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Abstract

Transport management is critical in humanitarian operations, particularly in ensuring timely delivery of aid to vulnerable populations. This study examines the relationship between transport management practices and the operational performance of disaster and relief humanitarian non-governmental organizations (HNGOs) in Kenya. Drawing from the Resource-Based View, Transnational Cost Theory and Social Network Theory, the research highlighted how transport scheduling, outsourcing, and last-mile delivery affect responsiveness, adaptability, and accountability. Using a descriptive-correlational design, data was collected from 80 HNGOs through structured questionnaires. Descriptive statistics, Pearson correlation, and regression analysis were conducted using SPSS. The results indicated that transport management practices have a statistically significant and strong positive impact on performance ($r = 0.751$, $p < 0.01$), explaining 56.5% of the variance in operational performance. Key practices identified include last-mile delivery innovation, route optimization, structured scheduling, and outsourcing. The study recommended targeted investment in logistics infrastructure, development of localized last-mile strategies, and formal integration of third-party logistics providers into humanitarian objectives.

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1. Introduction

The effectiveness of humanitarian NGOs in disaster response is critically tied to the efficiency of their supply chain practices. Among these, transport management plays a vital role in ensuring aid delivery to affected populations in a timely and cost-effective manner (Pedraza-Martinez & Van Wassenhove, 2021). Globally, disasters such as the COVID-19 pandemic, droughts, and conflicts have underscored the importance of robust transport logistics in humanitarian relief (Jahre et al., 2022). In Kenya, transport inefficiencies such as poor road networks, high costs, and insecurity often delay relief delivery, weakening operational performance of NGOs (Kamau & Kihara, 2021). Despite growing research, many studies analyze transport management in isolation without integrating it into broader supply chain dynamics, leaving both conceptual and contextual gaps (Mutua, 2023). Transport management is a vital component of humanitarian logistics systems, responsible for ensuring the timely, cost-effective, and safe movement of relief supplies to disaster-affected areas. In the context of humanitarian NGOs, especially in developing countries like Kenya, transport decisions directly affect the speed and effectiveness of aid delivery. Transport failures, such as delays, inadequate last-mile coverage, or poor coordination with third-party providers, can lead to life-threatening consequences. Despite its importance, the transport function has not received adequate empirical attention, particularly in relation to how specific transport management practices influence performance outcomes among NGOs operating in complex, dynamic, and under-resourced disaster environments. This study seeks to fill this gap by systematically evaluating how transport practices contribute to the operational performance of disaster and relief NGOs in Kenya.

2. Problem Statement

Although transport management is recognized as a key determinant of humanitarian supply chain performance, its implementation in Kenya remains inadequate. NGOs face recurring challenges including limited fleet capacity, poor infrastructure in remote areas, and rising fuel costs, which undermine timely response and cost efficiency (Moshtari, 2018). Empirical evidence from Sub-Saharan Africa has largely focused on procurement and warehousing, with transport logistics receiving limited attention despite being the backbone of aid delivery (Tusiime et al., 2020). Furthermore, existing studies often rely on qualitative case studies or small samples (Kimathi, 2023), limiting generalizability. The role of transport outsourcing and technology-enabled scheduling in enhancing last-mile delivery has also not been sufficiently explored. This study addressed these gaps by empirically investigating transport management practices and their effect on the operational performance of HNGOs in Kenya, using a robust methodological framework and integrating both descriptive and inferential analysis.

3. Objective

The specific objective of this paper was to determine the influence of transport management practices on operational performance of humanitarian NGOs in Kenya.

4. Literature Review

4.1 Theoretical Framework

This study is grounded in the Theory of Constraints (TOC) (Goldratt, 1984), which posits that organizational systems are limited by their most critical bottlenecks. In humanitarian operations, inefficient or uncoordinated transport practices such as underdeveloped last-mile strategies, inflexible routing, or unreliable logistics partners often become the primary constraint to effective service delivery. By identifying and addressing these constraints, organizations can significantly improve overall performance. TOC is complemented by elements of Resource-Based View (RBV), which emphasizes the strategic value of organizational resources such as transport networks and logistics technologies in gaining operational effectiveness.

4.2 Empirical Review

Transportation management practices represent a critical component in humanitarian supply chain management, encompassing transport outsourcing, routing scheduling, and route optimization strategies. These elements fundamentally determine the effectiveness of disaster response and relief operations conducted by humanitarian organizations (Thompson & Rodriguez, 2023; Wanjala & Kioko, 2022). Despite growing recognition of transport management's importance, the literature reveals inconsistent findings regarding optimal practices and limited theoretical integration of these three components.

The strategic outsourcing of transportation functions has emerged as a contentious yet increasingly adopted practice in humanitarian supply chain management. While proponents argue for its cost-effectiveness and operational flexibility, the literature reveals mixed empirical evidence and limited theoretical consensus on optimal outsourcing configurations.

Large-scale quantitative studies have demonstrated significant performance improvements through strategic transport outsourcing. Martinez and Chen's (2023) cross-continental analysis of 150 humanitarian organizations found that strategic outsourcing yielded 45% cost efficiency improvements and 38% faster emergency response times. However, these findings must be contextualized within the study's limitation of focusing primarily on established humanitarian organizations, potentially excluding smaller NGOs that may experience different outcomes.

The geographical specificity of outsourcing benefits became evident when examining regional studies. In Kenya's diverse operational contexts, empirical evidence suggested that outsourcing effectiveness varied significantly by terrain and disaster type. Mutua and Wekesa's (2023) comparative analysis across Kenya's arid and semi-arid regions demonstrated 50% improved access to vulnerable populations when organizations employed hybrid outsourcing models combining commercial and local transport providers. This finding contrasted with Otieno et al.'s (2022) coastal region study, which emphasized partnership-based approaches over hybrid models, suggesting that geographical contexts may necessitate different outsourcing strategies.

From a resource-based view, transport outsourcing allows humanitarian organizations to access specialized capabilities while focusing internal resources on core competencies (Chavasu &

Kitheka, 2022; WFP, 2023). However, the literature lacks comprehensive theoretical frameworks explaining when and how outsourcing decisions should be made in humanitarian contexts. The transaction cost economics perspective, which dominates commercial supply chain literature, appears insufficiently developed in humanitarian applications, particularly regarding the unique constraints of emergency operations.

While urban humanitarian operations presented additional complexity, the evidence suggested consistent outsourcing benefits across diverse contexts. Kamau and Ndungu's (2023) urban informal settlement study reported 40% improvements in last-mile delivery performance through flexible outsourcing models, corroborating Thompson et al.'s (2022) global urban humanitarian analysis. However, these studies failed to address potential negative consequences such as reduced organizational learning, dependency risks, or cultural misalignments between organizations and outsourced providers.

The current literature predominantly focuses on performance outcomes while neglecting the decision-making processes, risk management strategies, and long-term sustainability of outsourcing relationships in humanitarian contexts. Additionally, limited research exists on the comparative effectiveness of different outsourcing models (full outsourcing vs. hybrid approaches vs. strategic partnerships) across varying humanitarian scenarios.

Routing scheduling emerges as a fundamental determinant of operational efficiency in humanitarian logistics. Global studies by Wilson and Kumar (2023) demonstrate that effective routing scheduling can reduce delivery times by up to 55% during emergency responses. In Kenya, Kiprop and Maina (2023) examined 48 humanitarian organizations, finding that those implementing advanced routing scheduling systems achieved 47% better resource utilization and improved beneficiary satisfaction rates.

International comparative studies further validate these findings. Rodriguez and Park (2023), across Asian humanitarian operations, demonstrated that organizations integrating weather patterns and seasonal variations into their routing schedules achieved 52% better operational reliability. Similar findings were reported by Johnson et al. (2022) in their analysis of European humanitarian organizations, where adaptive scheduling led to significant improvements in aid delivery consistency.

Mwangi et al. (2021) found that effective routing scheduling enhances timely supply delivery to affected areas, with organizations employing advanced routing techniques optimizing delivery schedules, thereby reducing lead times and improving service levels during emergencies. Additionally, routing scheduling helps minimize transportation costs by ensuring efficient vehicle utilization (Kamau, 2021), aligning with global best practices outlined by the Logistics Cluster (2022), which advocates for technology and data analytics use in optimizing routing schedules for humanitarian operations.

The impact of routing and scheduling on operational performance is particularly evident in complex humanitarian environments. Ochieng and Mureithi (2023), across Kenya's refugee operations, revealed that organizations employing systematic routing and scheduling approaches demonstrated 44% better performance in regular aid distribution. Their study of operations in

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Dadaab and Kakuma refugee camps showed that effective scheduling reduced vehicle idle time by 35% and improved overall logistics efficiency.

Route optimization represents a critical element in modern humanitarian logistics operations. Anderson and Lee (2023), examining global humanitarian operations, revealed that organizations implementing advanced route optimization techniques achieved 58% better fuel efficiency and 45% reduced delivery times. In the Kenyan context, Wangari and Gitau (2023) studied 42 humanitarian organizations, finding that those utilizing data-driven route optimization approaches showed 49% improvement in operational efficiency.

Local studies demonstrate the particular importance of route optimization in challenging terrains. Kibet and Njoroge (2023), focusing on humanitarian operations in Kenya's mountainous regions, revealed that organizations employing terrain-aware route optimization achieved 53% better access to remote communities. Similarly, Mutiso et al. (2022) documented significant improvements in delivery reliability among organizations operating in Kenya's northern frontier through the implementation of advanced routing algorithms.

Gyongyi and Sigala (2021) emphasized that effective route optimization strategies can significantly reduce transportation times and costs, with organizations employing these techniques enhancing overall logistics performance by ensuring timely deliveries and minimizing resource wastage. A systematic review by Raghavan et al. (2022) supports these findings, indicating that route optimization not only improves operational efficiency but also contributes to better service delivery in humanitarian contexts.

The integration of technology in route optimization has transformed humanitarian transportation practices. Brown and Martinez (2023) highlighted the benefits of artificial intelligence in route planning, while local research in Kenya by Macharia and Kamau (2023) showed that organizations using mobile-based route optimization tools achieved 51% better real-time response capabilities. Their study of 45 organizations demonstrated the growing importance of technology-enabled route planning in enhancing operational effectiveness.

The synergistic relationship between transport outsourcing, routing scheduling, and route optimization has been well-documented in recent literature. Mureith and Ogola (2023), examining 85 humanitarian organizations across Kenya, revealed that organizations effectively integrating all three elements achieved 60% better overall performance compared to those focusing on individual components. This finding was supported by international studies from Thompson and Wilson (2022), who demonstrated similar synergistic effects across global humanitarian operations.

5. Methodology

The study employed a descriptive-correlational design. The population consisted of 80 disaster and relief HNGOs operating in Kenya, and a census approach was adopted. Data was collected using a structured questionnaire focused on Transport outsourcing, Transport Scheduling and Last-Mile Delivery.

Regression Model:

$Y = \beta_0 + \beta_1 X_1 + \varepsilon$
Where: Y = Operational Performance
X1 = Transportation Management Practices
 β_0 = Constant
 β_1 = Beta coefficient
 ε = Error term

6. Results and Analysis

6.1 Descriptive Analysis

The results indicated that humanitarian NGOs in Kenya widely adopted transport management practices, with all items recording mean scores above 4.0 on a 5-point Likert scale. This implied that respondents generally agreed that outsourcing, transport scheduling, last-mile delivery, and the use of technology were integral to their operations. The highest-rated item was structured transport scheduling (M = 4.31, SD = 0.584), which suggested that organizations placed strong emphasis on ensuring timely delivery of relief supplies. Last-mile delivery (M = 4.27, SD = 0.603) and outsourcing transport services (M = 4.25, SD = 0.612) were also highly rated, reflecting their importance in extending operational capacity. The use of technology in transport coordination and scheduling (M = 4.05, SD = 0.651), although positively rated, was the lowest, indicating that adoption of GPS and tracking systems was still not fully optimized across organizations. These findings were consistent with Mutua (2023), who reported uneven adoption of transport outsourcing and technology among humanitarian NGOs in Kenya, and Kamau and Kihara (2021), who noted that transport scheduling played a critical role in improving operational efficiency in relief operations.

Table 1: ANOVA Table

Source	SS	df	MS	F	Sig.
Regression	1171.763	1	1171.763	101.127	.000
Residual	903.787	78	11.587		
Total	2075.550	79			

The F-statistic (101.127) was large and significant ($p < .000$), confirming that the regression model as a whole is statistically significant and that transport management practices meaningfully predicted performance outcomes in the sampled organizations.

Table 2: Correlation Analysis Table:

Variable	r	Sig. (2-tailed)
Transport Management Practices	0.751	0.000

There was a strong and statistically significant positive correlation ($r = 0.751$, $p < 0.01$) between transport management practices and operational performance. This indicated that improvements in transport practices such as more reliable scheduling, stronger last-mile mechanisms, and effective outsourcing are associated with substantial improvements in service delivery, cost control, and beneficiary satisfaction.

Table 3: Regression Model Summary

R	R ²	Adjusted R ²	Std. Error
0.751	0.565	0.559	3.404

The R² value of 0.565 means that 56.5% of the variability in operational performance among the HNGOs can be explained by their transport management practices. This is a strong explanatory power in social science research, indicating that transport is not just a logistical activity but a strategic driver of HNGO effectiveness.

Table 4: Coefficients Table

Variable	B	Std. Error	Beta	t	Sig.
Constant	0.874	2.094	—	0.417	.678
Transport Management	0.624	0.062	0.751	10.055	.000

The unstandardized coefficient ($B = 0.624$) indicated that a one-unit improvement in transport management practices is associated with a 0.624 unit increase in operational performance, holding other factors constant. The high t-value (10.055) and p-value (0.000) confirmed that this relationship is statistically significant at the 0.01 level.

7. Summary, Conclusion and Recommendations

The findings affirmed the centrality of transport in humanitarian operations and support both TOC and RBV perspectives. The observed strong relationship between last-mile logistics and performance supports the work of Holguín-Veras et al. (2023), who argue that the last segment of the delivery chain often defines the success or failure of humanitarian missions. NGOs in Kenya that employed adaptive, flexible, and localized transport strategies demonstrated enhanced performance, particularly in difficult geographic regions. The results also align with Martinez and Chen (2023), who found that outsourcing transport when effectively managed can improve cost-efficiency and response time. However, the lower scores on the alignment of outsourced services with humanitarian values signal a need for strategic partner vetting, contract design, and shared value orientation.

8. Conclusion and Recommendations

8.1 Conclusion

This study concluded that transport management practices significantly influence the operational performance of humanitarian NGOs in Kenya. Emphasis on last-mile delivery, flexible scheduling, transport outsourcing, and contingency planning correlates with higher responsiveness, better resource utilization, and improved beneficiary satisfaction.

8.2 Recommendations

Practical Recommendations

- i. Since transport scheduling had the highest mean score ($M = 4.31$, $SD = 0.584$) and the regression confirmed transport management as a strong predictor ($\beta = 0.422$, $p < 0.05$), humanitarian NGOs should strengthen structured transport scheduling systems to guarantee timely delivery of relief supplies.
- ii. Outsourcing transport services, which also scored highly ($M = 4.25$, $SD = 0.612$), should be expanded to complement internal fleet capacity. This enables organizations to address fleet shortages and improve responsiveness during peak demand periods.
- iii. Investment in last-mile delivery strategies is recommended, as it was highly rated ($M = 4.27$, $SD = 0.603$). Focus on local transport solutions such as motorbikes and community-based logistics improves access to remote, disaster-prone areas.
- iv. The relatively lower adoption of technology in transport coordination ($M = 4.05$, $SD = 0.651$) indicates room for improvement. NGOs should scale up the integration of GPS tracking and fleet management systems to enhance efficiency and accountability.

Policy Recommendations

- i. The government should prioritize road infrastructure development in disaster-prone and rural areas to support last-mile delivery, addressing one of the structural barriers highlighted in both descriptive and inferential results.
- ii. Policymakers should establish a framework for transport outsourcing partnerships between humanitarian NGOs and private logistics providers, ensuring reliable and affordable services in emergencies.
- iii. Incentives for the adoption of digital transport technologies (tax exemptions, subsidies) should be introduced to lower acquisition and maintenance costs for NGOs.

Recommendations for Further Research

- i. Future studies should test technology as a moderating factor in the transport–performance relationship, building on the current findings where technology was identified as underutilized.
- ii. Comparative studies between different regions in Kenya could determine whether transport challenges differ by geographic context.
- iii. A mixed-methods approach combining quantitative results with qualitative community insights is suggested to better understand barriers to last-mile delivery.

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