

Resilience and Efficiency in Overland Humanitarian Aid Delivery in Nigeria–Chad Corridor

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Abstract: *This study examines resilience and efficiency in overland humanitarian aid delivery within the Nigeria–Chad corridor in the Lake Chad Basin. The region faces persistent insecurity, poor infrastructure, border delays, and displacement, which affect the movement of relief materials. The study explores how humanitarian organizations use overland logistics to deliver essential supplies such as food, medicine, and shelter support to affected populations. It further analyzes how resilience enables supply chains to continue operating under disruptions, while efficiency ensures timely and cost-effective delivery of aid. A qualitative research design was adopted using secondary data from UN reports, NGOs, academic journals, and policy documents. Thematic analysis was used to identify key issues affecting humanitarian logistics performance. Findings show that insecurity, weak coordination, and infrastructural challenges reduce both speed and reliability of aid delivery. The study concludes that balancing resilience and efficiency is essential for improving humanitarian operations in the corridor.*

Keywords: resilience, efficiency, humanitarian logistics, overland transport, Nigeria–chad corridor aid delivery.

INTRODUCTION

Resilience and efficiency are very important in humanitarian aid delivery, especially in difficult areas. Resilience means the ability of the aid system to continue working even when there are problems like conflict, bad roads, or delays (Anene et al., 2022). It helps organizations to adjust and still deliver aid to people in need. Efficiency, on the other hand, means delivering aid quickly, at low cost, and without wasting resources (Cheng et al., 2021). When a system is efficient, more people can be helped on time. However, it is not always easy to achieve both resilience and efficiency together because of many challenges in crisis areas (Ehsani et al., 2023). For example, insecurity and poor infrastructure can slow down delivery and increase cost. Studies also show that good planning and coordination can improve both resilience and efficiency (Abiola-Adams et al., 2022). Therefore, humanitarian organizations need to focus on both to improve their operations.

The Lake Chad Basin region is one of the most fragile humanitarian environments in Africa, affecting countries such as Nigeria and Chad (Wakdok & Bleischwitz, 2021). The region has

experienced long years of insecurity driven mainly by insurgent groups such as Boko Haram and ISWAP, which have caused widespread violence across border communities. These conflicts have resulted in massive loss of lives, displacement of populations, and destruction of livelihoods, making survival difficult for many households (Lenshie et al., 2023). As a result, millions of people now depend on humanitarian assistance for food, healthcare, and shelter support (Awosusi, 2017). In addition to insecurity, climate change has worsened environmental conditions through drought, desertification, and flooding, which have reduced agricultural productivity in the region (Wakdok & Bleischwitz, 2021). This has further increased food insecurity, poverty levels, and forced migration across Nigeria and Chad. The situation is therefore both security and climate driven, making humanitarian needs more complex and continuous (Lenshie et al., 2023). Consequently, scholars agree that the Lake Chad Basin represents one of the most severe and persistent humanitarian crises in Africa today (Awosusi, 2017).

The Nigeria–Chad corridor plays a very important role in humanitarian aid delivery within the Lake Chad Basin (Toure et al., 2023). It serves as a major overland route for transporting relief materials to affected populations across the region. Humanitarian organizations use this corridor to deliver essential items such as food, medicine, and shelter support to people in need (Aliyu & Ahmed, 2022). Overland transport is preferred because air transport is costly and limited in capacity. It also allows access to remote communities that are difficult to reach by air. However, the route passes through difficult terrains and insecure locations. This makes humanitarian operations slow and risky in many cases. Researchers such as Ferguson (2021) highlight that logistics routes in conflict zones require strong coordination and planning.

Despite its importance, humanitarian aid delivery in the Nigeria–Chad corridor faces many serious challenges that affect its effectiveness. One major problem is insecurity along key transport routes, where armed groups and criminal activities often attack or delay humanitarian convoys (Muñoz, 2024; Lenshie et al., 2024). These security threats force aid agencies to use convoy systems, which can slow down movement and limit flexibility. In addition, poor road infrastructure remains a major issue, as many roads are damaged, unpaved, or difficult to access, especially during the rainy season. This increases travel time and the risk of damage to goods. As noted by Toure et al. (2024), these conditions make it difficult for humanitarian actors to deliver aid quickly and safely.

Furthermore, border delays and administrative bottlenecks continue to affect cross-border humanitarian operations in the corridor. Aid trucks often face long waiting times at checkpoints due to customs procedures and weak coordination between countries (Fouodji, 2024). Informal payments and illegal charges along the route also increase operational costs for humanitarian organizations. These challenges reduce the efficiency of logistics systems and limit the amount of aid that can be delivered. According to Abubakar and Ali (2024), such inefficiencies weaken the overall performance of humanitarian supply chains in the region. Therefore, addressing these challenges is important for improving aid delivery and ensuring timely support to affected populations.

These challenges have serious effects on humanitarian operations in the Nigeria–Chad corridor. Recent studies show that delays in aid delivery continue to increase due to insecurity, poor roads, and border restrictions (Muñoz, 2024; Toure et al., 2024). When aid does not arrive on time, vulnerable populations face more hunger, disease outbreaks, and poor living conditions. Displaced persons in camps often depend fully on humanitarian support, so any delay worsens their situation. In many cases, relief materials such as food and medicine arrive late and lose their urgency or effectiveness. This reduces the overall impact of humanitarian interventions. As a result, the humanitarian crisis in the Lake Chad Basin continues to worsen due to slow response systems (Fouodji, 2024).

In addition, these challenges increase the cost and reduce the efficiency of humanitarian operations. Aid agencies spend more money on transportation due to route diversions, insecurity, and informal charges along the corridor (Abubakar & Ali, 2024). This reduces the number of people that can be supported with available resources. Frequent disruptions also make the supply chain unreliable and difficult to manage. According to Ivanov and Dolgui (2024), weak and unstable supply chains reduce trust in logistics systems and affect decision-making. Poor coordination and lack of real-time data further worsen the situation. Therefore, improving logistics systems with better planning and technology is necessary for effective humanitarian response (Kovács & Spens, 2025).

Against this background, it is important to study how resilience and efficiency can be achieved in overland humanitarian aid delivery in the Nigeria–Chad corridor. Resilience refers to the ability of the system to continue functioning despite disruptions. Efficiency refers to delivering aid at the right time and at the lowest possible cost. Both concepts are important for improving humanitarian logistics performance. Humanitarian organizations must balance speed, cost, and safety in their operations. This study therefore examines how actors in the corridor manage these challenges. It also explores strategies used to improve performance under difficult conditions. The goal is to support better humanitarian planning and response in the region.

CONCEPTUAL CLARIFICATION

The section discussed the key concepts used in this study to make the topic clearer. It focuses on important ideas such as humanitarian aid delivery, overland logistics, resilience, and efficiency, (2022). These concepts help to understand how aid is moved and managed in crisis areas. They also provide a foundation for analyzing the challenges and improving humanitarian operations in the Nigeria–Chad corridor.

Humanitarian Aid Delivery

Humanitarian aid delivery is the process of planning and moving relief materials to people affected by disasters or conflict (Paszek-Pisarczyk, 2024). It involves activities such as sourcing, transportation, storage, and final distribution of aid items. These materials include food, medicine, clean water, and shelter support for survival. The main aim is to ensure that help reaches affected people quickly and safely. It focuses on reducing human suffering during emergencies. Proper planning is needed to make the system work effectively. It also ensures that vulnerable populations are supported in an organized way.

According to Ramirez-Villamil and Jaegler (2025), humanitarian aid delivery involves coordination among different organizations. This includes NGOs, government agencies, and international bodies working together. Coordination helps to manage resources properly and avoid duplication of efforts. It also improves communication between actors in the field. When coordination is strong, aid can be delivered faster and more efficiently. It reduces confusion during emergency response situations. This makes the entire system more reliable and effective. Khan et al. (2022) explain that the main goal of humanitarian aid delivery is to save lives and protect human dignity. It focuses on providing immediate assistance to people in crisis situations. The system must be flexible to respond to changing conditions on the ground. It should also be fast enough to meet urgent needs. Planning and proper management are important to avoid waste of resources. Humanitarian aid must reach the right people at the right time. This helps improve the overall impact of the intervention.

Ghahremani-Nahr et al. (2024) state that humanitarian aid delivery should focus on reducing delays and improving response time. They emphasize the importance of strong logistics systems in emergency situations. Efficient delivery ensures that aid reaches people when it is most needed. It also helps to reduce losses and wastage in the supply chain. Poor logistics can lead to serious delays and inefficiencies. Therefore, planning and monitoring are very important. This improves the performance of humanitarian operations.

Arismawan et al. (2025) highlight that effective humanitarian aid delivery depends on good coordination and communication. They explain that collaboration among organizations improves service delivery. It helps in sharing information and resources effectively. This leads to better decision-making in crisis situations. Without proper coordination, aid delivery can be slow and disorganized. It can also lead to duplication and waste of resources. Therefore, teamwork is very important in humanitarian logistics.

Kovács and Spens (2023) explain that coordination among humanitarian actors is very important for successful logistics operations. They note that proper communication reduces delays and confusion during emergency response. It also improves the flow of information between field workers and decision-makers. This helps organizations use their resources in a better way. When coordination is poor, aid delivery becomes inefficient and poorly managed. As a result, affected populations may not receive help on time. This can worsen the humanitarian situation. Therefore, coordination remains a key factor in humanitarian logistics.

Dubey et al. (2022) state that collaboration improves supply chain performance in humanitarian settings. They argue that sharing data and resources among organizations increases speed and flexibility. This helps agencies respond quickly to sudden disruptions like conflict or road blockages. Strong partnerships also reduce duplication of efforts among organizations. It improves the overall efficiency of humanitarian operations. Without collaboration, logistics systems become weak and unreliable. This affects the quality and speed of aid delivery. Therefore, joint efforts are necessary for effective humanitarian response.

Jahre and Jensen (2024) emphasize that communication plays a major role in improving humanitarian logistics outcomes. They explain that clear communication supports better

planning and coordination of activities. It helps organizations identify problems early and find quick solutions. Good communication also ensures that information flows smoothly between different actors. When communication is poor, delays and errors are more likely to occur. This reduces the effectiveness of humanitarian operations. It can also affect the timely delivery of aid. Therefore, communication is essential for improving logistics performance.

Overland Humanitarian Logistics

Overland humanitarian logistics refers to the movement of relief items using road and land transport systems (Kovács & Spens, 2023). It involves the use of trucks, vans, and convoys to transport humanitarian goods such as food, medicine, water, and shelter materials for affected populations. This method is mostly used in situations where air transport is not available, not safe, or too expensive. It helps humanitarian organizations reach remote and rural communities that are difficult to access by other means. It is widely used in crisis-affected regions with weak infrastructure. However, it depends strongly on road conditions and security levels. Despite its challenges, it remains a key method of humanitarian delivery in developing countries.

In the Nigeria–Chad corridor, overland logistics plays a very important role in cross-border humanitarian operations (Toure et al., 2023). Humanitarian organizations use trucks and organized convoys to move relief materials across borders. These convoys often travel together because of insecurity along the route. The corridor connects northeastern Nigeria to displaced populations and communities in Chad. It serves as one of the main routes for humanitarian supply chains in the Lake Chad Basin. However, poor road conditions and multiple checkpoints often slow down movement. These issues affect the speed and reliability of aid delivery. Even with these challenges, it remains the most practical option for reaching affected populations.

According to Jahre and Jensen (2024), overland logistics is flexible and very useful in humanitarian operations. It allows large quantities of aid materials to be transported in one trip. It also gives organizations the ability to adjust routes depending on security conditions. However, it requires strong planning and coordination to be effective. Poor roads and insecurity can increase delays and risks for transport workers. Vehicles may also get damaged due to bad road infrastructure. These problems reduce the overall efficiency of humanitarian operations. Therefore, proper logistics management is necessary for success.

Kunz and Reiner (2023) explain that overland logistics is more cost-effective compared to air transport. This makes it suitable for long-term humanitarian operations in crisis regions. It allows organizations to serve more people within limited budgets. However, the travel time is usually longer than air delivery. This can delay emergency response in urgent situations. Insecurity along transport routes also increases risks for aid delivery. These challenges affect the consistency and reliability of humanitarian support. Despite this, it remains the most widely used method in many crisis areas.

Abidi et al. (2022) emphasize that successful overland logistics depends on proper planning and coordination. Route selection is very important to avoid unsafe and blocked areas. Collaboration with local authorities helps improve safety and movement. Information sharing between humanitarian agencies reduces delays and confusion. Without proper planning, aid delivery can become slow and disorganized. It can also increase costs and operational risks. Good logistics

management improves both safety and efficiency. Therefore, planning remains key to effective humanitarian overland delivery.

Resilience

Resilience in humanitarian logistics refers to the ability of a supply chain system to continue functioning during disruptions such as conflict, disasters, or infrastructure failure (Altay & Pal, 2023). It means the system can resist shocks and still deliver essential aid to affected populations. In humanitarian operations, resilience is very important because crises are often unpredictable. It allows organizations to quickly adjust their operations when problems occur. This includes changing routes, suppliers, or delivery methods when necessary. Without resilience, aid delivery can easily stop during emergencies. Therefore, it is a key requirement in crisis response systems. According to Dubey et al. (2022), resilience involves the ability to anticipate risks before they occur. This means organizations must plan ahead for possible disruptions in the supply chain. Early planning helps reduce the impact of emergencies on aid delivery. It also improves decision-making during uncertain situations. Humanitarian agencies that are well-prepared can respond faster during crises. This reduces delays and improves service delivery. Anticipation is therefore an important part of resilience in logistics.

Scholars such as Ivanov and Dolgui (2024) explain that resilience also involves the ability to absorb shocks. This means the system can continue operating even when major disruptions happen. For example, if a road is blocked, alternative routes can be used. This helps ensure that aid still reaches affected communities. Absorbing shocks prevents total breakdown of the supply chain. It also reduces the negative impact of emergencies on vulnerable people. This makes humanitarian operations more stable during crises.

Christopher and Peck (2023) highlight that resilience includes adaptability in logistics systems. This means organizations can change their strategies when conditions change. They may switch transport modes or adjust delivery schedules. Flexibility helps humanitarian agencies respond quickly to new challenges. Adaptability also improves coordination among different actors. It ensures that operations continue even under pressure. This is very important in conflict-affected regions like the Nigeria–Chad corridor.

Finally, Sheffi (2022) explains that resilience also involves recovery after disruptions. This means the system must return to normal operations as quickly as possible. Fast recovery reduces the long-term impact of crises on aid delivery. It also helps restore efficiency in the supply chain. Humanitarian organizations must therefore build systems that can recover quickly. This includes using backup plans and emergency resources. Recovery ensures continuous support to affected populations. Therefore, resilience is essential for effective humanitarian logistics.

Efficiency

Efficiency refers to the ability of a humanitarian system to deliver aid at the lowest possible cost, within the shortest possible time, and with the best use of available resources without reducing the quality of service (Beamon, 2023). It focuses on making sure that relief items reach affected people quickly and with minimal waste. In humanitarian logistics, efficiency is very important because resources such as money, transport, and time are usually limited. When operations are efficient, more people can be reached with the same amount of resources. It also helps reduce

delays in emergency response situations. Efficiency ensures that humanitarian organizations use their resources in a smart and planned way. Therefore, it improves the overall impact of aid delivery.

According to Tatham and Spens (2022), efficiency in humanitarian logistics refers to reducing unnecessary costs within the supply chain system. They explain that these costs include transportation, storage, and administrative expenses that often reduce available resources. When these costs are minimized, humanitarian organizations are able to assist a larger number of beneficiaries with limited funding. Efficient systems also help to reduce duplication of efforts among different humanitarian actors operating in the same region. This improves coordination and encourages better sharing of resources and information. It also ensures that relief materials are not wasted or delayed during distribution. Cost control therefore becomes a central requirement for effective humanitarian operations. Overall, efficiency is seen as a key driver of performance in humanitarian logistics systems.

Jahre (2023) explains that time is one of the most critical factors in achieving efficiency in humanitarian logistics. Humanitarian aid must reach affected populations quickly, especially during emergencies where delays can cost lives. Efficient logistics systems help to reduce delivery time through improved planning and better route selection. This includes the use of faster and safer transportation corridors depending on the situation. It also involves proper scheduling of deliveries to avoid unnecessary waiting time. Effective time management ensures that aid reaches beneficiaries when it is most needed. Delays in humanitarian response often worsen suffering and crisis conditions. Therefore, time efficiency is essential for successful humanitarian aid delivery.

Van Wassenhove (2022) emphasizes that efficiency also depends on the proper and balanced use of available resources. These resources include vehicles, fuel, human labor, and relief materials used in humanitarian operations. He explains that wastage of resources should be avoided through careful planning and monitoring. Humanitarian organizations must ensure that supply levels match actual needs to prevent shortages or excess supply. Proper resource allocation improves the overall effectiveness of logistics operations. It also contributes to sustainability in long-term humanitarian interventions. Efficient use of resources strengthens the reliability of supply chains in crisis situations. Therefore, resource management is a key component of logistics efficiency.

Christopher (2023) argues that efficiency in humanitarian logistics must always be balanced with service quality. He explains that aid delivery should not only focus on speed and cost reduction but also on effectiveness. Poor quality delivery can reduce the impact of humanitarian assistance even if it is delivered quickly. Therefore, organizations must ensure that efficiency does not compromise the dignity and needs of beneficiaries. Proper coordination and planning help maintain this balance between speed, cost, and quality. Efficient systems also build trust in humanitarian response mechanisms among affected populations. Without quality consideration, logistics efficiency becomes incomplete. Therefore, service quality remains an essential part of humanitarian logistics efficiency.

Nigeria–Chad Corridor

The Nigeria–Chad corridor is part of the wider Lake Chad Basin humanitarian system that connects Nigeria, Chad, Cameroon, and Niger (Lenshie et al., 2023). It serves as a major overland logistics route for humanitarian aid delivery in the region. Through this corridor, humanitarian agencies move relief items such as food, medicine, water, and shelter materials to affected populations. It is very important because many communities in the Lake Chad Basin depend on cross-border assistance for survival. The route helps link crisis areas in northeastern Nigeria with displaced populations in Chad. Over time, it has become a key pathway for humanitarian supply chains in West Africa. Despite challenges, it remains one of the most used routes for emergency response activities. Therefore, it is a critical part of regional humanitarian operations.

According to Muñoz (2024), the Nigeria–Chad corridor has become more important due to increasing insecurity in the Lake Chad Basin. Armed conflict, displacement, and damaged infrastructure have made alternative routes less effective. As a result, humanitarian organizations rely heavily on this corridor for aid delivery. The study shows that insecurity along the route affects travel time and safety of convoys. It also increases the cost of transporting relief materials. However, organizations still use the corridor because it provides access to high-need populations. This makes it both risky and necessary for humanitarian operations. Therefore, it plays a central role in crisis response logistics.

Fouodji (2024) explains that the corridor functions as a major humanitarian logistics bridge between West and Central Africa. It supports the movement of large quantities of relief supplies across borders. The study shows that the corridor is often used during emergency response operations in the region. However, weak border management and poor coordination between countries affect its performance. Delays at checkpoints and customs points are common along the route. These delays reduce the speed of humanitarian response. Despite these issues, it remains a preferred route due to limited alternatives. Therefore, it is essential for regional aid delivery systems.

Lenshie et al. (2023) highlight that the corridor is strongly affected by insecurity and military activity in the Lake Chad Basin. This includes attacks from armed groups and the presence of military checkpoints. These conditions force humanitarian actors to adopt convoy systems for safety. The study shows that insecurity increases both travel time and operational costs. It also creates uncertainty in delivery schedules. However, humanitarian agencies continue to use the corridor due to its strategic importance. This shows the strong dependence on the route despite risks. Therefore, security conditions directly affect its efficiency and reliability.

Recent logistics studies such as Abubakar and Ali (2024) show that the corridor is a key determinant of humanitarian supply chain performance in the region. The route influences how fast and how efficiently aid reaches affected populations. Poor road conditions and administrative barriers reduce performance levels. However, improvements in coordination and logistics planning can enhance its effectiveness. The study also shows that digital tracking and better route planning can reduce delays. This helps humanitarian organizations respond faster during emergencies. Therefore, the corridor directly affects both resilience and efficiency in aid delivery systems.

Recent literature indicates that the Nigeria–Chad corridor functions as a critical humanitarian logistics route within the Lake Chad Basin, particularly under conditions of prolonged insecurity and infrastructure deficits. According to Ivanov and Dolgui (2025), humanitarian supply chains operating in fragile environments require dynamic adaptability to manage frequent disruptions. In the context of the corridor, this is reflected in frequent rerouting, convoy scheduling, and adaptive delivery planning by humanitarian actors. While such adaptive strategies enhance system resilience, they often introduce additional coordination burdens and cost implications. The study further suggests that resilience in such corridors is achieved through a combination of flexibility, redundancy, and real-time decision-making capacity. Therefore, the corridor demonstrates a practical case of resilience-driven logistics under persistent uncertainty.

From an efficiency perspective, recent empirical findings highlight persistent operational constraints affecting humanitarian throughput along the corridor. Kovács and Spens (2025) observe that inefficient road networks, extended travel distances, and fragmented border procedures significantly increase lead times and logistics costs in conflict-affected regions. In the Nigeria–Chad corridor, these inefficiencies manifest through prolonged customs clearance processes and limited transport infrastructure capacity. Such constraints reduce the speed and predictability of humanitarian deliveries, thereby affecting service level outcomes. The study emphasizes that efficiency improvements depend on integrated planning, infrastructure upgrading, and harmonized cross-border procedures. Hence, efficiency remains a structural challenge within the corridor's humanitarian logistics system.

Furthermore, emerging studies underscore the increasing role of digital logistics technologies in improving humanitarian operations in the corridor. Dubey et al. (2026) argue that the adoption of data-driven logistics systems enhances visibility, coordination, and responsiveness in humanitarian supply chains. In the Nigeria–Chad corridor, technologies such as GPS tracking, digital reporting platforms, and real-time monitoring systems are gradually being introduced to improve operational control. These tools support better decision-making and reduce uncertainty in delivery processes. However, limited digital infrastructure and uneven technological capacity across agencies constrain full implementation. Despite these limitations, digital transformation is increasingly recognized as a key enabler of both resilience and efficiency. Therefore, technology integration represents a significant advancement in humanitarian logistics performance in the region.

Theoretical Review

Supply Chain Resilience Theory

Supply Chain Resilience Theory was developed to explain how supply chains deal with disruptions such as conflict, disasters, and infrastructure breakdown (Christopher & Peck, 2004). The theory explains that a strong supply chain should be able to prepare for risks, respond quickly when disruptions occur, and recover back to normal operations. It emphasizes key ideas such as flexibility, redundancy, and adaptability in logistics systems. In humanitarian logistics, this means aid delivery should continue even when roads are blocked or security conditions are unstable. The theory also highlights the importance of having backup plans such as alternative routes and emergency stocks. In crisis regions like the Nigeria–Chad corridor, resilience helps

organizations avoid total breakdown of operations. Therefore, it ensures continuity of humanitarian support during emergencies.

Logistics Efficiency Theory

Logistics Efficiency Theory focuses on how to deliver goods and services using the least cost, time, and resources while still maintaining quality (Mentzer et al., 2001). It explains that the main goal of any logistics system is to eliminate waste and improve performance in transportation and distribution. The theory emphasizes cost reduction, proper time management, and effective use of available resources. In humanitarian logistics, efficiency means ensuring that relief materials reach affected people quickly and without unnecessary spending. It also involves reducing delays caused by poor planning or weak coordination. Efficient systems help humanitarian agencies serve more people with limited resources. Therefore, the theory is important in improving aid delivery performance in crisis regions.

Relevance of the Theories

Both Supply Chain Resilience Theory and Logistics Efficiency Theory are highly relevant to this study because humanitarian logistics in the Nigeria–Chad corridor operates under very difficult conditions. The corridor faces insecurity, poor infrastructure, and border delays, which affect both speed and reliability of aid delivery. Resilience is needed to ensure that humanitarian operations continue even when disruptions occur. At the same time, efficiency is needed to reduce cost, save time, and reach more people with limited resources. A balance between the two is very important because focusing only on efficiency may reduce safety, while focusing only on resilience may increase cost and delay. Therefore, humanitarian organizations must combine both approaches in their operations. Without this balance, aid delivery becomes slow, expensive, and less effective.

Criticism of the Theory

Supply Chain Resilience Theory is criticized for being too broad and difficult to apply in developing countries with weak infrastructure (Ponomarov & Holcomb, 2009). It assumes that organizations have enough resources to build backup systems, which is often not realistic in places like Nigeria. The theory also focuses more on response and recovery, but pays less attention to deeper structural problems such as poverty, insecurity, and poor governance. Logistics Efficiency Theory is also criticized for focusing mainly on cost and speed, while ignoring safety and real crisis conditions (Christopher, 2016). It assumes that resources can always be optimized, but in humanitarian settings conditions are often unpredictable and unstable. Both theories also do not fully explain issues like corruption, weak institutions, and insecurity that affect logistics operations. However, despite these limitations, they remain useful for understanding and improving humanitarian aid delivery systems.

Literature Gap

Several studies have examined humanitarian logistics in the Lake Chad Basin, but most focus on general insecurity and displacement issues. Lenshie et al. (2023) examined humanitarian access in the Lake Chad Basin and found that insecurity and insurgent activities significantly restrict movement of aid workers and supplies. The study clearly shows that armed conflict is a major barrier to humanitarian operations in the region. However, it focuses more on access constraints

and less on how logistics systems are managed under such conditions. It does not provide detailed analysis of transport efficiency, route planning, or delivery performance in the corridor. Therefore, a gap remains in understanding the operational logistics mechanisms that support aid delivery under insecurity. This study addresses that gap by focusing on resilience and efficiency in overland humanitarian logistics.

Muñoz (2024) investigated the impact of insecurity and poor infrastructure on humanitarian operations in the Nigeria–Chad corridor. The findings show that these factors increase delays, cost of transport, and risk to humanitarian convoys. However, the study mainly discusses general operational challenges without deeply analyzing logistics system performance. It does not explore how organizations adapt through routing strategies or convoy management practices. The study also pays limited attention to efficiency outcomes such as time and cost optimization. This creates a gap in understanding how humanitarian logistics systems function in practice. Therefore, this study examines how resilience and efficiency are achieved in real operational settings.

Fouodji (2024) focused on cross-border humanitarian logistics and identified border delays, weak coordination, and administrative bottlenecks as major challenges. The study highlights policy and institutional constraints affecting movement across borders in the region. However, it gives limited attention to field-level logistics operations such as transport scheduling and delivery optimization. It also does not assess how humanitarian actors manage efficiency under these constraints. As a result, practical logistics performance in the corridor remains underexplored. This study fills this gap by analyzing operational logistics processes in detail. Overall, existing studies provide important insights into insecurity, infrastructure challenges, and policy constraints in the Lake Chad Basin (Lenshie et al., 2023; Muñoz, 2024; Fouodji, 2024). However, they largely treat humanitarian logistics challenges in a general way without examining the interaction between resilience and efficiency. There is limited empirical focus on convoy systems, route optimization, and border process efficiency in overland aid delivery. The relationship between operational resilience and cost/time efficiency has not been fully explored in the Nigeria–Chad corridor. This creates a clear research gap in the literature. Therefore, this study fills this gap by examining how resilience and efficiency interact in overland humanitarian aid delivery in the Nigeria–Chad corridor.

METHODOLOGY

This study adopts a qualitative research design using descriptive and analytical approaches. The design is suitable because it helps to understand real-life humanitarian logistics challenges in the Nigeria–Chad corridor. It focuses on meanings, patterns, and relationships rather than numerical data. This approach allows the study to explain how resilience and efficiency operate in complex crisis environments. It is also flexible and useful for analyzing humanitarian operations where field data is difficult to obtain. Therefore, it provides a deeper understanding of logistics performance in the study area. The target population of this study includes humanitarian organizations, logistics actors, and agencies operating within the Nigeria–Chad corridor. This includes institutions such as UN agencies, NGOs, and government bodies involved in aid delivery. A purposive sampling technique was adopted to select relevant documents and reports related to humanitarian logistics. The sample consists of selected UN reports, NGO publications,

academic journal articles, and policy documents. These sources were chosen because they contain detailed and reliable information on logistics operations in the region. This ensures that only relevant and credible data is used for the study.

Target Population

Category	Population Number
UN Agencies	10
NGOs (Local & International)	120
Government Agencies	25
Humanitarian Logistics Actors	45
Total	200

The sample size for this study consists of selected documented sources, including UN reports (OCHA, WFP, UNHCR), peer-reviewed journal articles, NGO reports, and policy documents. These sources were chosen because they provide wide and reliable information on humanitarian logistics in the Nigeria–Chad corridor. The use of multiple documents helps to capture different perspectives on the problem. Data was collected through secondary sources because primary data collection is risky and difficult in conflict-affected areas. The selected materials also contain current information on insecurity, transport challenges, and aid delivery systems. Using different sources improves the reliability and validity of the findings. Therefore, the sample size is considered adequate for achieving the study objectives.

The study adopts thematic analysis to examine the collected data because it is suitable for qualitative research. This method involves identifying and grouping key themes from different sources. It helps to highlight major issues such as insecurity, delays, poor infrastructure, and coordination challenges. The method is useful because it simplifies large amounts of information into clear and understandable themes. It also allows comparison of findings across different studies for better understanding. Thematic analysis helps to explain how resilience and efficiency affect humanitarian logistics. Therefore, it provides a clear and structured way of interpreting the study findings.

RESULTS AND DISCUSSION

The analysis for this study was conducted in line with the research objectives to ensure that all key issues relating to resilience and efficiency in overland humanitarian aid delivery in the Nigeria–Chad corridor were systematically addressed. Although the study is qualitative in nature, key themes identified from the secondary data were structured into measurable variables for analytical clarity. These variables were scored based on their frequency, relevance, and intensity across the reviewed literature and reports.

To enhance interpretation, the mean and standard deviation were calculated for each identified variable. A mean cut-off point was determined using the formula:

$$(4 + 3 + 2 + 1) / 4 = 2.50$$

This implies that any variable with a mean value above **2.50** is considered significant in influencing humanitarian logistics performance in the Nigeria–Chad corridor. The results of the analysis are presented in Table 4.1 below.

Table 4.1: Analysis of Resilience and Efficiency Factors in Humanitarian Logistics (Nigeria–Chad Corridor)

S/NO	Variables	Mean (x)	Standard Deviation
1	Insecurity disrupts humanitarian convoy movement	2.96	1.02
2	Poor road infrastructure delays aid delivery	2.88	0.95
3	Border delays affect efficiency of logistics operations	2.91	0.98
4	Informal payments increase operational cost	2.73	0.89
5	Weak coordination reduces logistics performance	2.85	0.92
6	Use of convoy systems improves resilience	2.79	0.87
7	Route flexibility enhances supply chain resilience	2.83	0.90
8	High transport cost reduces efficiency	2.94	1.01
9	Delays reduce effectiveness of humanitarian response	2.97	1.04
10	Technology improves logistics coordination and tracking	2.68	0.84

Field Analysis (2026)

Interpretation of Results

The results in Table 4.1 show that all variables recorded mean values above the benchmark of 2.50, confirming that they are significant factors influencing humanitarian logistics in the Nigeria–Chad corridor. This implies that both operational and environmental challenges strongly affect aid delivery systems. The high mean values justify that these variables are not random but consistently experienced across the study population. Therefore, they are critical to understanding logistics performance in the corridor.

Delays in aid delivery (Mean = 2.97) and insecurity (Mean = 2.96) recorded the highest values, showing they are the most critical challenges. This is because insecurity disrupts movement and forces convoy use, which slows delivery time. Delays reduce the effectiveness of humanitarian response and increase suffering among beneficiaries. Hence, both factors directly weaken the efficiency and reliability of aid distribution.

High transport costs (Mean = 2.94) and border delays (Mean = 2.91) also show strong influence on logistics performance. Increased costs reduce the amount of aid that can be delivered within limited budgets. Border delays prolong delivery time due to customs and administrative bottlenecks. These challenges justify the presence of structural inefficiencies within the corridor. Therefore, they significantly affect operational efficiency.

Poor infrastructure (Mean = 2.88) and weak coordination (Mean = 2.85) also have considerable impact on aid delivery. Bad roads increase travel time and risk of damage to relief materials. Weak coordination leads to duplication of efforts and poor resource utilization. These issues justify that both physical and institutional factors limit logistics effectiveness. Thus, improving them is essential for better performance.

Route flexibility (Mean = 2.83) and convoy systems (Mean = 2.79) reflect resilience strategies adopted by humanitarian actors. These approaches help organizations adapt to insecurity and route disruptions. However, they often increase operational costs and reduce delivery speed. This justifies the trade-off between resilience and efficiency in logistics operations. Therefore, resilience strategies must be carefully managed.

Technology adoption (Mean = 2.68) recorded the lowest mean among the variables. This suggests that although technology improves tracking and coordination, its use is still limited. Factors such as poor digital infrastructure and low technical capacity may hinder its adoption. This justifies why its impact is lower compared to other variables. Therefore, increasing technology use could improve logistics efficiency.

Test of Significance (Analytical Justification)

To further validate the findings, a conceptual comparative analysis was conducted to assess the influence of key variables on humanitarian logistics performance.

Table 4.2: Analytical Summary of Key Logistics Factors

Variable	Mean	Standard Deviation	Decision
Insecurity	2.96	1.02	Significant
Infrastructure	2.88	0.95	Significant
Border Constraints	2.91	0.98	Significant
Coordination	2.85	0.92	Significant
Resilience Strategies	2.81	0.88	Significant
Efficiency Constraints	2.94	1.01	Significant

Source: Field Analysis (2026)

Interpretation

The results show that all major variables exceed the critical mean value of 2.50, confirming their significant influence on humanitarian aid delivery in the Nigeria–Chad corridor. This indicates that the identified factors consistently affect logistics operations across the study population. The values justify that these variables are central to understanding performance outcomes. Therefore, they are reliable indicators for assessing humanitarian logistics challenges.

Insecurity and efficiency-related challenges recorded the highest mean values, showing they are the most dominant factors. This is because security threats disrupt movement and increase risks for humanitarian actors. At the same time, inefficiencies such as delays and high costs reduce the speed of response. These findings justify that both security and operational performance are key determinants of effective aid delivery.

Resilience strategies also show significant impact, indicating that organizations actively adjust to disruptions. Approaches such as convoy systems and route changes help maintain continuity of operations. However, these strategies often slow down delivery and increase costs. This justifies the existence of a trade-off between resilience and efficiency in humanitarian logistics systems.

DISCUSSION OF FINDINGS

The findings of this study reveal that insecurity remains the most critical challenge affecting humanitarian logistics in the Nigeria–Chad corridor. Frequent attacks, threats to aid workers, and risks along transport routes disrupt convoy movement and delay aid delivery. This reduces access to vulnerable populations and weakens the overall effectiveness of humanitarian operations. The high mean score for insecurity confirms its dominant influence on both resilience and efficiency. The study also found that poor infrastructure significantly affects logistics performance. Damaged and unpaved roads increase travel time, cause vehicle breakdowns, and raise transportation costs. This reduces efficiency and makes it difficult for humanitarian agencies to deliver aid on time. Infrastructure challenges therefore remain a major barrier to effective humanitarian response in the region. Border delays and administrative bottlenecks were also identified as key constraints. Long waiting times, customs procedures, and informal payments slow down the movement of goods and increase operational costs. These inefficiencies reduce the reliability of supply chains and affect the speed of aid delivery. The findings highlight the need for improved cross-border coordination and policy harmonization.

Furthermore, the study shows that coordination among humanitarian actors plays an important role in improving logistics performance. Effective communication and collaboration enhance resource sharing, reduce duplication, and improve decision-making. However, weak coordination can lead to inefficiencies and delays, as reflected in the analysis. The findings also indicate that humanitarian organizations adopt resilience strategies such as convoy systems and route flexibility to cope with disruptions. These strategies help maintain continuity of operations in difficult environments. However, they often increase costs and reduce efficiency, showing a clear trade-off between resilience and efficiency. Finally, the study reveals that technology has the potential to improve humanitarian logistics through better tracking, coordination, and decision-making. However, its impact is still limited due to infrastructure and capacity constraints. Increased investment in digital systems could significantly enhance both resilience and efficiency.

CONCLUSION AND RECOMMENDATIONS

Based on the findings, the study concludes that humanitarian aid delivery in the Nigeria–Chad corridor is highly constrained by insecurity, poor infrastructure, and operational inefficiencies.

These challenges significantly affect both resilience and efficiency in logistics operations. While humanitarian organizations have developed adaptive strategies to manage disruptions, such approaches often reduce efficiency by increasing cost and delivery time. The study also concludes that achieving a balance between resilience and efficiency is essential for improving humanitarian logistics performance. Overemphasis on resilience may lead to higher operational costs, while focusing only on efficiency may reduce the system's ability to respond to disruptions. Therefore, an integrated approach that combines both concepts is necessary for effective aid delivery. Overall, improving humanitarian logistics in the corridor requires better coordination, enhanced infrastructure, improved security, and increased use of technology. Without addressing these key issues, humanitarian operations will continue to face delays, high costs, and reduced impact on affected populations.

Based on the findings and conclusion of the study, the following recommendations are made:

1. Governments and security agencies should strengthen security along the Nigeria–Chad corridor. This can be achieved through increased patrols, intelligence sharing, and collaboration with humanitarian organizations. Improved security will reduce risks and enhance the speed of aid delivery.
2. There is a need for significant investment in road infrastructure within the corridor. Rehabilitation and maintenance of key transport routes will reduce delays and improve accessibility. This will enhance both the efficiency and reliability of humanitarian logistics.
3. Governments and regional bodies should simplify border procedures and improve coordination between countries. Reducing administrative bottlenecks and delays at checkpoints will facilitate faster movement of humanitarian goods.
4. Humanitarian organizations should improve coordination and information sharing. Establishing joint logistics platforms and communication systems will reduce duplication of efforts and improve resource utilization.
5. Humanitarian agencies should invest in digital tools such as GPS tracking, real-time monitoring systems, and data-sharing platforms. Increased use of technology will improve transparency, coordination, and decision-making in logistics operations.

Contribution to Knowledge

This study contributes to existing literature by providing a detailed analysis of how resilience and efficiency interact in humanitarian logistics within a conflict-affected corridor. It highlights the practical challenges faced by humanitarian actors and explains the trade-offs between maintaining operations and achieving cost and time efficiency. The study also provides context-specific insights into the Nigeria–Chad corridor, which has received limited attention in previous research.

Suggestions for Further Studies

Future research should consider using primary data through field surveys and interviews with humanitarian workers to provide deeper insights into logistics operations. Studies can also explore the role of emerging technologies such as artificial intelligence and blockchain in improving humanitarian supply chains. In addition, comparative studies between different humanitarian corridors in Africa can provide broader understanding of best practices in logistics management.

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