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Effective Logistics Systems and Disaster Responsiveness: An Empirical Evidence of Humanitarian Firms in Mandera County, Kenya

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Abstract

Aim: This study examined the relationship between logistics systems and disaster responsiveness among humanitarian firms in Mandera County, Kenya.

Methods: The research utilized a descriptive research design, aiming to gather information on the Enhancing Effective Logistics Systems on Disaster Responsiveness of Humanitarian firms in Mandera County, Kenya. In this study, the focus was on 140 logistic coordinators from 8 humanitarian organizations operating in Mandera County. Purposive sampling was employed to select 28 logistic coordinators from the total population. The data were input and analyzed utilizing SPSS software version 22. Descriptive statistics, including percentages, means, and frequencies. Correlation analysis was employed as an analytical method to evaluate associations between the variables studied.

Results: There is a high positive correlation between disaster responsiveness and information flow ($r = 0.982$), suggesting that effective information dissemination contributes significantly to the overall responsiveness of disaster management efforts. Similarly, both disaster responsiveness and information flow exhibit strong positive correlations with adequate funding ($r = 0.938$ and $r = 0.983$, respectively), highlighting the crucial role of financial resources in facilitating timely and effective disaster response activities. Additionally, the warehouse system shows strong positive correlations with all other factors (ranging from $r = 0.914$ to $r = 0.975$), indicating that a well-organized warehouse system is closely associated with enhanced disaster responsiveness, efficient information flow, and adequate funding.

Unique Contribution to Theory, Practice and Policy: The study contributes to the field of humanitarian logistics by providing empirical evidence on the critical role of integrated logistics systems in enhancing disaster responsiveness. Moreover, it highlighted the need for further dialogue to address concerns about funding and logistical effectiveness in disaster response. Recommendations included establishing a Funding Stability Mechanism and implementing standardized communication protocols to enhance disaster responsiveness among humanitarian firms in Madera County, Kenya.

Keywords: *Humanitarian logistics, disaster responsiveness, information flow, funding mechanisms, warehouse systems, Mandera County*

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INTRODUCTION

Humanitarian organizations, as highlighted by Ndirangu and Nyamwaura (2023), are instrumental in disaster responsiveness, offering crucial aid and support to communities affected by various crises. Operating through diverse structures such as international NGOs, local agencies, government bodies, and volunteer groups, each entity contributes specialized expertise and resources to relief efforts. These organizations secure funding from various sources, including donations. As outlined by Koseoglu and Yildirimli (2019), effective logistics systems are pivotal in disaster responsiveness as they guarantee the prompt and efficient distribution of aid and assistance to impacted communities.

Mandera County, situated in northeastern Kenya, contends with various natural and man-made disasters that have profound effects on both its communities and infrastructure. The area is prone to frequent droughts, stemming from its arid and semi-arid climate, which result in critical water shortages, failed crops, and losses in livestock, thereby worsening poverty and malnutrition among residents (Chepkenen *et al.,* 2020). Additionally, as highlighted by Daud *et al.* (2022), Mandera faces flooding triggered by intense rainfall and insufficient drainage systems, resulting in extensive damage to residences, infrastructure, and agricultural lands. These floods also contribute to outbreaks of waterborne illnesses such as cholera and typhoid. Furthermore, the county is susceptible to inter-communal conflicts and acts of terrorism, marked by sporadic violence and assaults by armed factions, which jeopardize the safety and well-being of its residents, leading to casualties, displacement, and property destruction. While Mandera County experiences recurrent droughts, floods, and insecurity, the effectiveness of humanitarian interventions in this region is significantly constrained by logistical challenges such as poor road infrastructure, insecurity, and limited supply chain coordination. These constraints directly affect disaster responsiveness, necessitating empirical investigation.

The urgent need for effective logistics systems in facilitating disaster responsiveness in Mandera County is analogous to vital bodily systems ensuring the well-being and survival of the community. Just as the circulatory system delivers life-saving oxygen to areas in need, robust logistics infrastructure swiftly mobilizes aid and resources to disaster-stricken regions. Similarly, efficient logistics coordination acts as a nervous system, transmitting information and enabling rapid decision-making for effective crisis management. Moreover, logistics serve as the backbone of disaster preparedness, providing stability and resilience against external pressures. Therefore, the integration of comprehensive logistics strategies is essential for Mandera County to enhance resilience, strengthen early warning systems, improve infrastructure, and ensure timely and effective emergency response interventions, safeguarding lives and livelihoods in the face of natural and man-made disasters.

Statement of the Problem

A recent report jointly issued by the Kenya National Drought Management Authority (NDMA) and the Mandera County Government (2022) highlighted the occurrence of numerous disasters within the region, underscoring the urgent need for evaluation and response. These disasters, which affect Mandela County and its residents, encompass a wide range of calamities, including but not limited to natural phenomena like droughts, floods, and other climate-related events. Such crises exact a heavy toll on the county's infrastructure, causing significant damage to roads, buildings, and utilities, thereby impeding access to vital services. Moreover, the accompanying loss of lives,

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injuries, and displacement of populations places immense strain on local healthcare systems and emergency response capacities, exacerbating the severity of the situation. The economic ramifications are profound as well, as businesses encounter operational setbacks and financial distress, potentially leading to job losses and economic hardship for residents. Furthermore, environmental degradation resulting from these disasters, including pollution and ecosystem destruction, poses long-term challenges with implications for biodiversity and sustainability.

The social fabric of the community is also disrupted, with vulnerable groups disproportionately affected, thereby heightening overall complexity and urgency in addressing these issues. Despite the high frequency of disasters in Mandera County, humanitarian response efforts remain constrained by inefficient logistics systems, characterized by poor transportation networks, inadequate supply chain coordination, and limited access to critical resources. These inefficiencies delay aid delivery and reduce the effectiveness of disaster response interventions. This lack of responsiveness exacerbates the impact of disasters, prolongs the suffering of affected populations, and undermines the effectiveness of relief efforts. Therefore, enhancing logistics systems is crucial to improving the disaster responsiveness of humanitarian firms in Mandera County, enabling them to deliver assistance swiftly and efficiently to disaster-affected communities.

LITERATURE REVIEW

Theoretical Framework

Grey systems theory

Grey Systems Theory, introduced by Professor Deng Julong in the early 1980s, offers a valuable framework for managing uncertainty, complexity, and limited information within systems. It extends traditional system theory to address situations where data is incomplete or unreliable, acknowledging both known and unknown information. In the context of enhancing effective logistics systems for disaster responsiveness of humanitarian firms in Madera County, Kenya, Grey Systems Theory can be applied to model complex interactions, adapt to dynamic environments, and address data limitations. In this study, Grey Systems Theory is particularly relevant in modeling uncertainties in logistics systems, such as unpredictable demand for relief supplies, fluctuating transportation conditions, and incomplete information during disaster situations. It supports decision-making in environments where data on supply chain performance and disaster impact is limited or uncertain.

Goal setting theory

Goal Setting Theory, developed by Edwin A. Locke in the 1960s, emphasizes the significance of setting specific, challenging, and achievable goals to enhance motivation, performance, and task persistence. This theory posits that individuals are driven to achieve goals that are clear and demanding, as they direct attention, mobilize effort, and foster the development of strategies to attain them. Locke's research demonstrated that feedback on progress toward goal attainment is crucial for maintaining motivation and adjusting strategies as needed. Goal setting theory is applied in this study to explain how clearly defined logistical objectives, such as delivery timelines, inventory targets, and response benchmarks, can enhance organizational responsiveness during disaster situations. By embracing a cycle of continuous improvement based on insights from experiences, organizations can enhance their capacity to respond to disasters and meet the needs of affected populations more effectively.

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Conceptual Framework

The conceptual framework illustrates the relationship between logistics systems (independent variable) and disaster responsiveness (dependent variable). Logistics systems are operationalized through key components such as transportation, inventory management, warehousing, and information flow. These elements influence the speed, efficiency, and effectiveness of disaster response.

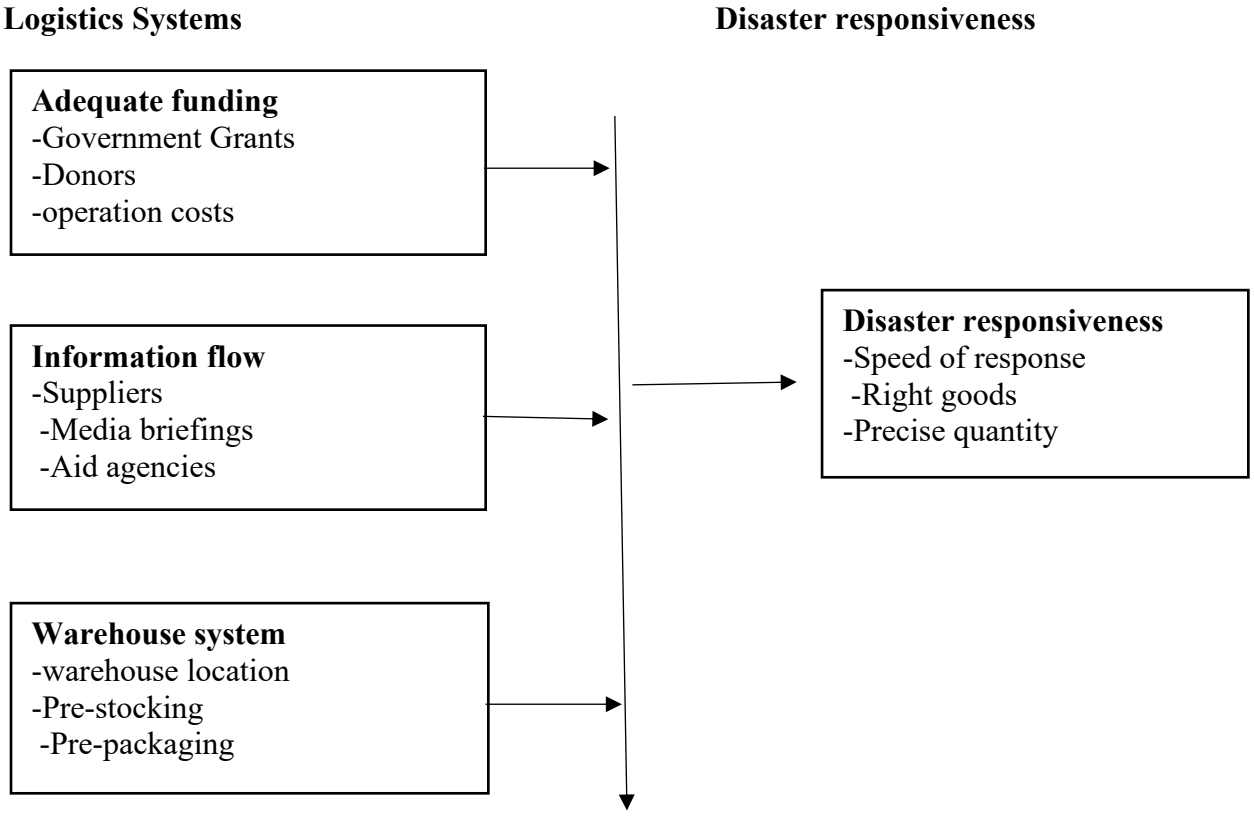


Figure 1: Conceptual Framework

Empirical Review

According to Paciarotti *et al.* (2021), adequate funding is crucial in humanitarian logistics, as it ensures the prompt delivery of life-saving aid to affected populations during crises. This financial support empowers humanitarian organizations to respond swiftly to emergencies by acquiring, transporting, and disseminating essential supplies such as food, water, shelter, and medical assistance. Particularly during the early stages of a crisis, timely funding becomes paramount, enabling organizations to assess immediate needs, mobilize resources efficiently, and offer urgent assistance to those most in need.

Government grants are pivotal for humanitarian organizations' disaster response capabilities, funding essential logistics operations like infrastructure, transportation, and technology (Dzigbede *et al.,* 2020). These grants enable the establishment of strategic logistical hubs in disaster-prone areas, crucial for swift and efficient relief distribution (Modgil *et al.,* 2020). Such funding is

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indispensable for developing and maintaining logistical frameworks, ensuring effective disaster response and alleviating human suffering.

Chakravarty (2021) highlights that donors, comprising individuals, corporations, foundations, and international organizations, significantly contribute funds to bolster disaster response efforts. These funds are channeled towards enhancing logistics systems, encompassing supply chain management, transportation, and coordination mechanisms. Hezam (2022) underscores that donor funding empowers humanitarian firms to acquire vital resources such as vehicles, communication equipment, and technology platforms for real-time tracking and monitoring of relief operations. Additionally, as noted by Frennesson *et al.* (2022), donors may offer flexible funding, enabling organizations to tailor their logistics systems to the specific requirements of each disaster scenario, be it a natural calamity, conflict situation, or pandemic outbreak.

Frennesson *et al.* (2022) outline that operational costs in logistics cover daily expenses like salaries, fuel, maintenance, and facility rental. Effective logistics management enhances cost efficiency by reducing transportation, inventory holding, and warehousing expenses. Moreover, it ensures customer satisfaction through timely product delivery and managing order processing. Logistics management also fosters operational flexibility, enabling quick responses to market changes. Additionally, it plays a vital role in risk management by identifying bottlenecks and implementing strategies to mitigate risks such as supplier delays and natural disasters.

Effective information flow is crucial for improving the efficiency, effectiveness, and accountability of humanitarian relief organizations. It facilitates timely decision-making, fosters collaboration and coordination, aids in risk management, and ensures that response efforts address the specific needs of affected communities. Therefore, investing in strong information management systems and communication networks is essential for the success of humanitarian relief operations (Dubey *et al.,* 2022).

Logistic distribution in humanitarian supply chain management relies heavily on suppliers, who provide essential goods like food, medical supplies, and shelter materials necessary for disaster response (Sentia *et al.,* 2023). Effective communication with suppliers, as highlighted by Paciarotti *et al.* (2021), involves updates on inventory levels, availability of goods, and potential disruptions such as delays or shortages. This communication ensures that humanitarian organizations can promptly access necessary resources to respond to disasters (Korir, 2023).

Media briefings are pivotal for information dissemination in humanitarian logistics during disaster response. They facilitate communication with the public, stakeholders, and affected communities, sharing essential details about relief efforts and distribution plans (Nasir *et al.,* 2023; Wang *et al.,* 2023). These briefings foster transparency, ensuring accountability and trust among stakeholders. Moreover, they streamline coordination, minimize duplication of efforts, and optimize resource utilization. Additionally, media briefings deliver critical emergency messaging, aiding community safety, and serve as platforms for advocacy and fundraising (Zewde, 2023). Overall, they significantly contribute to the effectiveness of humanitarian disaster response through communication, transparency, coordination, and support mobilization.

In humanitarian disaster response, aid agencies serve as pivotal conduits for information flow, assessing needs, coordinating stakeholders, and mobilizing resources (Sharif *et al.,* 2023; Hussain *et al.,* 2023). These agencies handle logistics, engage with affected communities, and evaluate

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response efficacy. This exchange of information facilitates a cohesive and efficient response, bridging assistance gaps and optimizing resource allocation. Through adept information management, aid agencies play a critical role in saving lives, mitigating suffering, and fostering resilience in disaster-affected communities.

As outlined by Eligüzel *et al.* (2023), warehouse location significantly influences disaster responsiveness. It's crucial to position warehouses strategically in accessible areas free from natural hazards like floods or landslides. Moreover, situating warehouses near disaster-prone zones minimizes transportation time and costs during emergencies. Assessing current warehouse locations is essential to ensure they're optimally positioned for the timely and efficient distribution of relief supplies to affected communities.

Pre-stocking entails storing crucial relief supplies in warehouses prior to a disaster. This practice enables humanitarian organizations to respond promptly to emergencies, as they can quickly mobilize and distribute relief items without procurement and transportation delays. Assessing the adequacy and variety of pre-stocked supplies helps determine the readiness of warehouse systems to promptly meet the needs of disaster-affected populations. By ensuring warehouses are well-stocked with diverse supplies, organizations can enhance their responsiveness during disasters, effectively meeting the immediate needs of affected communities (Yoruk *et al.,* 2023).

Pre-packaging, as described by Mittal (2023), entails organizing relief supplies into standardized kits or packages before warehousing. This approach streamlines distribution during emergencies by minimizing the time and effort needed for sorting and packaging. Evaluating the effectiveness of pre-packaging practices, as highlighted by Erden *et al.* (2023), identifies avenues for enhancing warehouse operations and disaster responsiveness.

Research Gaps

Musyoka and Wanjohi (2024) carried out a study on agile logistics management and the performance of humanitarian firms in Northeastern Kenya. This study investigated the determinants influencing effective logistics coordination in humanitarian efforts within Kenya's Northern Eastern Region. It focused on understanding how organizational competence, transport infrastructure, and information sharing impact crisis response efficiency in this challenging context. The research employed a descriptive design, targeting 33 logistics coordinators from 13 humanitarian organizations. Through purposive sampling, 28 coordinators were selected. Data collection used structured questionnaires, with analysis performed using SPSS software (version 24). The study revealed significant positive correlations between organizational competence skills, transport infrastructure, information sharing, and effective logistics coordination. Organizational competence skills showed the strongest correlation, followed by transport infrastructure and information sharing.

Issues with decision-making processes and communication channels were also identified. Conclusion: Stakeholder engagement plays a vital role in the successful implementation of logistics coordination in humanitarian efforts. The study emphasized the interdependence of organizational competency, transport infrastructure, and information sharing in achieving effective coordination, highlighting the need for a comprehensive approach to enhance crisis response efforts. The study suggests actively involving skilled personnel in decision-making, enhancing communication channels, prioritizing investment in transportation infrastructure, and fostering

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collaboration among humanitarian organizations. These recommendations aim to improve the overall effectiveness of humanitarian logistics coordination in the Northern Eastern Region of Kenya. Although conducted in a manufacturing context, Collins & Patrick (2019) highlight the importance of inventory control systems, which can be adapted to humanitarian logistics for efficient stock management.

METHODOLOGY

The research utilized a descriptive research design, aiming to gather information on the Enhancing Effective Logistics Systems on Disaster Responsiveness of Humanitarian firms in Madera County, Kenya. In this study, the focus was on 140 logistic coordinators from 8 humanitarian organizations operating in Mandera County. Purposive sampling was employed to select 28 logistic coordinators from the total population. The data were input and analyzed utilizing SPSS software version 22. Descriptive statistics, including percentages, means, and frequencies. Correlation analysis was employed as an analytical method to evaluate associations between the variables studied.

RESULTS

The correlation analysis conducted on logistic systems on disaster responsiveness reveals strong positive relationships among all variables. The provided data presents correlations between four key factors related to disaster management: disaster responsiveness, information flow, adequate funding, and the warehouse system. The correlations are significant ($p < 0.01$) and indicate strong positive relationships between these factors. Specifically, there is a high positive correlation between disaster responsiveness and information flow ($r = 0.982$), suggesting that effective information dissemination contributes significantly to the overall responsiveness of disaster management efforts. However, the exceptionally high correlation coefficients ($r > 0.90$) may indicate potential multicollinearity or overlap between constructs, suggesting the need for further validation using techniques such as factor analysis. Overall, these findings underscore the interconnectedness of various components within disaster management systems and highlight the importance of integrated approaches to enhance preparedness and response capabilities in the face of disasters.

Table 1: Descriptive Analysis for Adequate Funding and Disaster Response

	Statement	Strongly Disagree F (%)	Disagree F (%)	Neutral F (%)	Agree F (%)	Strongly Agree F (%)	Total F (%)
1	Adequate funding is crucial for maintaining sufficient stockpiles of emergency supplies and resources for disaster response.	1(3.7)	1(3.7)	1(3.7)	19(70.4)	5(18.5)	27(100)
2	Timely and predictable funding, enabling humanitarian firms to	1(3.7)	1(3.7)	23(85.1)	1(3.7)	1(3.7)	27(100)

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	plan and execute logistics operations during disasters						
3	Government and donor funds are sufficient to cover the operational costs associated with logistics systems for disaster response.	0(0.0)	25(92.6)	0(0.0)	1(3.7)	2(7.5)	27(100)

The findings indicate that a majority of respondents (88.9%) agreed that adequate funding is essential for maintaining emergency stockpiles. However, a large proportion (85.1%) remained neutral regarding the predictability of funding, suggesting uncertainty in funding consistency.

Table 2: Descriptive Analysis for Information Flow and Disaster Response

Statement	Strongly Disagree F (%)	Disagree F (%)	Neutral F (%)	Agree F (%)	Strongly Agree F (%)	Total F (%)
The organizations do have a communications channel to respond quickly when a disaster occurs	1(3.7)	1(3.7)	7(25.9)	1(3.7)	17(62.9)	27(100)
Do the humanitarian firms contribute to the overall effectiveness and coordination of disaster response	4(14.8)	5(18.5)	15(55.6)	2(7.4)	1(3.7)	27(100)
Do the humanitarian firms face challenges in effectively utilizing media briefings to communicate critical information during disasters	1(3.7)	1(3.7)	1(3.7)	24(88.9)	0(0.0)	27(100)

Most respondents (62.9%) strongly agreed that their organizations have communication channels that enable rapid disaster response. However, the high neutral response (55.6%) regarding coordination suggests gaps in collaborative effectiveness.

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Table 3: Descriptive Analysis for Warehouse Systems and Disaster Responsive

Statement	Strongly Disagree F (%)	Disagree F (%)	Neutral F (%)	Agree F (%)	Strongly Agree F (%)	Total F (%)
Do you believe the current warehouse locations adequately serve the affected areas	1(3.6)	1(3.6)	24(85.7)	1(3.6)	2(7.1)	28(100)
Does your organization engage in pre-packaging of relief items in warehouses before disaster events	1(3.6)	25(89.2)	1(3.6)	1 (3.6)	0(0.0)	28(100)
Do you perceive pre-stocking of warehouses to be in expediting response efforts during disasters	1(3.6)	2 (7.1)	20 (71.4)	4(14.3)	1(3.6)	28(100)

While respondents acknowledged the importance of warehouse location, a significant majority (89.2%) indicated that pre-packaging is not practiced, suggesting operational inefficiencies in preparedness strategies.

CONCLUSION AND RECOMMENDATIONS

Summary

The findings collectively demonstrate that disaster responsiveness is significantly influenced by logistics system components, particularly information flow, funding, and warehouse infrastructure. Among these, information flow exhibited the strongest relationship, highlighting the central role of communication in disaster management.

There was a significant positive correlation with adequate funding ($r = 0.982$, $p < 0.01$), information flow ($r = 0.938$, $p < 0.01$), and the warehouse system ($r = 0.914$, $p < 0.01$). This suggests that effective disaster responsiveness is closely linked to having sufficient financial resources, streamlined information dissemination, and a well-organized warehouse system to support response efforts. Adequate funding exhibits similarly strong positive correlations with disaster responsiveness ($r = 0.986$, $p < 0.01$), information flow ($r = 0.983$, $p < 0.01$), and the warehouse system ($r = 0.837$, $p < 0.01$). This underscores the importance of financial resources in bolstering various aspects of disaster management, including responsiveness, information dissemination, and logistical support. Information flow also demonstrates strong positive correlations with disaster responsiveness ($r = 0.928$, $p < 0.01$), adequate funding ($r = 0.983$, $p < 0.01$), and the warehouse system ($r = 0.975$, $p < 0.01$).

This indicates that effective communication and information sharing play a crucial role in facilitating disaster responsiveness, leveraging financial resources, and optimizing warehouse operations for timely and efficient response efforts. Warehouse system shows significant positive correlations with disaster responsiveness ($r = 0.914$, $p < 0.01$), adequate funding ($r = 0.837$, $p <$

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0.01), and information flow ($r = 0.975$, $p < 0.01$). This highlights the importance of a well-organized warehouse infrastructure in supporting overall disaster management, serving as a crucial component for efficient resource allocation, storage, and distribution during response operations.

Conclusions

The findings indicate that adequate funding, information flow, and warehouse systems are significantly associated with disaster responsiveness. However, descriptive results suggest variability in perceptions regarding funding adequacy, indicating potential gaps in financial stability. Additionally, the lack of consensus among stakeholders regarding the relationship between funding and logistical effectiveness in disaster response emphasizes the necessity for further exploration and dialogue to better understand perceptions and identify areas for improvement in funding mechanisms and policies. Moreover, concerns were raised about resource allocation, financial planning, and overall support for disaster management initiatives, indicating the inadequacy of government and donor funds for effective disaster responsiveness. To address these concerns, policymakers and funding entities may need to reassess funding mechanisms, increase financial support, or optimize resource utilization to enhance the effectiveness of disaster response operations.

The study observed that firms demonstrated strong preparedness in communication infrastructure and processes, enabling swift resource mobilization and coordination during emergencies. This communication readiness significantly boosts the efficiency and effectiveness of disaster response operations, facilitating timely coordination among stakeholders and rapid assistance deployment to affected areas. Additionally, there were varied perceptions regarding the capabilities and effectiveness of humanitarian organizations, highlighting the need to address this ambiguity to enhance coordination and collaboration with other stakeholders in disaster response. Ensuring effective allocation of resources is crucial to maximizing the impact of humanitarian contributions. Media briefings emerged as a valuable communication tool for disseminating crucial information to the public and relevant stakeholders during crises. Effective communication through media briefings fosters transparency, provides timely updates, and mobilizes support for disaster response efforts. This underscores the importance of investing in robust communication strategies and utilizing media channels to enhance public awareness, facilitate coordination, and ultimately elevate the effectiveness of disaster response operations.

There is uncertainty about the suitability of warehouse locations for disaster response and concerns about the lack of pre-packaged relief supplies. This ambiguity may hinder the effective distribution of aid during crises. Improving preparedness measures like pre-packaging can enhance response efficiency. Additionally, doubts exist regarding the effectiveness of pre-stocking warehouses. Addressing these concerns is crucial for optimizing disaster response strategies. Clarifying the benefits and challenges of pre-stocking practices can inform decision-making and improve resource allocation. Ultimately, these efforts aim to ensure timely access to emergency supplies and enhance the effectiveness of disaster response operations.

Recommendations

In Mandera County, Kenya, given the observed concerns regarding funding predictability, it is recommended that humanitarian organizations and policymakers establish dedicated contingency

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funding mechanisms, such as emergency response funds or pre-approved financing frameworks, to ensure timely resource mobilization during disasters.

To address gaps in coordination and resource allocation, it is recommended that humanitarian organizations establish multi-stakeholder coordination platforms, such as periodic forums or joint planning committees, to enhance transparency, improve communication, and align disaster response strategies. Encouraging dialogue among policymakers, funding organizations, and stakeholders can address concerns about resource allocation and financial planning. Regular forums or working groups can assess current mechanisms, identify areas for improvement, and enhance transparency in funding allocation processes to optimize disaster response operations.

Although communication systems were found to be relatively strong, it is recommended that organizations standardize communication protocols and integrate digital information systems to enhance real-time coordination and reduce information asymmetry during disaster response. This ensures consistency and efficiency in communication practices, enabling swift mobilization of resources and coordination among stakeholders during emergencies. By establishing clear guidelines, organizations can enhance communication readiness and improve the effectiveness of disaster response efforts.

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