 'urgent requirements' type of arrangement. Organisations struggle to strike a balance between their internal operational requirements and their desire to collaborate.
Donations	Assuring that donors' financial pledges are achieved and funding is given to relief agencies as needed, may present challenges.

TABLE 2 (Continues...): Humanitarian logistics challenges.

Factors	The challenges
Needs versus loss-based relief	Donors and international response organisations must decide whether to prioritise humanitarian assistance based on need or loss. The relief groups make this determination following their policies.
Financial resources mobilisation	Inability to obtain financial resources when necessary.
Political issues	The region's political circumstances may preclude the quick delivery of aid supplies or longer-term reconstruction, putting the security and safety of aid workers at risk.
Sociocultural issues	- Sociocultural barriers exist between supporting agencies and donors on the one hand, and local officials and victims on the other hand. - Diverse requirements in impacted countries, combined with diverse socioeconomic and cultural contexts to which relief and donor agencies must adapt successfully, present a challenge for the relief and reconstruction endeavour.
Reconstruction challenges	Following a disaster, a huge reconstruction effort is required to provide suitable housing and rehabilitating the infrastructure.

community can establish a pool of logistics professionals and make them available to the humanitarian sector on an as needed and urgent basis. Because of the seasonal nature of the demand for HL services and the fact that they are only required in the incident of an emergency, logistics experts from the business sector could collaborate with field-based NGOs in both the pre-and post-disaster stages (Gustavsson 2002).

When communities are affected by natural catastrophes or developmental obstacles, workers from all disciplines collaborate to aid in social reconstruction. Collaboration across disciplines and community engagement are critical for achieving meaningful and sustained change in underdeveloped communities (Pardasani 2006). Local communities, particularly at the village and municipal levels, can strengthen their ability to plan for and respond more efficiently and effectively to the logistical issues they encounter following a natural disaster (Sheppard et al. 2013). Additionally, Oloruntoba (2005) stressed the critical necessity for or inclusion of indigenous people in HL activities in the aftermath of any disaster. Investment in communication and information technology is critical to resolving the crisis and mitigating its impacts. Non-governmental organisations must develop an understanding of the critical role supply chain management and logistics may play. A critical area of concern that necessitated collaboration between NGOs and the private sector is global communications. Furthermore, amongst many other technological solutions, blockchain can be claimed to play a crucial role in tackling the challenges related to HLSCM, specially regarding trust, collaboration, and coordination (Ar et al. 2020; Aranda, Fernandez & Stantchev 2019; Dubey et al. 2020; Erol et al. 2020; Ko & Verity 2019; Ozdemir et al. 2021; Stathakis 2019).

Conclusion

The article aimed to develop the understanding of HL challenges based on past research findings by answering the following research questions: (1) What is the role of HL in managing disaster relief operations? and (2) What challenges

are encountered by HOs in performing HL operations during any disaster relief operations?

It was found that HOs have to undergo several challenges related to HL whilst managing any disaster event. The challenges are related to transportation, infrastructure, warehousing, procurement, last-mile connectivity, coordination in logistics activities, collaboration and trust amongst partners, safety and security concerns, political issues, fund management, need assessments etc. The study also highlighted how these challenges have effected the disaster relief operations in the past major disaster incidents. It has been demonstrated in numerous disaster scenarios that there were insufficient policies, guidelines, laws, regulations, and preparedness strategies in place to deal with such calamities. Therefore, it clearly brings forth and underlines the critical significance that preparedness and response play in disaster management. Mitigation and readiness are critical stages, and their associated costs are significantly higher than those associated with recovery and reconstruction.

Local populations' functions and engagement would enable governments and residents to oversee preparedness and response activities independently. This would necessitate a systematic shift in training and command, finance, and control across the logistics and supply chain spectrum. Increased local participation in disaster preparedness and the response would result in increased efficiency and efficacy in the HSC. The establishment of long-term relationships with suppliers, pre-positioning of warehouses, and training of personnel to deal with the conditions that characterise the HSC must all be properly scheduled. Decentralising operational decision-making closer to catastrophe-prone areas will enable a quicker and more effective HL response in disaster events. With disaster situations occurring frequently, there is an imperative need to establish strategies for disaster management that are both effective and efficient.

As none of the disaster situations can be avoided, the damage however can be minimised by careful planning and appropriate humanitarian logistical operations. Identification of obstacles in various scenarios and operations would assist many stakeholders, including policymakers, state governments, and humanitarian/NPOs, in effectively planning and managing any catastrophic situation, ultimately saving millions of lives. Additionally, this study assists in determining and comprehending the complex issues inherent in HL, hence supporting the formulation of strategic plans and the definition of operational objectives. Lastly, this will assist in emphasising the implications as well as the critical nature of collaboration across HSC participants. This study investigated the challenges faced in disaster relief operations by various humanitarian participants in the past decades in different scenarios and comprehensively presented the overall HL challenges that can emerge as an obstacle to any HO in managing any future disaster events in a single study. The obstacles to effective logistics planning and implementation create impediments for numerous stakeholders involved in humanitarian aid management. Thus, this study can serve as

a guide for the stakeholders to prepare themselves for any disaster related events and plan the logistics activities and required resources accordingly to rapidly respond to the situation by minimising the adverse consequences. The issues identified in this study can also serve as a road map for effectively integrating HLSC and addressing the challenges for HL to be successful.

The article has a few limitations. It is based on secondary sources and takes a global perspective. The challenges differ by country and location, based on the infrastructure, legislation, geography, topography, population, and rules and regulations of the place. As a result, various avenues for future investigation exist. The challenges can be empirically explored in each region/nation, and strategies can be devised based on the findings.

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The author declares that he has no financial or personal relationships that may have inappropriately influenced him in writing this article.

Author's contributions

S.N. is the sole author of this article.

Ethical considerations

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Disclaimer

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